SATF 2014

Science and Applications of Thin Films, Conference & Exhibition

September 15 to 19, 2014

Altin Yunus Resort & Thermal Hotel,

Cesme, Izmir, Turkey

www.satf2014.org

Preface

On behalf of the Conference Committee, I would like to warmly welcome to everyone participating to the *"Science and Applications of Thin Films, Conference & Exhibition (SATF 2014)"* being held in Altin Yunus Resort & Thermal Hotel, Çeşme, Izmir, Turkey, from September 15 to 19, 2014.

The international conference will focus on various topics related to Thin Films and novel phenomena in Thin Film science and applications. The conference is intended to provide an opportunity to bring prominent scientists together from various countries, with a common objective to exchange information and ideas, to promote stimulus discussions and collaborations among participants and furthermore to foster young scientists.

Additionally, Izmir hosts a large number of extremely important architectural and cultural sites. The town is nicknamed as the Pearl of the Aegean and Cesme in İzmir is surrounded by the Aegean Sea in three sides at the very western end of Urla Peninsula and is neighbor of the Sakiz (Chios) Island. My wish is that you will all join us for a symphony of outstanding science, and take a little extra time to enjoy the unique beauty of Çeşme and its surroundings.

Finally, we want to express our special gratitude to all the participants, and we would also like to thank our colleagues in the Conference Committee, whose commitment enabled us to achieve our goal. In the spirit and tradition of Turkish hospitality, we once more welcome you all to SATF 2014, I would like to wish you a nice and enjoyable stay in the Çeşme, may you all return home feeling recharged and ready to continue the invaluable explorations.

Best regards,

Lutfi Ozyuzer
Chair

Scope of the SATF 2014 Conference & Exhibition

The SATF 2014 international conference will focus on various topics related to Thin Films and novel phenomena in Thin Film science and applications.

More specifically,

- Science of Thin Films and Quantum Effects
- Theory of Structure, Surface and Interface
- Thin Film Growth & Epitaxy
- Nanostructured Growth
- Optical, Optoelectronic and Dielectric Coatings
- Organic Thin Films
- Thin Films in Biology
- Superconducting Thin Films
- Thin Films in Photovoltaic Cells and Energy
- Metallurgical Coatings
- Applications of Electrochemical and Electroless Depositions
- Advances in Deposition Techniques
- Characterization and Instrumentation
- Large Scale Coating and Industry

International Organizing Committee

Local Organizing Committee

Mustafa Guden (Honorary Chair)	Rector of IZTECH, TURKEY
Lutfi Ozyuzer (Chair)	IZTECH, TURKEY
Gurcan Aral	IZTECH, TURKEY
Gulnur Aygun	IZTECH, TURKEY
Mehtap Ozdemir	Gediz Univ., TURKEY
Devrim Pesen	IZTECH, TURKEY
Koray Sevim	IZTECH, TURKEY
Enver Tarhan	IZTECH, TURKEY

Scientific Committee

Lutfi Ozyuzer (Chair)	IZTECH, TURKEY
Bekir Aktas	GIT, TURKEY
Sahabul Alam	Univ. of Dhaka, BANGLADESH
Andre Anders	Lawrence Berkeley National Laboratory, USA
Gulnur Aygun	IZTECH, TURKEY
Paola Barbara	Georgetown University, USA
Necdet Basturk	Hacettepe Univ., TURKEY
Ibrahim Belenli	Abant Izzet Baysal Univ., TURKEY
Basak Bengu	Arçelik Inc., TURKEY
Rifat Capan	Balikesir Univ., TURKEY
Kuei-Hsien Chen	National Taiwan University, TAIWAN
Arif Demir	Kocaeli University, TURKEY
Mustafa M. Demir	IZTECH, TURKEY
Michel Duclot	Université Joseph Fourier, FRANCE
Ali Erdemir	Argonne National Lab., USA
Mehmet Ertugrul	Ataturk Univ., TURKEY
Germán F. de la Fuente	CSIC-Universidad de Zaragoza, SPAIN
Kenneth Gray	Argonne National Lab., USA
Dirk Hegemann	EMPA, SWITZERLAND
Vladislav Korenivski	Royal Institute of Technology, SWEDEN

Kamil Kosiel	Institute of Electron Technology, POLAND
Mehmet Mutlu	TOBB Univ., TURKEY
Waldemar Nawrocki	Poznan Univ. of Tech., POLAND
Salih Okur	Katip Celebi Univ., TURKEY
Ahmet Oral	Middle East Technical Univ., TURKEY
Lutfi Oksuz	Suleyman Demirel Univ., TURKEY
Ramis Oksuzoglu	Anadolu Univ., TURKEY
Mehtap Ozdemir	Gediz Univ., TURKEY
Orhan Ozturk	IZTECH, TURKEY
Devrim Pesen	IZTECH, TURKEY
Annemarie Schröder-Heber	Schmitt Engineering, GERMANY
Yusuf Selamet	IZTECH, TURKEY
Yilmaz Simsek	Erlangen Univ., GERMANY
Jochen M. Schneider	Aachen University, GERMANY
Takashi Tachiki	National Defense Academy, JAPAN
Enver Tarhan	IZTECH, TURKEY
Rasit Turan	Middle East Technical Univ., TURKEY
Takashi Uchida	National Defense Academy, JAPAN
Ugur Unal	Koc Univ., TURKEY
Eyyuphan Yakinci	İnonu Univ., TURKEY
Ekrem Yanmaz	Karadeniz Technical Univ., TURKEY

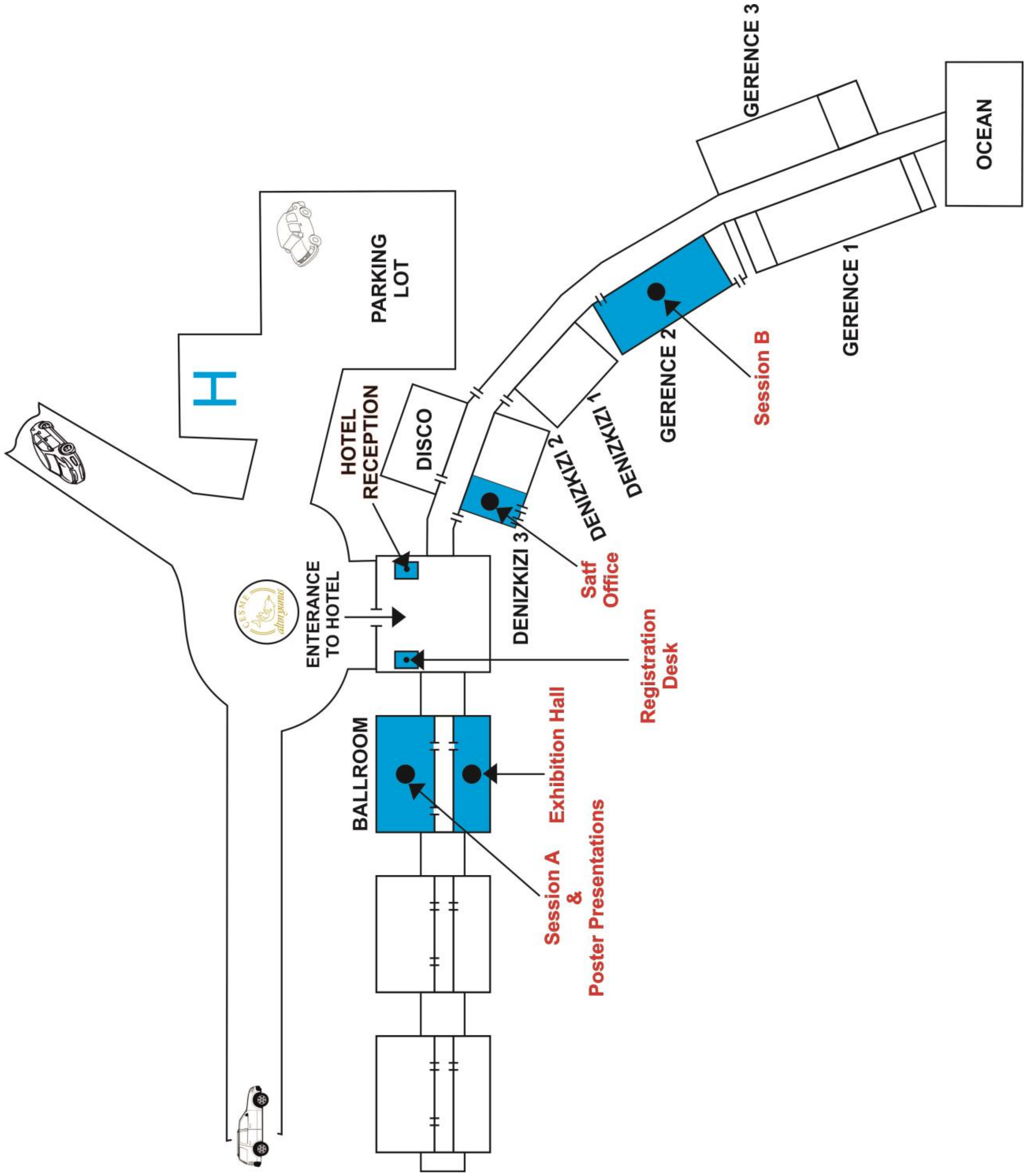
Supporting Students

Hakan Alaboz	IZTECH, TURKEY
Gulsah Akca	IZTECH, TURKEY
Halil Arslan	IZTECH, TURKEY
Ayten Cantas	IZTECH, TURKEY
Yasemin Demirhan	IZTECH, TURKEY
Sena Gulen	IZTECH, TURKEY
Hasan Koseoglu	IZTECH, TURKEY
Metin Kurt	IZTECH, TURKEY
Tugce Semerci	IZTECH, TURKEY
Oyku Tanisman	IZTECH, TURKEY

Adnan Tasdemir	IZTECH, TURKEY
Cem Turkay	IZTECH, TURKEY
Fulya Turkoglu	IZTECH, TURKEY
Mutlu Yaman	IZTECH, TURKEY
Sebnem Yazici	IZTECH, TURKEY
Hurriyet Yuce	IZTECH, TURKEY

Altin Yunus Resort & Thermal Hotel

MAP



CONFERENCE PROGRAM

	Sept. 15, Monday
8:45-9:00	
9:00-9:30	
09:30-10:00	
10:00-10:20	
10:20-10:40	
10:40-11:10	
11:10-11:40	
11:40-12:00	
12:00-12:20	
12:20-12:40	
12:40-14:00	LUNCH
14:00-19:00	**Registration**
19:30-20:30	DINNER
20:30-21:30	
21:30-23:30	**Welcome Cocktail (Altin Yunus Resort & Thermal Hotel)**

	Sept. 16, Tuesday Ballroom	Sept. 16, Tuesday Gerence 2
	SC: Lutfi Ozyuzer	
8:45-9:00	Opening Ceremony **Prof. Lutfi Ozyuzer** SATF2014 Chairman **Prof. Mustafa Guden** Rector of IZTECH	
9:00-9:30	**IS01: Ian Boyd** VUV Processing of Advanced Materials	
09:30-10:00	**IS02: Hironori Katagiri** Development of CZTS Thin Film Solar Cells by 2-Stage Process	
10:00-10:20	**CT01: Kuei-Hsien Chen** CZTS as Photovoltaic Material	
10:20-10:40	**CT02: Rasit Turan** Structuring surface of crystalline Si solar cell for efficient light harvesting	
10:40-11:10	COFFEE BREAK	
11:10-11:40	SC:Waldemar Nawrocki	SC: Gulnur Aygun
	IS03: Jens Birch Group-III Nitride Nanorods Grown by Magnetron Sputter Epitaxy	**IS04: Li-Chyong Chen** Graphene Oxides and their Hybrids for Solar Fuels and CO_2 Conversion Applications
11:40-12:00	**CT03: Ugur Serincan** The Growth of Group III-V Compound Nanowires on Si Substrates by Molecular Beam Epitaxy	**CT06: Tsutomu Iwayama** Luminescent Si nanocrystals synthesized by reactive pulsed laser deposition
12:00-12:20	**CT04: Fikret Yıldız** Forming Canted Magnetic Anisotropy and Orientation in Epitaxially Grown Magnetic Thin films	**CT07**: **Ebru Güngör** Al Doping Induced Optical Andelectrical Properties of SOL-GEL Prepared ZnO Thin Films
12:20-12:40	**CT05: Mohamad Reza Mohamadizadeh** Photocatalytic Activity of TiO_2 Thin Films by Hydrogen DC Plasma	**CT08: Dimitris Davazoglou** Transition Metal Oxides as Hole Selective Interlayers in Organic Photovoltaics
12:40-14:00	LUNCH	

14:00-14:30	SC: John Reno	SC: Hsiang-Chen Wang
	IS05: Stanislav Mráz Structure Evolution of Magnetron Sputtered TiO_2 Thin Films	**IS06: Şefik Süzer** XPS for Charge-Sensitive Analysis of Ultra-Thin Coatings
14:30-14:50	**CT09: Mehtap Özdemir** Photocatalytic Proproperties of TiO_2 Thin Films and Fibers	**CT12: Hassan Kassem** Vibrational properties of kinetic Monte Carlo simulation of semiconductor heteroepitaxy on perfect substrates
14:50-15:10	**CT10: Dejan Klement** First Steps Towards the Growth of Single-crystal $SrTiO_3$ on Si(001) by Pulsed-Laser Deposition: Formation of a Strontium Buffer Layer	**CT13: Gülnur Aygün** In-situ Spectroscopic Ellipsometry and Structural Study of HfO_2 Thin Films Deposited by RF Magnetron Sputtering
15:10-15:30	**CT11: Mohamed Hafez** Growth of Gadolinium Doped Cobalt Titanium Ferrite Thin Films by Pulsed Laser Deposition	**CT14: Alexander Samoylov** Study of Interface Layers in PbTe(Ga)/BaF_2/CaF_2/Si Heterostructures by Rheed and High Resolution TEM
15:30-17:30	**COFFEE BREAK & POSTER SESSION A**	
	SC: Petre Badica	SC: Annemarie Schröder-Heber
17:30-18:00	**IS07: Jas Pal Badyal** Plasma Chemical Deposition of Functional Nanocoatings	**IS08: CheeWee Liu** SiGe/Ge epi Films with Photonic and Electrical Applications
18:00-18:20	**CT15: Hsiang-Chen Wang** High Performance Cu_2O/ZnO Core-shell Nanorod Samples	**CT18: Joanna Cookney** CO_2 Responsive ZIF-8 Ultrathin Nanofilms
18:20-18:40	**CT16: Gökhan Özgür** Optical, Magneto-optical and Electrical Characterizations of co-Sputtered ZnO:Ni Thin-Films	**CT19: Feride Sermin Utku** Construction and Hydroxyapatite Coating of Meso-nanoporous Titania Surfaces Using Electrochemistry
18:40-19:00	**CT17: Süha Sipahi** Effect of Wafer Curvature on post-CMP Nitride Uniformity	**CT20: Mohamadreza Etminanfar** Effect of the Surface Modification of Ni-Ti Smart alloys on the Electrochemical Deposition of Calcium-Phosphate Coatings
19:30-20:30	DINNER	

	Sept. 17, Wednesday Ballroom	Sept. 17, Wednesday Gerence 2
	SC: John Zasadzinski	SC: Kamil Kosiel
9:00-9:30	**IS09: Shigetoshi Ohshima** Reducing Microwave Surface Resistance of YBCO thin Films under High dc Magnetic Fields by Introduction of Artificial Pins	**IS11: Hakan Altan** Characterization of Various Nanocomposites using Spectroscopic Techniques in the THz Region
09:30-10:00	**IS10: Kensuke Nakajima** Terahertz Emission from Monolithic thin film Bi-2212 intrinsic Josephson Junctions	**IS12: Antonello Andreone** THz characterization of a Metamaterial-based Spatial Light Modulator
10:00-10:20	**CT21: Vladimir Egorkin** Plasma Electrolytic Oxidation of Aluminium and Titanium Alloys by Microsecond Current Pulses	**CT23: Anna Szerling** Ultrathin Metallic Layers for THz-QCLs Technology
10:20-10:40	**CT22: V. Zhukova** Influence of the defects on magnetic properties of glass-coated microwires	**CT24: Patrick Rufangura** Dual-band Perfect Metamaterials Absorbers for Solar Cell Applications
10:40-11:10	COFFEE BREAK	
11:10-11:40	SC: Lutfi Ozyuzer	
	SI01:Şener Oktik Coating technologies for the flat glass industry	
11:40-12:00	**SS01:Seniz Turkuz** Temperable solar low-e coatings: from laboratory to industrial production	
12:00-12:20	**SS02:Gul Pekisik** Thin Film Coated Architectural Glasses and Properties	
12:20-12:40	**SS03:Lukas Simurka** Nano-mechanical behaviours of thin films on glasses	
12:40-13:00	**SS04:Refika Budakoglu** Functional Coatings on Glasses by Sol-Gel Technology	
13:00-14:00	LUNCH	

14:00-14:30	SC: Kazuhiro Endo **IS13: John Zasadzinski** Atomic Layer Deposition of MoN and $Nb_xTi_{1-x}N$ Superconducting Films	SC: Kuei-Hsien Chen **IS14: Peter Notten** From Materials Research to 3D-Integrated Li-ion Micro-Batteries
14:30-14:50	**CT25: Maxim Polyakov** Combined Synthesis-Transport Technique for Copper Films Deposition	**CT28: Ugur Ünal** Effect of Deposition Conditions on the Morphology and Properties of Manganese, Iron and Zinc Oxide Films
14:50-15:10	**CT26: Murad Redzheb** Characterization of advanced k1.9, 2.0 and 2.2 ultra-porous SiOC(H) films deposited by Plasma-Enhanced Chemical Vapor Deposition	**CT29: Ashrit Pandurang** Nanostructured Tungsten Trioixde Thin Films Using a Novel Technique
15:10-15:30	**CT27: Lebogang Kotsedi** Laser Induced Oxidation of titanium metal thin film on glass substrate using femtosecond laser	**CT30: Merve Biçen** The Effect of Inorganic Filler on the Properties of Polyimide Hybrid Films
15:30-17:30	**COFFEE BREAK & POSTER SESSION B**	
17:30-18:00	SC: Volkan Gunay **IS15: Maria Iavarone** Emergence of Superconductivity and Vortex Confinement in Superconductor/Ferromagnet Hybrid Systems	SC: Jas Pal Badyal **IS16: Aseel Hassan** Thin Films of Liquid Crystalline Phthalocyanine and Their Composites with Nanomaterials
18:00-18:20	**CT31: Bengü Özuğur Uysal** Structural, Electrical and Optical Properties of SnO_2 nano films by spin-coating method	**CT34: Manfred Stamm** Functional Organic Coatings with Polymer Brushes
18:20-18:40	**CT32: Yu Hu Yeh** Copper electrodeposition on a magnesium alloy (AZ80) with a U-shaped surface	**CT35: Aleksey Potapov** Formation and Properties of Films Based on Polyvinyl Alcohol and Doped with Silver Nanoparticles
18:40-19:00	**CT33: Valeriy Fedirko** Vortices Depinning and Critical Current in a Superconducting slab with Linear Defects	**CT36: Mohamad Fariza** The effect of pH Solution and Bath Temperature on Electrodeposit-n-Cu_2O Thin Film
20:30-23:30	**Gala Dinner & Turkish Night (Altin Yunus Resort & Thermal Hotel)**	

	Sept. 18, Thursday Ballroom	Sept. 18, Thursday Gerence 2
	SC: Uğur Ünal	SC: Uğur Serincan
9:00-9:30	**IS17: Dong-Sing Wuu** Novel Surface-Plasmon-Enhanced Coatings for Light-Emitting Devices	**IS19: Hidemi Shigekawa** Probing Ultrafast Carrier Dynamics by Optical pump-probe STM
09:30-10:00	**IS18: Alpan Bek** Plasmonic Large Area Thin-Film Interfaces for Potential Solar Cell Applications	**IS20: Mohamed Missous** NanoTesla Magnetometry using integrated 2 Dimensional Electron Gas (2DEG) systems
10:00-10:20	**CT37: Noriaki Matsunami** Growth of Mn-doped ZnO thin films by rf-sputter deposition	**CT39: Zaoli Zhang** Study on the Atomic and Electronic Structure in Metal Nitride Films Using Modern Transmission Electron Microscopy
10:20-10:40	**CT38: Ceren Yılmaz** Photoelectrochemical Properties of Electrochemically Deposited Metal Chalcogenide/ZnO Films	**CT40: Alexander Samoylov** The Critical Thickness of Prepared by MBE Technique $Pb_{1-x}Sn_xTe$ Nanolayers on BaF2 (111) Substrates
10:40-11:10	COFFEE BREAK	COFFEE BREAK
11:10-11:40	SC: Şefik Süzer **IS21: Lothar Pfitzner** SEA – Semiconductor Equipment Assessment for Thin Films, their Metrology and Implementation into Manufacturing	SC: Mehmet Ertuğrul **IS22: Satoshi Demura** Electrochemical Synthesis of iron-based Superconductor FeSe Films
11:40-12:00	**CT41: Waldemar Nawrocki** Technological and Physical Limits for Scaling of Silicon Devices in Integrated Circuits	**CT44: Tsutomu Iwayama** Si nanocrystals Formation in SiO_2 on Si by Si Ion Implantation: The effects of RTA, Excimer-UV and e-Beam Irradiation
12:00-12:20	**CT42: Öcal Tuna** Electrochromic Properties of Tungsten Trioxide (WO_3) layers grown on ITO/Glass Substrates by Magnetron Sputtering	**CT45: Rinat Iskakov** Lithium-Containing Silica-Organic Polymeric Electrolytes
12:20-12:40	**CT43: Shaoquan Jiang** Microstructure, colossal magnetoresistance effect and thermal infrared property of annealed $La_{0.7}Sr_{0.3}MnO_{3-\delta}$ thin films on Si(100)	**CT46: Chin Huo Chuang** Effect of the Cu-substrate thickness on the hardness variation of Cr-C deposits after flame heating
12:40-14:00	LUNCH	
14:00-19:00	**SOCIAL PROGRAM (Ephesus Tour, Sightseeing Tour, Boat Tour)**	
19:30-20:30	DINNER	

Only for Friday	Sept. 19, Friday Ballroom	Sept. 19, Friday Gerence 2
	SC: Devrim Pesen	SC: Arif Demir
9:00-9:30	**IS23: John Reno** THz Quantum Cascade Lasers	**IS25: Deepak Kumar Basa** Laser and Thermal Annealing Studies of a-$Si_{1-x}C_x$:H Thin Films Deposited by PECVD
09:30-10:00	**IS24: David Haviland** Quantitative Atomic Force Microscopy for the Characterisation of Thin Films	**IS26: Daniel Lundin** Understand High-Power Impulse Magnetron Sputtering (HiPIMS) through plasma discharge modeling
10:00-10:20	**CT47: Shi-hua Chen** Optical Perception of Few-layer Graphenes	**CT49: Süleyman Er** Computational Study of Metal-Organic Based Graphene Analogs
10:20-10:40	**CT48: Yasemin Demirhan** Log Periodic Antenna Structures Fabricated from Bİ2212 Single Crystals	**CT50: Soner Karataş** a-Si:H/c-Si Heterointerface Study Using Solar Cell Simulation
10:40-11:00	COFFEE BREAK	
11:00-11:30	SC: Lütfi Öksüz	SC: Mehmet Mutlu
	IS27: Ray Hua Horng Effects of Structural Properties and Morphologies of Ga-Doped ZnO Thin Films on their Optoelectronic Characteristics	**IS28: Kazuhiro Endo** Lattice Engineering and Growth Mechanism Control of HTS Thin Films and Heterostructures by MOCVD and by Spin Coating
11:30-11:50	**CT51: Hamide Kavak** Growth and characterization of electrodeposited ZnO thin film	**CT54: Yigit Ozan Aydin** Solar Cell Processing by Nanosecond Pulsed Fiber Laser Amplifier
11:50-12:10	**CT52: Ayça Kıyak Yıldırım** Effect of Potential on Structural, Morphological and Optical Properties of ZnO Thin Films Obtained by Electrodeposition	**CT55: Tayyar Güngör** PIC Based Boxcar Averager System Design and Application
12:10-12:30	**CT53: Nilüfer Evcimen Duygulu** Effect of r.f. Power Variation on Gallium Doped Zinc Oxide Thin Films	**CT56: Şebnem Yazıcı** Preparation and Characterization of Cu2ZnSnS4 Absorber Layer on Metallic Flexible Substrates
12:30-14:00	LUNCH	

	SC: Orhan Öztürk	SC: Fikret Yıldız
14:00-14:30	**IS29: Hasan Efeoglu** Theoretical and Experimental Two Terminal Memristors: Preliminary Findings For Future Applications	**IS30: Petre Badica** From HTS Thin Films Growth to Single Crystal Objects Growth
14:30-14:50	**CT57: Bulat Z. Rameev** Ferromagnetic Resonance Studies of Thin Films of Magnetic Oxides	**CT61: Lütfi Öksüz** Plasma Systems in Thin Film Coating
14:50-15:10	**CT58: Melek Kiristi** RF Magnetron Sputtering Deposited W/Ti and V_2O_5 Thin Films For Complementary All-Solid-State Electrochromic Device Application	**CT62: Hasan Koseoglu** Terahertz Imaging Using High Tc Superconducting BSCCO Bolometric Detector
15:10-15:30	**CT59: Özge Bayraklı** Characterization of Ag-Ga-In-Te Thin Films for Solar Cell	**CT63: Hakan Alaboz** New Transfer Method of Exfoliated Thin $Bi_2Sr_2CaCu_2O_{8+\delta}$ Single Crystals on Sapphire for Hot Electron Bolometer
15:30-15:50	**CT60: Christopher Maghanga** Optical Properties of TiO_2 Based Multilayer Thin Films: Application to Optical Filters	**CT64: Nihan Arapoğlu** Lateral diffusion in tunsten trioxide oxide thin films
15:50-16:10	COFFEE BREAK	
	SC: Lutfi Ozyuzer	SC: Bulat Z. Rameev
16:10-17:30	**CT65: Ugur Turkan** Development and Chracterization of Multiple Layer Silk Fibroin/Hyaluronic Acid Film on CoCrMo Alloy	**CT69: Abdolali Zolanvari** Mechanical Properties Measurements of TiN Films Deposited by PACVD Technique
17:30-17:50	**CT66: Nouredine Sengouga** Numerical simulation of bias and light stress on amorphous indium-gallium-zinc-oxide (a-IGZO) thin film transistors	**CT70: Ahmed Kharmouche** AGFM, FMR and BLS studies of Co_xCr_{1-x}/Si(100) thin films
17:30-17:50	**CT67: A. Karoro** Novel Selective Solar Absorber Coatings	
17:50-18:10	**CT68: Burç Mısırlıoğlu** Effect of the Interface Character on the Stability of ferroelectricity in a Semiconductor Film	
18:10-18:30	**Concluding Remarks**	

POSTER SESSION A (3.30 pm to 5.30 pm, September 16, 2014)

PA001	**Elaboration and Characterization of Copper Doped ZnO Thin Films by Sol Gel Method** Mourad Zaabat, Tarek Saidani, Ahlam Benaboud and Azeddine Boudine
PA002	**Characterization and Tribological Behavior of Electroless Ni–P–WC Composite Coated Iron Based P/M Parts** Ulaş Matik and Ramazan Çitak
PA003	**Stress Controlling in Fe-Doped ZnO Nanostructures Synthesis by Convenient Electrochemical Techniques** Khalled Al-Heuseen and K. Al-Heuseen
PA004	**Influence of Phosphorus Contents on the Crystallization and Tribological Characteristics of Electroless Ni–P Films** Ulaş Matik and Ramazan Çıtak
PA005	**Structural and Optical Investigations of Ag Thin Films Deposited on Porous Silicon** Mehmet Ozdogan, Alper Cetinel, Gokhan Utlu, Nurcan Artunc, Gundogdu Sahin and Enver Tarhan
PA006	**Electroless Deposition of Dense Pd Membranes on the Ultrasound-Assisted-Activated Alumina Support for Hydrogen Separation** Ting-Kan Tsai, Y. F. Cheng, J. K. Chen, J. H. Li and J. S. Fang
PA007	**Optical and Electrochemical Properties of Tungsten Oxide (WO_3) Thin Films** Sani Demiri and Fatma Özütok
PA008	**Synthesis and characterization of polyaniline PANI quartz crystal microbalance QCM prepared by electrochemical method** Malika BEROUAKEN and GABOUZE Noureddine
PA009	**Ultrasound improves the anticorrosive performance of electrolss Ni-P coating on the mild steel** Mohammad Entezari and Zahra Sharifalhoseini
PA010	**Fabrication and Characterization of Superconducting Bi2212 Bolometer for the Detection of THz Waves** Metin Kurt, Tugce Semerci, Hasan Koseoglu, Yasemin Demirhan, N. Miyakawa, H. B. Wang, and Lutfi Ozyuzer
PA011	**Study of the Physical Properties of Nanostructure ZnO:Cu Thin Films Obtained by Spray Pyrolysis Technique** Maryam Sarhadi and S.M.Rozati
PA012	**Comparative Study of Humidity Sensor Based on ZnO Thin Films Prepared by Sol-Gel Process** S.Ghanem, A.Telia and C.Boukaous
PA013	**Characterization Physical Properties and Structural of Cu–Te–Se Chalcogenide Alloys** Farid Abdel-Rahim
PA014	**A Contribution to the Study of the Performance Improvement of a Capacitive Pressure Sensor Using Carbide Silicon Membrane** Fouad Kerrour, Salah Kemouche and Abdelaziz Beddiaf

PA015	**Capacitance–Voltage Characteristics of SiCN/Si(100) Prepared by HWCVD Method** Akira Izumi and Shinya Morita
PA016	**In the production of conductive carbon and graphite based nanocomposite coatings to increase conductivity by decreasing amount of additives** Metin Yurddaskal, Mustafa EROL and Erdal CELIK
PA017	**Preparation, optical and electrochemical gas sensing properties of Nickel doped lithium iron phosphate thin films** Patima Nizamidin and Abliz Yimit
PA018	**Silver Coated Polymer Fibers by Roll to Roll Inverted Cylindrical Magnetron Sputtering** Adnan Tasdemir, Zeynep Meric, Mutlu D. Yaman, Cem Türkay, Gulnur Aygun and Lutfi Ozyuzer
PA019	**Design of Jaumann Type Radar Absorbing Composites using Thin Film Resistive Sheets** Mutlu D. Yaman, Lutfi Ozyuzer, Adnan Tasdemir, Serkan Kangal and Metin Tanoglu
PA020	**ITO Coated Thin Films and Its Optical and Electrical Characterizations** Cem Türkay, Mutlu D. Yaman, Adnan Tasdemir, Gulnur Aygun and Lutfi Ozyuzer
PA021	**Enhancement of Optical and Electrical Properties of ITO Thin Films by Electro-Annealing** Hasan Koseoglu, Mutlu D. Yaman, Metin Kurt, Fulya Turkoglu, Gulsah K. Akca, Gulnur Aygun, Lutfi Ozyuzer
PA022	**The Effect of Substrate Temperature and Biasing on Mechanical and Tribological Properties and Corrosion Resistance of CrN/Al 5083 Coatings** Kaykhosrow KHojier and Lida Ahmadkhani
PA023	**The Wear Properties of Low Carbon Steel Coated (St52) with ZrB_2 Nanoparticles by Laser Cladding** Tuncay Şimşek, Mustafa Bariş, Adnan Akkurt, Orhan Yilmaz and Murat Bilen
PA024	**The Wear Properties of Low Carbon Steel (S235JRC) Coated with Co_2B Nanoparticles by Laser Cladding** Mustafa Bariş, Tuncay Şimşek, Adnan Akkurt, Orhan Yilmaz and Murat Bilen
PA025	**A Comparative Study of the Processes at Sintering of Coated and Premixed with Graphite Fe-powders** Lubomir Anestiev, Jordan Georgiev and Marcela Selecká
PA026	**Restoration of Protective Coatings on Details and Products that Have Been in Exploitation** Dmitry Mashtalyar, Sergey Sinebryukhov, Konstantine Nadaraia and Sergey Gnedenkov
PA027	**Characterization of Electrochemically Deposited Ni–Mo Alloy Coatings** BEN TEMAM Hachemi and E. GUETTAF TEMAM
PA028	**The effects of Aluminum addition on TRD-NbN coated AISI M_2 Steel** Eray Abakay, Ibrahim Fatih Kekik, Saduman Sen and Ugur Sen
PA029	**Properties of TiAlON layers Deposited on Tungsten Carbide (WC) Substrate by Physical Vapor Deposition (PVD)** Gaber EL-AWADI

PA030	**A Novel Device Configuration Based on Multilayer a-SiC - Metal – a-SiC for Energetic and Photonic Applications** Aissa KEFFOUS
PA031	**Study of Optical Anisotropy with Correlation Between the Structural and Electrical Properties of Sb-doped $CuInS_2$ Thin Films Nano-Engineered by Glancing Angle Deposition.** Ferid Chaffar Akkari
PA032	**Investigating effect of oxygen pressure on structural, optical and morphological properties of Eu^{3+-} doped Y_2O_2S thin film deposited by Pulsed Laser Deposition method.** Abdub Ali, FB Dejene and HC Swart
PA033	**Morphological and Optical Properties of Cr-doped ZnO Thin Films Prepared by Sol–Gel Spin Coating Method** Omer Guler, Handan Aydin, Cihat Aydin, Seval Hale Guler, Fahrettin Yakuphanoglu
PA034	**Preparation and Characterization of NiMnZnO Nano-fiber Thin Films** Cihat Aydin, Handan Aydin and Fahrettin Yakuphanoglu
PA035	**Producing Nanocrystalline Silicon Suboxide Thin Films nc-SiO_x:H $_{(x<1)}$ in PECVD** Kemal Rüzgar and Akın Bacioglu
PA036	**Formation of Anatase TiO_2 Films with a Porous Structure and Enhanced Photoactivity by the Synergy of WO_3 and Sodium** Giin-Shan Chen and J. L. Kuo
PA037	**Preparation, Magnetic and Transport Properties of Co-Cu Microwires** Valentina Zhukova, M Ilyn, J. J. del Val, A. Granovsky, A. Zhukov
PA038	**Synthesis and Optical Properties Nanostructure of Sn Doped Zinc Oxide Thin Films** H. Aydın, C. Aydın and F. Yakuphanoglu
PA039	**Synthesis and characterization of crack-free large-area 2D of transition metal oxides inverse opal film by a dynamic hard-template strategy on flexible and hard substrates** Yahia Djaoued and Hua Li
PA040	**Effect of Correlated Mixed Disorder on Miniband Structure and Resonance Energy of GaAs/$Al_xGa_{1-x}As$ Superlattices** Djelti Radouan, Besbes Anissa, Bentata Samir and Aziz Zoubir
PA041	**Low-Temperature Single-Source Precursors for Tin-Rich Indium Tin Oxides and Their Application for Thin-Film Transistors** Yilmaz Aksu, Kerim Samedov and Matthias Driess
PA042	**Design and Fabrication of Single and Double Layer Anti-Reflection Coating on Glass and Silicon by a-SiO_x:H and a-SiN_x:H Deposition in PECVD** Oldouz Tofigh Kouzehkonani and Akın Bacıoğlu

PA058	**Fabrication and characterization of mixed matrix cation exchange membranes modified by simultaneous using Ilmenite-co-iron oxide nanoparticles** Sayed Mohsen Hosseini, A. R. Hamidi, A. R. Moghadassi, S. S. Madaeni
PA059	**Polyvinyl alcohol films modified by organic dyes and zinc oxide nanoparticles** H. A. Almodarresiyeh, L.N. Filippovich, S. N. Shahab, N. G. Ariko and V. E. Agabekov
PA060	**Study on Doped TiO_2 Thin Films Prepared by Sol-Gel Process** Mohamed Mahtali, Khalida Benzouai, Afifa Derrouiche, Zahia Daas and Abderahmane Boutelala,
PA061	**Structural Analysis of Silicon Nanostructures Obtained from Thermal Annealing of a-Si/SiO_2 Superlattices** Lucie Prušáková, Pavol Šutta, Ing. Veronika Vavruňková and Ing. Marie Netrvalová
PA062	**Probing Lanthanum-Boron Double Film by Carbon Monoxide Adsorption** Tamerlan Magkoev, I.V. Tvauri, S.A. Khubezhov, A.G. Kaloeva, G.S. Grigorkina, A.P. Bliev, V.A. Sozaev, O.G. Ashkhotov,
PA063	**The Effect of Annealing Temperature on the Microstructure and Electrical Property of La-Sr-Mn-O Thin Films Grown on Si(100) Substrates** Gang Wang and Shaoqun Jiang
PA064	**Optical Emission Spectroscopy of Sputtered Titanium and Nickel in RF Magnetron Discharge** Bouaouina Boudjemaa, S.E Abaidia and M.Salhi
PA065	**The Electronic and Magnetic Properties of $La_{0.85}Zr_{0.15}MnO_3$ Deposited on $SrTiO_3$ and MgO Substrates** N. G. Deshpande, C. H. Weng, Y. F. Wang, Y. C. Shao, C. Q. Cheng, D. C. Ling, H. C. Hsueh, C. H. Du and W. F. Pong
PA066	**On the Current-Density Electric Field Characteristics in Carbon Nanotubes** Ghassem Ansaripour
PA067	**Quantum-Size Oscillations of Thermoelectric Characteristics in IV-VI Semiconductor Nanostructures** Dmytro Freik, Rasit Ahiska Igor Yurchyshyn Lyubov Mezhylovska
PA068	**1D and 2D Photonic Crystal on the Left-Handed Metamaterial Base: Band Structure and Optics** Filiz Karaomerlioglu
PA069	**Synthesis and Characterization of Sol-Gel Synthesized CdZnO Nanocomposites** Sinem Aydemir and Şeref Kalem
PA070	**RADAR ABSORBING MATERIALS (RAM) BASED ON THIN OXIDE FILMS** Rafael De La Vega de Mendonça and Viviane Lilian Soethe
PA071	**Chemical composition and structure of thin $La_xHf_{1-x}Oy$ films on Si** T.P.Smirnova, L.V.Yakovkina, V.O.Borisov and V.N.Kichay
PA072	**Temperature Dependence of Raman Scattering in (211)B CdTe/GaAs Grown by Molecular Beam Epitaxy** Selin ÖZDEN, Sinem DUMAN and Yusuf SELAMET

PA073	**Quenching of Pyrene and Tris(2,2'-bipyridine)ruthenium Dyes in Their Thin Film Forms by Nitric Oxide Radical** Ozlem Oter, Akif Cihan Aydın, Kadriye Ertekin and Erdal Celik
PA074	**Fabrication of High-T_c Superconducting Multilayer Structure with $YBa_2Cu_3O_{7-x}$ Thin Films Separated by $SrTiO_3$ Interlayers** Yigitcan Uzun and Ilbeyi Avci
PA075	**Fabrication of NdFeB Thin Films for Applications in Superconductor and Ferromagnetic Systems and Characterization by Using Low Temperature Scanning Hall Probe Microscopy** Sunusi Suleiman Usman
PA076	**Analysis of Interface Charge Densities for ZrO_2 Based MOS Devices** N. P. Maity, Reshmi Maity, R. K. Thapa and S. Baishya
PA077	**Effects of Withdrawal Speed on the Microstructural and Optical Properties of Sol-gel Prepared ZnO:Al Thin Films** Sinem Aydemir
PA078	**Preferred Orientation of $NaCl_xBr_{(1-x)}$ Polycrystalline in Different Atomic Planes** H. Sadeghi , A.Zolanvari, Z. Shahedi and F. Es'hagi
PA079	**Study of Intermediate Bands of Amorphous Oxygen-deficient and Hydrogen-Doped Molybdenum and Tungsten Oxide Films and Application in Multicolor Organic Light Emitting Diodes** Maria Vasilopoulou, Nikos A. Stathopoulos, Stelios A. Savaidis and Dimitris Davazoglou
PA080	**Surface Finishing Processing for Biocompatibility of the Multipurposes Medical Transmission Tubes** Ozlem Salman and Kadir Çeviker
PA081	**Semi-empirical Method to Extract Minority Carrier Bulk Lifetime and Surface Recombination Velocity in P-type Multicristallines Silicon Wafers from QSSPC Measurements** BOUHAFS Djoudi, N. Khelifati Abdelghani Boucheham, B. Palahouane,
PA082	**Analysis of FGM vibrating rectangular nanoplates in thermal environment** Korosh Khorshidi and Ali Bakhsheshy
PA083	**Structural and Optical Properties of Composite Thin Films Deposited by PLD Method** Mesure Mutlu Sanli, Elif Kacar, Mesadet Asuman Sinmaz, Belgin Genc Oztoprak and Arif Demir
PA084	**Plasma-Assisted Approach for Developing Janus Nanofibers that Improve Cell Proliferation and Extracellular Matrix Production** Mehmet Mutlu, Gizem Kaleli, Gözde Kabay, Zahida Sultanova, Özge Dincel and Bong Sup Shim
PA085	**Production and Development OF Yttrium Tantalate Niobate ($YTa_{0.85}Nb_{0.15}O_4$) Thin Film X-ray Phosphor via Sol-Gel Technique** Serdar YILDIRIM, Selim Demirci, Omer Mermer, Mustafa Toparlı, L. Zumre Alıcan Alıcıkus, Fadime Akman and Erdal Celik,

PA086	**The Effect of the Crystalline Order on Magnetic Properties of Mn Implanted TiO_2** O.Yildirim, S. Cornelius, M. Butterling, W. Anwand, A. Wagner, A. Smekhova, C. Baehtz, K. Potzger
PA087	**A Study of TiAlN Thin Films Deposited by Rf Magnetron Sputtering** Amina Zouina AIT DJAFER, Nadia Saoula, Daniel Wamwangi and Abdellatif Zerizer
PA088	**Influence of Substrate Temperature and Pulse Rate on the Structural and Luminescence Properties of $(Y\text{-}Gd)_3Al_5O_{12}:Ce^{3+}$ Phosphor Thin Films Grown by Pulsed Laser Deposition.** Ali Wako, Fancis B. Dejene and Hendrik C. Swart
PA089	**Modeling of Nanosecond Pulsed Electron Beam Ablation: Heating and Sublimation of a Graphite Target.** Muddassir Ali and Redhouane Henda
PA090	**Red Emitting Eu-doped YVO_4 Thin Film Phosphors Prepared by PLD** Foka Kewele, B.F Dejene and H.C Swart
PA091	**Measurement and simulation of point defects and trapping centers in lightly B-doped silicon for photovoltaic application** A. Dussan, F. Mesa and B. A. Paez-Sierra
PA092	**Characterization of VO_2 Films by X-Ray Photoelectron Spectroscopy (XPS)** A. Cantas, H.Yuce, M. Ozdemir, G. Aygun and L. Ozyuzer
PA093	**Growth and Characterisation of Electrodeposited ZnO Thin Films** N. Ait Ahmed, H. Hammache, S. Sam, L. Makhloufi, N. Gabouze
PA094	**Structural and Magnetic Properties $La_{0.7}Sr_{0.3}MnO_3/LaNiO_3$ Superlattices Prepared by RF Sputtering** Hsin-Yi Lee and Heng-Jui Liu
PA095	**Effect of Hydrogen on the Properties of Hydrogenated Amorphous Silicon Carbide (a-SiC:H) Thin Films, Studied by FTIR and Spectroscopic Ellipsometry.** Amer BRIGHET and Mohamed Kechouane
PA096	**Structural, Morphological and Optoelectrical Characterization of Bi_2S_3 Thin Films Grown by Co-Evaporation** F. Mesa, C.A. Arredondo and W. Vallejo
PA097	**Conversion Treatment of Thin Chromium Layers Deposited on High Carbon Steel Substrates** Younes BENARIOUA
PA098	**Plasma Chemical Deposition of Nancomposite Polymer-based Coatings with Controlled Release of Biocide Agents** Alexander Rogachev, V.E. Agabekov, A.V. Rahachou, M.A. Yarmolenka and D.V. Tapalski
PA099	**Horseradish peroxidase enzyme immobilization on modified porous silicon for hydrogen peroxide detection** Amel Lounas, Yannick Coffinier, Nourerdine Gabouze, Sabrina Sam, Khadidja Khaldi, Rabah Boukherroub
PA100	**Study of immobilized-acetylcholınesterase on modified porous silicon surface** KHALDI Khadidja, Sabrina SAM, Amel LOUNAS, Nacera GHELLAI and Noure-Eddine GABOUZE

PA115	**Raman and Optical Studies of Spray Pyrolysed Sb_2S_3 Thin Films** MEDLES Mourad, N. Benramdane, A. Bouzidi, K. Sahraoui, R. Desfeux and C. Mathieu
PA116	**Influence of Sulphur in the Precursor on Efficiency of Cu_2ZnSnS_4 Solar Cell** Fulya Turkoglu, Sebnem Yazici, Metin Kurt, Gulsah K. Akca, Gulnur Aygun, E. Tarhan and Lutfi Ozyuzer
PA117	**Solution Processed Polymer-Fullerene Inverted Bulk Heterojunction Solar Cells** Sule Erten Ela
PA118	**Structural and Luminescence Properties of Yellow $Y_3Al_5O_{12}:Ce^{3+}$ Thin Film Phosphors Prepared by Pulsed Laser Deposition** FB Dejene, KT Roro and LF Koao
PA119	**Fabrication of Characterization BZCYYb Electrolyte Thin Films for IT-SOFCs by E-Beam Vapor Deposition** Min hwan Lim
PA120	**Performance Analysis of a Thin-Film Photovoltaic Generator of 3.6 kW Installed in Kahramanmaras** Saban Yılmaz, Saban Yılmaz, Hasan Rıza Ozcalık and Mustafa Aksu
PA121	**Tracing Current-voltage Curve of Silicon Solar Panel Based on LabVIEW Arduino Interfacing** Arar Hemza, HAOUAM Abdslam and Chenni Rachid
PA122	**Effect of Hydrogen on the Optical and Structurales Pproperties of Amorphous Silicon Carbide Films** Imene ABDENNEBI, Kamel MIROUH and Mohamed KECHOUANE
PA123	**Controlling Si-H Bonds in i-layer on the Characteristics of a-Si:H p-i-n Solar Cells** Yeu-Long Jiang and Tai-Chao Kuo
PA124	**Electrical Properties of CuO/ZnO/ITO Hetrojunction Elaborated by Spray Pyrolysis for Photovoltaic Devices** Lamia Chabane, N. Zebbar, M. Lamri Zeggar, M. S. Aida, M. Kechouane
PA125	**Effect of Substrate Temperature on the Structural, Morphological and Optical Properties of Sb_2S_3 Thin Films** Fethi Aousgi, Wissem Dimassi, Brahim Bessais and Kanzari Mounir
PA126	**Synthesis of Silver Paste for Solar Cells Metallization** Yacine Boukennous, N. Moudir, I. Bozetine, R. Sikaddour, F. Tiour, M. Maoudj and A. Hazmoune
PA127	**Plasmonic Light-trapping for Silicon Solar Cells Using Au-Ag Nanoclusters** Melih Zafer ONDERLI, Necmi SERIN, Savas SONMEZOGLU
PA128	**Aluminum doped zinc oxide Wide bandgap p-type optical window for μc-Si superstrate solar cell** Idris Bouchama, F. Khaled, A. Bouloufa and Kamal Djessas
PA129	**Effect of paste concentration on morphology and size of pores in titania porous layer** Razieh Adelfar
PA130	**Electrical Characterizations of Cu_2ZnSnS_4 Absorber Layer Material for Thin Film Solar Cells** Fatime Gulsah Akca, Sebnem Yazici, Mehmet Ali Olgar, Fulya Turkoglu, Gulnur Aygun, Ekrem Yanmaz, Lutfi Ozyuzer

PA131	**TCO/SILICON HETEROJUNCTION SOLAR CELL: EFFECT OF NANOPARTICLES.** Alla Chebotareva, G.G.Untila, T.N. Kost, S.A. Evlashin and A.S. Stepanov
PA132	**Modelling the effect of defects n the performance of an n-CdO/p-Si solar cell** Nouredine Sengouga, S. Chala and F. Yakuphanoglu
PA133	**X-Ray Photoelectron Spectroscopic (XPS) Depth Profiling Analysis of HfO_2/Hf/Si Multilayer Structure** Ayten CANTAS, Gulnur AYGUN, Lutfi OZYUZER

POSTER SESSION B (3.30 pm to 5.30 pm, September 17, 2014)

PB001	**Heavy Metal Uptake Studies on Mg-Al and Zn-Al Layered Double Hydroxides Thin Films Obtained by Laser Techniques** A. Vlad, R. Birjega, A. Matei, M. Dumitru, M.Filipescu, C. Luculescu, V. Ion, M. Dinescu, R. Zavoianu, O.D. Pavel
PB002	**Electropolymerized Metallophthalocyanine Thin Films** Duygu Akyüz, Ali Rıza ÖZKAYA and Atıf KOCA
PB003	**Layer by Layer Growth of Copper Silver Film Using Underpotential Deposition by an Electrochemical Process** Jau-Shiung Fang, Y.S. Liu and T.S. Chin
PB004	**Corrosion and Microhardness Behavior of Electrodeposited Ni–Mo Alloy Coatings in the Presence of Organic Inhibitor** BEN TEMAM Hachemi and E. GUETTAF TEMAM
PB005	**Influence of Heat Treatment on the Structural Characteristics of Electroless Ni–B Film** Ulaş Matik, Handan Turan Matik and Ramazan Çitak
PB006	**Polyaniline on Porous Silicon for as Sensing** Maha AYAT, Luca Boarino, Noureddine Gabouze, Mohamed Kechouane and Nawel Chiboub
PB007	**Preparation and Tribological Properties of Nano-MoS_2-containing Composite Coating by Plasma Electrolytic Oxidation on Ti6Al4V Alloy** Yongkun Qin, Dangsheng Xiong and Jianliang Li
PB008	**Electrocrystallization of Copper Indium Diselenide Semiconductor for Solar Cell Applications** Serkan Gürbüz , Sema Memiş, A. Sezai Saraç and Melek Erol
PB009	**The Effect of Bias Voltage on the Electrochemical Corrosion Behaviors of TiO_2 Coating Deposited on Stainless Steel by Rf Magnetron Sputtering** Noureddine Madaoui, N. Saoula, K. Kheyar, S. Belhousse and C. Yaddaden
PB010	**Pulse-controlled Surface Roughness, Microstructure and Magnetisation Reversal in Electrodeposited Nanocrystalline Nickel Films** Farzad Nasirpouri, Mohammad Reza Sanaeian, Alexander S Samardak , E.V. Sukovatitsina, Alexey V. Ognev , L.A. Chebotkevich
PB011	**Optical Measurement of Mechanical Stress in Al_2O_3 Thin Films** Miloslav Ohlidal, Ivan Ohlidal, Pavel Nadasky and Jakub Klus
PB012	**Determination of Optical Parameters of Thin Films Non-Uniform in Thickness** Ivan Ohlidal, David Necas, Vladimir Cudek and Miloslav Ohlidal
PB013	**Characterization of Turkey-gordes Zeolite Minerals and Utilization Areas** Öykü Bilgin

PB029	**The Effect of Time on ZnO Nanorods Grown Hydrothermal Method** Zeynep Turgut, Sibel Morkoç Karadeniz Çağrı Çırak, Burcu Bozkurt Çırak, Tuba Kılınç, Mehmet Ertuğrul and Ali Ercan Ekinci
PB030	**Effect of Annealing Temperature on Structural and Luminescence Properties of EU_{3+}-doped Y_2O_3 Red Phosphor Thin Films by Pulse Laser Depostion Method** Abdub Ali, FB Dejene and Hendrik Swart
PB031	**Ethylene Glycol, Methanol and Ethanol Electro-Oxidation at Cu_2O Thin Film** Tayakout BEZGHICHE, T.Bezghiche-Imloul, H. Hammache-Makhloufi, N.Ait Ahmed and L. Makhloufi
PB032	**pH Sensing in Aqueous Solutions Using a Nanostructured MnO_2 Thin Film** Nabila CHERCHOUR, Bouzid Messaoudi, Claude Deslouis and Alain Pailleret
PB033	**Multifunctional Composite Coatings Formed by Plasma Electrolytic Oxidation** Dmitry Mashtalyar, Sergey Sinebryukhov, Igor Imshinetskiy, Konstantine Nadaraia and Sergey Gnedenkov
PB034	**Synthesis, Characterization and Electrochemical Performance of Manganese Dioxide /Carbon Nanotubes Composite** S. Kendouli, N. Sobti and S. Achour
PB035	**Correlation Between Sheet Resistance and Crystalline Texture in Thin Copper Films** Henry Fernández, Marcos Flores and Rodrigo Espinoza
PB036	**Porous Palladium Thin Films Fabricated by Hydrothermal Treatment in Aqueous Citric Acid Solution** Yohei Tamura, Takashi Harumoto and Takashi Ishiguro
PB037	**Development of Magnetism in Iron Thin Film Grown on Patterned Surface** Daniel Merkel
PB038	**Elaboration and Characterization of Polystyrene Doped SnO_2 Thin Films** Fahima Boudjada, Abdelghani Djebli, Mouna Hallel, Boubaker Boudine, Hocine Chorfi and Miloud Sebaïs
PB039	**Deposition of Nanocomposite Thin Films in Low-Pressure Microwave Plasma Effect of Nanoparticles Encapsulated in Amorphous Carbon Films** Kihel Mouloud, R. Clergereaux and S. Sahli
PB040	**Optical Nitric Oxide Sensor Properties of Phthalocyanine Based Dyes in Their Thin Film Forms** Ozlem Oter, Akif Cihan Aydın, Kadriye Ertekin and Erdal Celik
PB041	**Improving the efficiency of dye–sensitized solar cells (DSSC) using metal transition doped TiO_2 as *semiconductor*** Lolwa Samet, Basma Yacoubi, Radhouane Chtourou
PB042	**Fabrication and Characterization of IZO Thin Films Prepared by The Colloidal Method** M. Medjaldi O. Touil, M. Zaabat, B. Boudine, O. Halimi and M. Sebais
PB043	**Production and Application of Al_2O_3 Dielectric Layer on Silicon Wafer Using Magnetron Sputtering Method** Umit Evren, Caglar Ozer, Omer Mermer, Mustafa Toparlı, L. Zumre Alıcan Alıcıkus, Fadime Akman and Erdal Celik

PB044	**Effect of Crystallographic Texture of Aluminum Substrate on Optical Properties of Anodized Films** Nahid Sarrami and Maryam Bagheri
PB045	**Improved Crystallinity and Enhanced Photoluminescent Properties of Laser-ablated Eu^{3+} Doped YVO4 Thin Films Produced by Optimizing the Deposition Time.** Foka Kewele, B.F Dejene and H.C Swart
PB046	**Super Intensity Laser Field Interacted with Atomic System and High HArmonic Spectrum Obtained from Characteristics of High Energy** Dilan Alp
PB047	**Properties of Piezoelectric ZnO Thin Films Grown by Pulsed Laser Deposition onto Glass and Silicon Substrates** Adel Taabouche, Abderrahmane Bouabellou, Fouad Kermiche, Faouzi Hanini and Yacine Bouachiba
PB048	**Theoretical and Experimental Evaluation of Magnetoelectric Effect in $Pb(Zr,Ti)O_3/CoFe_2O_4$ Thin Film Composite on $SrTiO_3$ Substrate** Kazem Tahmasebi
PB049	**VOC Sensitivity Characterization of a Novel Polymer Spin Coated Thin Film** Murat Evyapan, M. Evyapan, W. S. Hanoosh, A. K. Hassan
PB050	**An Investigation of 1,7- dibromo- n,n'-(bicyclohexyl)- 3,4:9,10- Perylendiimide Langmuir-blodgett Film for Organic Vapor Sensing Using Surface Plasmon Resonance Technique** Yaser Açıkbaş, Rıfat Çapan, Matem Erdoğan, Funda Yükrük,
PB051	**Vibrational and Electrical Analysis of Molecular Based Electronics** Fredy Mesa, B.A Paez-Sierra, F. Mesa and A. Dussan
PB052	**Polypyrrole Coated Cellulosic Substrate Modified by Copper Oxide Nanoparticles as Electrode for Nitrate Electroreduction** Makhloufi laid, A. Hamam, D. Oukil and A. Dib
PB053	**Electrochemical Behaviour of Complexes of Copper(II) with Polyphosphonate Acid** Aliouane Nabila, Houa Hammache and Gilles Bouet
PB054	**Oxygen Sensing Properties of Nano-silver Doped Tetraphenylporphyrine Derivatives in Refinery Related Workplace Environments** Zeynep Ay, Kadriye Ertekin , Cevher Gündoğdu Hızlıateş , Yavuz Ergün and Erdal Celik
PB055	**Electrical Characteristic Parameters of an Organic-inorganic Device Based on Quinoline Yellow Dye** A. Ugur, A. Gencer Imer and Y.S. Ocak
PB056	**Color Tunability in Multilayer OLED Based on DCM Doped in a PVK Matrix** Petia Petrova, Petar Ivanov and Reni Tomova

PB057	**Structural and Optical Study of Co Doped ZnO Thin Films** Khantoul Ahmed Reda
PB058	**Synthesis and Characterization of Polyaniline - Silicon Carbide Prepared by Electrochemical Method** M. Berouaken, H.Menari, A. Keffous, N. Gabouze, M. Trari
PB059	**A Comparison Study of RF Plasma Polymerization Of Aniline Derivatives** Melek Kiristi, Aysegul Uygun Oksuz and Lutfi Oksuz
PB060	**Preparation and Electrochemical Characterization of Thin Film Polyvinyl Chloride Baesd/Chitosan-Co-Iron Nickel Oxide Nanoparticles Composite Heterogeneous Cation Exchange Membrane** Sayed Mohsen Hosseini, E. Salehi, A. R. Hamidi, S. Ansari and S. S. Madaeni
PB061	**Effect of Post-heating Temperature on Structural and Optical Properties of Sol-gel Derived ZnO Thin Films** Sinem Aydemir and Ferhunda Atay
PB062	**Analysis of Interface Charge Densities for High-k Dielectric Material Based Metal-Oxide-Semiconductor Devices** N. P. Maity, R. Maity, K. Thapa and S. Baishya
PB063	**Effect of Seed Layer Thickness on the Perpendicular Magnetic Anisotropy and Spin-orbit-torque Driven Switching in Hf/CoFeB/MgO Structure** Mustafa Akyol, Guoqiang Yu, Wanjun Jiang, Juan G Alzate, Pedram Khalili Amiri, Ahmet Ekicibil and Kang L. Wang
PB064	**Surface Electronic Structure of Semimetal/metal Bi Films on GaAs (110) Study by UV Photoemission Spectroscopy** Mahmoud Abusamak
PB065	**Effect of the Metal Content on Structure and Magnetism of the Cobalt-fullerene Mixed Films** Vasily Lavrentiev
PB066	**Analytical Study on electron-beam Processing for Nanoscale Films** Y. H. Tsai, C. Y. Ho and B. C. Chen
PB067	**Magnetic Anisotropy in Bicomponent Self-assembled Ni-Pd Nanowires Studied by Magnetic Resonance Spectroscopy** Konrad Kierczynski, V. Bayev, J.A. Fedotova, A. Maximenko, E. Streltsov, M. Malashchonak, M. Milosavljević, P. Zukowski, T.N. Koltunowicz and K. Kierczynski
PB068	**Dielectric Properties and Model of the Impedance Formation of $(Co45Fe45Zr10)_x(PZT)_{(100-x)}$ Nanocomposites Produced by Means of Ion Sputtering** P. Żukowski, T.N. Kołtunowicz, O. Boiko, J.A. Fedotova, A.K. Fedotov and A. Larkin
PB069	**Resonance Properties at Alternating Current of Nanocomposite $(CoFeZr)_x(CaF_2)_{(100-x)}$ Produced by Ion Beam Sputtering** T.N. Kołtunowicz, P. Żukowski, V. Bondariev, J.A. Fedotova, A.K. Fedotov and A. Larkin

PB070	**Exchange Bias Effect in Mn-rich $YMnO_3$ Thin Films** Manish Kumar, R. J. Choudhary and D. M. Phase
PB071	**Effect of Doping on ZnO Thin Films Prepared by Spray Pyrolysis Technique** Mohamed Mahtali, Afifa Derrouiche, Kalida Benzouai, Zahia Daas and Abderahmane Boutelala
PB072	**Fabrication of Hot Electron Bolometer from High Temperature Superconductor Bi2212** T. Semerci, M. Kurt, Y. Demirhan, H. Koseoglu, H. Alaboz, N. Miyakawa, H. B. Wang' L. Ozyuzer
PB073	**Effect of Different Areas of Superconducting $Bi_2Sr_2CaCu_2O_{8+D}$ Mesas for Terahertz Emission** Sena Gülen, Hilal Sağlam, Yasemin Demirhan, Kazuo Kadowaki and Lütfi Özyüzer
PB074	**Effect of Oxidation Thickness on Tensile Deformation Behavior of Al Nanowire: A Parallel Molecular Dynamics Study Using the Variable Charge Method** Gurcan Aral
PB075	**Inhomogeneous Photocatalytic System on TiO_2 in Contact with Aqueous Sodium Carbonate Solution** Mitsutake Oshikiri
PB076	**A Sensitive Nonenzymatic H_2O_2 Sensor Based on Silicon Nanowires** Chafiaa Yaddaden
PB077	**Influence of Nano-Scale Particles and Nanocluster on the Wetting Behavior and Corrosion Resistance Ability of Metal in Humid Air** Nan Wang and Dangsheng Xiong
PB078	**Influence of Process Parameters on the Properties of TiO_2 Films Deposited by A D.C. Magnetron Sputtering System on Glass Support** Bogdan Toma , Raluca Baciu , Stefan Lucian Toma and Lucian Eva
PB079	**The Influence of the Surface on the Thermoelectric Properties of SnTe:Bi Thin Films** Lyubomyr Nykyruy, Rasit Ahiska, Ivan Chavjak and Nataliia Freik
PB080	**Modeling and Simulation of Tunneling Current using High-k Material Al_2O_3 Based MOS Devices** N. P. Maity, R. Maity and S. Baishya
PB081	**Detailed Morphological Analysis of Vanadium Pentoxide Thin Films** Meltem Dönmez, Buse Cömert, Nihan Akın, Mehmet Çakmak and' Süleyman Özçelik
PB082	**A Comparison Study of Green Luminescence Quenching and UV Emission Enhancing in Oxygen Deficit and Annealed Nano Crystalline ZnO Thin Films** Taj Khan
PB083	**Influence of Metal Impurities and Surface Temperature to the Formation of Thin (Me)-aC:H Film** Zivile Rutkuniene and Lina Vigricaite

PB084	**Characterization of VO_2 Films grown by Magnetron Sputtering for Field Effect Transistor Applications** Hurriyet Yuce, Sena Gulen, Mehtap Koklu, Gulnur Aygun, Lutfi Ozyuzer
PB085	**ZnO Flower-Like Morphology Prepared by Electrodeposition on Silicium Substrate** Hammache Houa, N. Ait Ahmed, H. Hammache, S.Sam , A. Keffous and N.Gabouze
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PB087	**Hybrid Orientation Structure Fabrication on SOI Substrates Using Orientation Selective Epitaxy** Tomoyasu Inoue and Shigenari Shida
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IS01

VUV Processing of Advanced Materials

Ian W. Boyd

Brunel University, ETC, Brunel University, Kingston Lane, Uxbridge, United Kingdom

ian.boyd@brunel.ac.uk

An increasing advantage in the production of ultrathin films and nanostructured layers, is the ability to fabricate at modest temperatures without the need for highly excited and damaging ionic species. Ultraviolet (UV) photon-induced chemistry offers not only this convenience, but many other unique benefits for the growth of simple and mixed layers and also for modification of a wide range of surfaces, such as reduced temperatures and lack of presence of accelerated ionic species.

The natural decay of selected excited dimers and complexes gives rise to a wide spectrum of distinct narrow-band wavelengths from the near visible (354 nm) down to the deep UV (126 nm) which can be utilised to promote a diversity of reactions leading to the low temperature formation of a wide range of thin films and nanostructures. By judicious design, these sources can be intense, highly efficient, and cover large areas.

The application of these excimer lamps towards nanoscale photo-deposition, doping, processing of carbon nanotubes, and formation of nanoparticle-impregnated oxides, will be described. These relatively low cost lamp systems can provide an attractive low temperature alternative for large-scale high temperature materials processing in a wide range of industrial sectors.

IS02

Development of CZTS Thin Film Solar Cells by 2-Stage Process

Hironori Katagiri[1], Kazuo Jimbo[1] and Tsukasa Washio[1]

[1]*Nagaoka National College of Tecjnology, Electrical and Electronics Systems Engineering, Japan*

hiro@nagaoka-ct.ac.jp

Recently, several institutes have achieved the conversion efficiency of over 20 % with $CuIn_{1-x}Ga_xSe_2$ (CIGS) cells. These results showed that the chalcopyrite CIGS would be the most promising materials toward the next generation of thin film solar cells. However, this system consumed some rare-metal such as indium, gallium and selenium as constituents of the absorber. For a rapid expansion of PV in the forthcoming future, we think that the problem of lack of resources will occur if we wouldn't prepare another type of thin film solar cells. From this point of view, we have developed Cu_2ZnSnS_4 (CZTS) thin film solar cells. The constituents of CZTS are all earth-abundant and non- toxic materials.

In 1988, Prof. Ito of Shinshu University of Japan fabricated successfully CZTS thin films using an atomic sputtering technique. Prof. Ito showed that the band gap energy of CZTS films was around 1.45 eV and the absorption coefficient was in the order of $104cm^{-1}$. Furthermore, he fabricated a heterojunction using both p-type CZTS and n-type Cd-doped tin oxide and reported the photovoltaic effect of 165 mV for the first time.

In 1996, we fabricated successfully a CZTS thin film on a soda-lime glass (SLG) substrate by a 2-stage process. This process consists of an electron-beam evaporation followed by a sulfurization. As a result, the open-circuit voltage of 400 mV and the conversion efficiency of 0.66 % were obtained for the first time by making a thin film solar cell structure of SLG/Mo/CZTS/CdS/AZO. To improve the conversion efficiency, many experiments have been conducted since then. In the late 1990's, the authors focused on stoichiometric CZTS films to characterize their properties. From our present viewpoint, this is considered as one of the reasons why the conversion efficiency was so limited.

In this presentation, the history of the development of CZTS solar cells with the 2-stage process in our laboratory will be surveyed. Most important topic is concerned with the active composition: Co-sputtering technique towards three targets is used to examine what proportion of the composition is desirable to increase the conversion efficiency. As a result, Cu-poor and Zn-rich composition is more efficient than the usual stoichiometric CZTS. And then, an optimization of sulfurization process by using TG/DTA system that is available in the H_2S atmosphere will be presented. When we examined the sulfurization condition, we used both the results of XRF composition measurements and TG/DTA thermal analysis. It was confirmed that the raising rate of the substrate temperature within the certain temperature region affected significantly to the film properties. And some of our latest results will be discussed.

IS03

Group-III Nitride Nanorods Grown by Magnetron Sputter Epitaxy

Jens Birch

Thin Film Physics Division, Linköping University, Linköping, SE-58183, Sweden

jebir@ifm.liu.se

One-dimensional group-III Nitride nanorods (NR), have drawn a large interest during the past decade thanks to great prospects for increased quantum efficiency, higher sensitivity, lower heat generation, etc. as compared to bulk and quantum well-based devices.

Magnetron Sputter Epitaxy (MSE) allows for epitaxial growth of InAlN NRs as well as GaN NRs.[1,2] Moreover, low temperature group-III N epilayer growth is possible by MSE[3] and it is easily scalable to large areas, which make it an industrially potent, yet unexploited, technique.

$Al_{1-x}In_xN$ NRs grown on ZrTiN seed layers feature In-rich cores and Al-rich shells, as observed by high resolution electron microscopy (HREM) and quantitative valence electron energy loss spectroscopy using scanning transmission electron microscopy. Such nanorods exhibit near band-edge optical emission at ~5 eV, as observed by cathode luminescence. The internal composition gradient in $Al_{1-x}In_xN$ nanorods is also utilized for high precision tailoring of nanorod morphologies, such as spirals and zig-zag shapes with unique optical properties. For example, $Al_{1-x}In_xN$ spirals with a pitch of ~200 nm can be designed to produce either fully right-handed or left-handed circularly polarized reflected light at specific wavelengths in the UV-regime.

High quality GaN NRs, grown at 1000°C on Si(111), 4-H SiC(0001) and SiO_x substrates. NRs on SiO_x can be grown at thickness ~35 nm and lengths up to several µm without extended defects as seen in HREM. Low-temperature micro photoluminescence (µPL) reveal intense and sharp BE emission with a FWHM = 1.7 meV at 3.48 eV. On clean Si and SiC substrates, NRs emerge from nanowall structures with an epitaxial relationship to the substrates and planar defects can be observed in the NRs which causes the µPL to broaden to ~13 meV.

In conclusion, we show that MSE can be used to produce unique and high quality group-III N NRs, comparable to those grown by MBE.

[1] C.-L. Hsiao, et al. APEX 4, 115002 (2011)
[2] M. Junaid "Magnetron Sputter Epitaxy of GaN Epilayers and Nanorods", Thesis 2012, Linköping Studies in Science and Technology. Dissertation #1482, ISBN 978-91-7519-782-1
http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-84655
[3] C.-L. Hsiao, et al. Thin Solid Films 524, 113 (2012)

IS04

Graphene Oxides and Their Hybrids for Solar Fuels and CO_2 Conversion Applications

Li-Chyong Chen

National Taiwan University, Center for Condensed Matter Sciences, 1 Roosevelt Road, Section 4, 10617 Taiwan

chenlc@ntu.edu.tw

Photocatalytic conversion of carbon dioxide (CO_2) to hydrocarbons such as methanol makes possible simultaneous solar energy harvesting and CO_2 reduction, two birds with one stone for the energy and environmental issues. This work describes a high photocatalytic conversion of CO_2 to methanol using graphene oxides (GOs) as a promising photocatalyst. The modified Hummer's method has been applied to synthesize the GO based photocatalyst for the enhanced catalytic activity. The photocatalytic CO_2 to methanol conversion rate on modified graphene oxide is 0.172 μmol per g-cat−h under visible light, which is six-fold higher than the pure TiO_2. Meanwhile, we have developed a novel one-step and effective electrochemical (EC) method to directly exfoliate graphite into thin reduced graphene oxide (RGO) nanosheets at room temperature. The oxidation degree of the RGOs depends on the switching potentials of the EC synthesis. The high switching potential can significantly increase the C/O ratio of the RGOs. The ability to control the light-absorption of the RGOs by simply adjusting the switching potentials can be further achieved. Moreover, we also construct an RGO–ZnO heterojunction and investigate its photoelectrochemical (PEC) properties. The results show that highly photoactive RGO as a photosensitizer can make H_2 evolution easier and improve the photoconversion ability of ZnO under visible-light irradiation. This approach presents us with a possibility for the environmentally friendly, ultrafast, low-cost, and large-scale production of RGOs and great potential in solar-energy conversion applications of graphene-based materials. Further, Cu and MoS_2 nanoparticles were deposited on GO as co-catalysts to enhanced the photocatalysis reaction. Not only methanol, but also acetaldehyde was detected. Total solar to fuel yield of 6.8 μmole per g-cat−h has been achieved, which is 170 times enhancement relative to the commercial P-25 photocatalyst. In all the above-mentioned hybrids, the photo- catalytic performance is always much better than that of constituent component when used alone. Detailed preparation and characterization of the catalysts will be presented. The role and interplay of the constituent components will also be discussed in this paper.

IS05

Structure Evolution of Magnetron Sputtered TiO_2 Thin Films

Stanislav Mráz

Materials Chemistry, RWTH Aachen University, Kopernikusstr. 10, Aachen, 52074, Germany

mraz@mch.rwth-aachen.de

The structure evolution of TiO_2 thin films deposited by RF and DC magnetron sputtering onto non-intentionally heated, floating, glass and Si (100) substrates was investigated. As the total pressure was varied from 0.15 to 4.0 Pa, corresponding to the pressure-distance product values from 10.5 to 280 Pa mm, rutile, anatase, and a mixture thereof were deposited. The pressure-distance induced changes in ion energy were quantified by probing the ion energy distribution functions. The ion energy during synthesis was additionally varied by applying a substrate bias potential ranging from floating to -100 V revealing a similar phase formation characteristic. While the structure evolution of the TiO_2 thin films reported in the literature exhibits a rather complex dependence on the process parameters, a simple correlation between the structure evolution and the ratio between the ion energy flux and the deposition flux was identified here. Phase pure anatase films were grown below 540 eV / Ti atom and phase pure rutile films were grown above 1000 eV / Ti atom. The here presented data suggest that the ratio between the ion energy flux and the deposition flux ratio defines the phase formation of TiO_2 thin films during magnetron sputtering.

IS06

XPS for Charge-Sensitive Analysis of Ultra-Thin Coatings

Sefik SUZER

Bilkent University, Chemistry Department, Ankara 6800, Turkey

suzer@fen.bilkent.edu.tr

Unlike what is generally thought in freshman textbooks, most materials carry uncompensated electrical charges, as a result of electrification or electret formation. This phenomena is well-known to men for more than 2500 years, and has also been intelligently utilized for that long. An “electret” is defined as a material that develops a permanent electrostatic potential or a permanent dipole moment. In complete contrast to metallic and semiconducting systems, the atomic/molecular-level nature of electrets is poorly understood in most cases. Therefore, better understanding at the atomic and molecular level, i.e. the chemistry, is a must for more intelligent utilization of these materials. Kelvin Probe Atomic Force Microscopy (KP-AFM) has been the most advanced analytical tool for probing and quantifying the charge developed and mapping in the submicron dimensions. However, as in most electrical based measurements it lacks chemical specificity. Spectroscopic techniques like IR, NMR or variants of them coupled with scanning probe techniques like NSOM, etc. have excellent chemical specificity, but they are not sensitive to charge and/or electrostatic potentials developed. In this respect, ESR and EPR techniques have been quite successful for analysis of trapped charges on polymer and/or oxide surfaces, especially in combination with other surface specific techniques. However, use of these techniques are also limited since they can probe only radicals and paramagnetic species. Unlike common optical spectroscopic techniques, XPS is a charged particle based chemical analysis technique, extremely sensitive to the electrical potentials developed due to uncompensated charges. In the early days of XPS, charging was considered as a nuisance for characterization of insulating (electrets) materials. Hence elaborate compensation methods were developed using low energy electron and/or ions to minimize it. However, complete removal is only an ideal, and besides one can learn a lot by controlled use of the charging/discharging phenomena (a blessing). The generated photoelectrons’ energy is influenced by the local electrical potential(s) (Vloc) resulting from charge accumulation, in addition to the chemical identity of the atoms, which is the mainstay of the technique. There are a myriad of chemical, physical, thermal, optical, mechanical phenomena contributing to charge accumulation on materials and/or surface structures, all amenable to charge sensitive XPS analysis. It is equally surprising that, although XPS has been utilized for more than 5 decades, this capability is almost completely left-out, untapped, and not utilized, except by few groups around the globe. We will describe its power by giving a variety of applications from our recent work, particularly related to ultra-thin coatings.

IS07

Plasma Chemical Deposition of Functional Nanocoatings

Jas Pal Badyal

Durham University, Chemistry Department, Durham University, Durham, DH1 3LE, United Kingdom

j.p.badyal@durham.ac.uk

The worldwide market for functional surfaces exceeds $50 billion per annum (US Department of Energy). A key driver is the added value that can be imparted to commercial products by the molecular engineering of their surface properties. For example, the cleanliness of optical lenses, the feel of fabrics, the resistance of biomedical devices to bacteria, the speed of computer hard disks, and even the wear of car brake pads are all governed by their surface properties. The fabrication of such surfaces requires the incorporation of specific functional groups; for which there exists no shortage of potential methods including: self-assembled monolayers (SAMs), Langmuir-Blodgett films, dip-coating, grafting, chemical vapour deposition, to name just a few. However such techniques suffer from drawbacks including substrate-specificity (cannot be easily adapted to different materials or geometries) and environmental concerns associated with the utilization of solvents, strong acid / base media, or heat. Plasma surface functionalization is a promising alternative which offers a wide range of benefits including low energy consumption, absence of solvents, minimal waste, rapid treatment times, scalability, and ambient processing temperatures. Some innovative plasmachemical functionalization approaches will be described for the molecular tailoring of solid surfaces so as to make them super-repellent, catalytic, bioactive, non-fouling, thermoresponsive, rewritable, opto-chiral, antibacterial, capture and release, or nano-actuated. The application of this research has led to 37 patent families and the establishment of 3 successful start-up companies (Surface Innovations Ltd, Dow Corning Plasma Ltd, and P2i Ltd).

IS08

SiGe/Ge Epi Films with Photonic and Electrical Applications

Chee Wee Liu

Department of Electrical Engineering, National Taiwan University

Chee@cc.ee.ntu.edu.tw

Since the Γ valley is 140 meV above than L valley, Ge is of the great interest for light emitting material. The direct band gap (1550 nm) emission is useful for optical interconnect and telecommunication. Metal-insulator-semiconductor (MIS) light-emitting diodes (LEDs) such as bulk Ge, SiGe quantum dot (QD), and quantum well (QW) can cover the luminescence spectra up to 2.2 μm. A novel photodetector using the tunneling structure makes the device operate in the deep depletion region for the IR detection. The broadband absorption of SiGe/Si QD IR photodetector is also demonstrated.

For the technology nodes of 10 nm and beyond, the high mobility channels (Ge/GeSn and III-V) are required to enhance drive current, and new device architectures (FinFET, tri-gates, and GAA FETs) are desired to reduce power and short channel effect. To further go beyond the limitation of Si channels, the Ge channels directly on Si holding substrate seem to be the most feasible candidate for commercialization. Ge integrated with Si is not straightforward since the 4 % mismatch between Ge and Si generates the misfit and dislocations. The misfits of the bottom Ge can be removal by anisotropic etching. The nearly defect-free Ge channel can be formed for GAA transistors. The Ge GAA pFETs and nFETs have been demonstrated with the good electrical performance.

IS09

Reducing Microwave Surface Resistance of YBCO Thin Films under High dc Magnetic Fields by Introduction of Artificial Pins

Shigetoshi Ohshima

Faculty of Engineering, Yamagata University, Yonezawa 992-8510, Japan

ohshima@yz.yamagata-u.ac.jp

It is well known that microwave surface resistance (R_s) of $YBa_2Cu_3O_{7-d}$ (YBCO) thin films is approximately three order magnitude smaller than that of copper films, however, the R_s of YBCO thin films increases with increasing applied dc magnetic fields rapidly. We investigated the effect of introducing artificial pinning centers (APCs) into YBCO thin films to reduce the R_s under dc magnetic fields. YBCO thin films with and without $BaMO_3$ (M=Zr, Hf) on MgO substrate were fabricated by using pulsed laser deposition technique. The film thickness was 300nm. We used mix targets of $BaMO_3$ and YBCO to dope $BaMO_3$ to YBCO. The dopant of $BaMO_3$ was changed from 1.0 to 3.0 wt %. The temperature dependence of the R_s was measured by dielectric resonator method. The magnetic field was applied normal to the substrate plane and changed from 0 to 5 tesla. The temperature was changed from 4.2 K to 80K.

The R_s of the YBCO with and without $BaMO_3$ increased with increasing applied dc magnetic field in all the temperature region, however, we found that R_s(H) of YBCO with $BaMO_3$ thin films was small change compared with R_s(H) of YBCO thin film. The R_s at 1GHz, 5tesla and 20K were as follows; YBCO=30 micro-ohm, YBCO with 1.5wt% BHO=16 micro-ohm, YBCO with 1.5wt% BZO=18 micro-ohm, YBCO with 3.0wt% BHO=21 micro-ohm, YBCO with 3.0wt% BZO=28 micro-ohm. The YBCO thin film with added 1.5wt% $BaHfO_3$ had the smallest R_s. K. Matsumoto et al reported that the critical current density (J_c) of YBCO thin films with added about1.5wt% BHO was the largest compared with that of YBCO and YBCO with BZO thin films. In addition, we have reported the relationship between R_s and J_c. The R_s is in inverse proportion to the J_c. Therefore, we can explain that the reducing microwave surface resistance of YBCO thin films is occurred by introduction of artificial pins.

IS10

Terahertz Emission from Monolithic Thin Film Bi-2212 Intrinsic Josephson Junctions

Kensuke Nakajima

Yamagata University, 4-3-16 Jonan, Yonezawa, 992-8510, Japan

nakajima@yz.yamagata-u.ac.jp

Since the first successful terahertz wave emission from mesa type intrinsic Josephson junction made of a small flake of single Bi-2212 crystal[1], few groups have replicated the emission from the intrinsic Josephson junctions made of single crystal flakes to study emission mechanism. Besides studies on the mechanism, engineering studies on device design including material developments is also important from application point of view. We have first developed monolithic device consisting of step edge type intrinsic Josephson junction (SEIJJ) made of Bi-2212 thin films grown by the capped-LPE method on step engraved MgO substrates. The SEIJJ exhibit excellent heat dissipation compared with those made of single crystal flakes. In this paper, we report monotonic terahertz wave emission from the voltage-biased step edge type intrinsic Josephson junctions up to 75K. Frequency of emission is measured by a terahertz lamellar grating interferometer to be around 0.6 THz. It is shown that the bias voltage satisfies the Josephson relation multiplied by the number of junction consisting of Cu-O double layers of Bi-2212 crystal and the frequency is in good agreement with the half wave resonance frequency of the junction width. These results will prove that the monolithic Bi-2212 SEIJJ device is possible terahertz emitting device operating at 77K.

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References

[1] L. Ozyuzer et al, Science 318, 1291 (2007).

IS11

Characterization of Various Nanocomposites using Spectroscopic Techniques in the THz Region

Hakan Altan

Middle East Technical University, Physics Dept, METU, Universiteler Mah Dumlupinar Bulv No 1, Cankaya 6800, Ankara, Turkey

haltan@metu.edu.tr

Nanocomposite materials can be characterized as a medium where some conducting or semiconducting nanosized particle is embedded in a host dielectric. Such structures are typically grown as films on various substrates. Film structures can have varying optical and or electrical properties based on the nano-constituent. To determine the changes in these properties a variety of techniques can be implemented. One technique, equivalent to non-other, which has proven to garner attributes such as the electrical properties of these films, has been Time-Domain and its dynamical counterpart Time-Resolved THz Spectroscopy. Over the last few years the latter technique has been regarded as an excellent tool to understand the conductivity of various nanocomposite films. In this talk these techniques will be discussed in light of measurements we have performed in our own laboratories on various films.

IS12

THz Characterization of a Metamaterial-Based Spatial Light Modulator

Antonello Andreone

University of Naples "Federico II", Piazzale Tecchio 80, Naples I-80125, Italy

andreone@unina.it

The aim of this work is to investigate new classes of artificial materials exhibiting unconventional properties in order to build novel devices operating in the Terahertz regime. We focus on the design, fabrication and characterization of tunable metamaterials with unit cells based on Split Ring Resonators. By incorporation of a nematic liquid crystal in the structure, we observe a frequency shift in the resonant response over 10% in bandwidth and more than 10 dB change in the signal absorption. We discuss how such a hybrid structure can be exploited for the development of a THz spatial light modulator.

IS13

Atomic Layer Deposition of MoN and $Nb_xTi_{1-x}N$ Superconducting Films

John Zasadzinski

Illinois Institute of Technology, Physics Department, Life Science, 3101 S. Dearborn, Chicago, IL 60616, United States

zasadzinski@iit.edu

Atomic layer deposition (ALD) is a sequential, self-limiting, chemical deposition process that can create thin films and multilayers with monolayer control. Additional advantages include a relatively low substrate temperature as well as the ability to conformally coat unusually * shaped objects (e.g. multifilament wires and RF cavities). We report here the ALD deposition of MoN and $Nb_xTi_{1-x}N$ superconducting thin films grown on various substrates (Si, sapphire, quartz) at 450 °C with transition temperatures, T_c ~ 12K and 13K respectively. Films have been characterized by XRD, electric transport R(T), critical current density, and superconducting tunneling spectroscopy. Artificial tunnel barriers of Al_2O_3 (1-3 nm thick) also grown by ALD are shown to provide much improved tunneling characteristics compared to the native oxide. Relatively high quality superconducting gap features are observed in the tunneling conductance with zero bias conductances typically ~ 10% of the high bias value. For both materials the superconducting gap closes near the measured Tc indicating bulk superconductivity at the surface. The suitability of such films for electronic devices, including Josephson junctions and superconducting RF cavities, will be discussed.

IS14

From Materials Research to 3D-Integrated Li-ion Micro-Batteries

Peter Notten

Eindhoven university of technology, Den Dolech 2, Eindhoven 5600 MB, Netherlands

p.h.l.notten@tue.nl

Planar thin-film lithium ion batteries nowadays reveal excellent reversible electrochemical performance. To increase the energy density of these thin-film batteries, novel approaches have been proposed. One of the new concepts is based on the etching of deep 3D-structures into a silicon substrate, increasing the effective surface area significantly. In combination with advanced materials new opportunities are obtained to increase the energy density further. Silicon and Germanium turned out to be excellent candidates for Li-storage electrode materials. About 4 Lithium atoms can be stored per Si/Ge atom. The volume expansion is, however, tremendous inducing material deterioration. In order to cope with this various approaches has been adopted. Nano-wires were found to be too mechanically sensitive to be applied in all-solid-state battery stacks. Honeycomb structure has recently also been proposed. Striking reversible materials deformation has been reported upon (de)lithiation. Finally, thin films turned out to extremely stable and the Lithium concentration profiles has recently been in situ characterized by Neutron Depth Profiling (NDP).

IS15

Emergence of Superconductivity and Vortex Confinement in Superconductor/Ferromagnet Hybrid Systems

Maria Iavarone

Temple University, Physics Department, Barton Hall 1900 N. 13 Street PhiladelphiaUnited States

iavarone@temple.edu

Magnetically coupled superconductor-ferromagnet systems have been studied by low temperature Scanning Tunneling Microscopy and Spectroscopy.The stray field of the ferromagnet induces a non-uniform superconducting state characterized by a local superconducting critical temperature Tc and a non monotonic behavior of Tc vs H close to the critical temperature [1,2]. We studied Pb/[Co/Pd] systems and we visualized the emergence of superconductivity in regions above the separation between adjacent magnetic domains, as well as reverse domain wall superconductivity. Moreover, deep in the superconducting state vortices of opposite polarity are induced by the stray field of the ferromagnet in zero applied external field and they are strongly confined on the stripe of the same polarity. The nucleation of spontaneous vortex-antivortex strongly depends on the domain width. Our results demonstrate that such S/F structures are attractive model systems that offer the possibility to control the strength and the location of the superconducting nuclei.

[1] Yang Z., Lange M., Volodin A., Szymczak R., and Moshchalkov V.V., Nature Mater. 3, 793 (2004)
[2] Aladyshkin A. Yu., Buzdin A. I., Fraerman A.A., Melnikov A.S., Ryzhov D.A., and Sokolov A. V., Phys. Rev. B 68, 184508 (2003)

IS16

Thin Films of Liquid Crystalline Phthalocyanine and Their Composites with Nanomaterials

Aseel Kadhim Hassan

Sheffield Hallam University, 153 Arundel Street Cantor Building, Sheffield, South Yorkshire S1 2NU, United Kingdom

a.hassan@shu.ac.uk

Phthalocyanine molecules and their substituted derivatives represent a very interesting class of materials, which has been studied for long as model organic semiconductor. Their unique structure can be chemically tuned in order to suit a broad range of applications; among those are chemical detection, organic field effect transistors (OFETs) and photovoltaic (PV) devices are of special interests. In this talk peripherally substituted metal phthalocynanine molecules with liquid crystalline properties are prepared as thin films and their self-organisation behavior is discussed. These discotic molecules can adopt two characteristic orientations of columnar superstructures on surfaces, both are required for electronic device applications with different geometries; the edge-on orientation of the discotic molecules (homogeneous alignment) has the discotic molecules and columns parallel to the substrate surface whereas in the face-on orientation (homeotropic alignment) the molecules and columns lie parallel to the substrate surface. The electrical and optical properties of both types of supramolecular structures of liquid crystalline MPc films are discussed in detail. The study will also highlight the hybrid structures of these molecules with different nano-structures such as gold nanoparticles and carbon nanotubes and their possible device applications.

IS17

Novel Surface-Plasmon-Enhanced Coatings for Light-Emitting Devices

Dong-Sing Wuu

Department of Materials Science and Engineering, National Chung Hsing University, Taiwan, R.O.C.

dsw@dragon.nchu.edu.tw

In this study, a surface-plasmon-enhanced light-emitting device (SPE-LED) was successfully fabricated by improving the external quantum efficiencyvia the increase of light extraction efficiency of the device. We have demonstrated a spin coating process as a promise method, which was used a nano-Ag solution coated on p-GaN layer as the grating structure. The benefits of spin coating include fast process time, higher production yield, lower cost, and high uniformity over the curved surface. Moreover, the size, density, and periodic distance of metallic nanostructures can be controlled by the some conditions, such as a spin coating rate, thermal annealing condition and concentration of the nano-Ag solution. Subsequently, an evaporated 200-nm-thick indium tin oxide (ITO) as an ohmic contact layer was deposited on the Ag nanoparticle top layer. Based on the atomic force microscopy, scanning electron microscopy and transmission electron microscopy, the structural properties of ITO/p-GaN with Ag nanoparticles have been investigated. Consequently, it is expected that the LED performance can be improved significantly via an assistance of the three-dimensional distribution of nanoparticles. For revealing the superiority of device performance on SPE-LEDs, the other conventional LEDs without Ag nanoparticles were also fabricated for comparison.

IS18

Plasmonic Large Area Thin-Film Interfaces for Potential Solar Cell Applications

Alpan Bek

Middle East Technical University, Physics Department, Dumlupınar Blv. 1, Ankara 6800, Turkey

bek@metu.edu.tr

Single and double plasmonic interfaces consisting of silver nanoparticles (Ag NPs) embedded in media with different dielectric constants including SiO_2, SiN_x and Al:ZnO, have been fabricated by a self-assembled dewetting technique and integrated to hydrogenated amorphous silicon (a-Si:H) films. Single plasmonic interfaces exhibit plasmonic resonances whose frequency is red-shifted with increasing NP size and with the thickness of a dielectric spacer layer. Double plasmonic interfaces exhibit resonances consisting of double minima in the transmittance spectra. The optical extinction of a-Si:H deposited on these interfaces is broadened into the red indicating higher absorption and/or scattering at wavelengths higher than those typically absorbed by a-Si:H without plasmonic interfaces. Additionally, we study the potential of textured Al:ZnO films decorated with plasmonic metal NPs for enhancing incident light absorption in the active layer of a solar cell (SC). Textured Al:ZnO has strong scattering properties of light. Ag NPs can serve as efficient light scattering centers to increase the optical path length of light in the absorber layer of SCs, as they possess localized surface plasmons. We fabricate an optimally textured Al:ZnO layer using a single step HCl chemical etching procedure. Our results show that Al:ZnO layers textured this way provide drastic increases in the transmittance haze and may provide from 95 % to 220 % enhanced diffuse transmittance over entire solar spectrum. Moreover, using the simple dewetting technique at moderate temperatures, Ag NPs were fabricated on as-deposited (flat) and textured Al:ZnO layers. Combined Al:ZnO and Ag NPs as a single light trapping interface can act as the front surface of a thin film SC. We observe that the plasmonic interfaces resonate in the visible and near infrared portion of the spectrum which is consequential for trapping the incident photons in the thin layers of the SC.

IS19

Probing Ultrafast Carrier Dynamics by Optical Pump-Probe STM

Hidemi Shigekawa

Faculty of pure and applied science, University of Tsukuba

hidemi@ims.tsukuba.ac.jp

In the field of nanoscale science and technology, the addition of high temporal resolution to scanning probe microscopy (SPM) has been attracting considerable attention since its invention. We have been developing a microscopy technique that simultaneously realizes the spatial resolution of scanning tunneling microscopy (STM) and the temporal resolution of ultrashort-pulse laser technology, i.e., optical pump-probe (OPP) method [1-7]. The combination of STM with optical technology has advantages to enable the analysis of photo-induced dynamics on the nanoscale as well as the realization of ultrafast time-resolved microscopy. In OPP-STM, a non-equilibrium carrier distribution is generated using ultrashort laser pulses and its relaxation processes are probed by STM based on the OPP method. By combining the microscopy with atom tracking technique, even a single-atomic-level analysis of the carrier dynamics has become possible [5-7]. Furthermore, with the development of a new modulation technique of circularly polarized light, detection of spin dynamics has been realized [8]. The relaxation of spins optically oriented in quantum wells formed by GaAs/AlGaAs was observed independently. Furthermore, spin precession in GaAs sample under a magnetic field was successfully probed using tunneling current by the time-resolved STM. Details will be discussed with the recent results at the conference.

References:

[1] Y. Terada, S. Yoshida, O. Takeuchi, and H. Shigekawa: Nat. Photonics 4 (2010) 869.
[2] Y. Terada, S. Yoshida, O. Takeuchi, and H. Shigekawa: J. Phys.: Condensed Matter 22 (2010) 264008.
[3] S. Yoshida, Y. Terada, R. Oshima, O. Takeuchi, and H. Shigekawa: Nanoscale 4 (2012) 757.
[4] S. Yoshida, M. Yokota, O. Takeuchi, Y. Mera, and H. Shigekawa: Appl. Phys. Exp. 6, (2013) 016601.
[5] S. Yoshida, M. Yokota, O. Takeuchi, H. Oigawa, Y. Mera, and H. Shigekawa: Appl. Phys. Exp. 6, (2013) 032401.
[6] S. Yoshida, Y. Terada, M. Yokota, O. Takeuchi, H. Oigawa, and H. Shigekawa: The European Physical Journal Special Topics 222, 1161-1175 (2013)
[7] M. Yokota, S. Yoshida, Y. Mera, O. Takeuchi, H. Oigawa, and H. Shigekawa, Nanoscale, 2013, 5, 9170-9175 (2013).
[8] S. Yoshida, Y. Aizawa, Z. Wang, R. Oshima, Y. Mera, E. Matsuyama, H. Oigawa, O. Takeuchi, and H. Shigekawa, Nature Nanotechnlogy, DOI: 10.1038/NANO. 2014. 125.

IS20

NanoTesla Magnetometry using Integrated 2 Dimensional Electron Gas (2DEG) Systems

Mohamed Missous

University of Manchester, School of Electrical and Electronic Engineering, Sackville Street Manchester Greater, Manchester M13 9PL, United Kingdom

m.missous@manchester.ac.uk

The high electron mobility of III-V compound semiconductors has been a prime advantage for their use as magnetic sensors in application requiring high sensitivity and/or harsh environments conditions. Traditional bulk compounds semiconductors have demonstrated ability to measure magnetic fields around the 1μT level precluding them from many applications where higher resolution/sensitivities are needed.

When combined in the form heterojunctions the enhanced mobilities permit operations down to or below 1 nT making them very competitive with GMR and AMR sensors while preserving a remarkable dynamic range since being inherently non-magnetic these sensors do not saturate. The heterojunction Hall sensors have the potential to also double up as transistors and thus offer the possibility of opening up the way for a new technology that combines both magnetic sensing with electronics conditioning circuitry on the same chip.

Commercially available Hall Effect ICs are all based on Silicon CMOS technology mainly due to their small dimension and low cost. However, short comings of theses ICs include low magnetic field sensitivity, limited operating frequency range and high power consumption. In order to provide a higher sensitivity, lower field detectability and wider operating frequency range, a new type of Hall integrated circuits have been developed, which utilises a two Dimensional Electron Gas (2DEG) system. The high electron mobility and the moderate sheet carrier densities permit both magnetic and circuit functionalities in a similar manner to CMOS Hall ICs. These integrated Hall ICs are based on the GaAs-InGaAs-AlGaAs system, which is a relatively mature technology enabling accurate modelling and simulation of transistors for the development of Process Development Kits (PDK). All circuit elements required for successful integration have been developed in an effort to design and fabricate low power integrated Hall ICs with unprecedented sensitivities.

2DEG Hall sensor, current source, differential amplifier, comparator and source follower were designed and integrated to form the first highly sensitive, low power (~18 mW) III-V DC unipolar Hall integrated circuit. This is a three terminal device which utilises 2 μm gate length technology, offering very high yields and at least ~50% higher switching sensitivity (~6 mT) compared to existing commercial unipolar ICs. Linear Hall Effect Integrated Circuits (LHEIC) were also been developed. These LHEIC have a state-of-the-art sensitivity of 533 μV/μT and are capable of detecting magnetic fields as low as 177 nT (in a 10 Hz bandwidth), at frequencies from ~100 Hz to 200 kHz. This provides at least an order of magnitude improvement in sensitivity and a factor of four improvements in detectability of small fields, compared to commercial Si linear Hall ICs.

Future applications and implications for the feasibility of 2D magnetic imaging systems leading to Magnetic cameras will be discussed.

IS21

SEA – Semiconductor Equipment Assessment for Thin Films, Their Metrology and Implementation into Manufacturing

Lothar Pfitzner

Fraunhofer-IISB, Schottkystrasse 10 Erlangen, 91058 Germany

lothar.pfitzner@iisb.fraunhofer.de

The European position as a supplier of micro- and nanoelectronics and as a supplier of Semiconductor Manufacturing Equipment and Materials has been altered significantly over the past two decades. The number of IC-manufacturing sites in Europe has remained almost constant - whereas other regions especially in the Far East have grown heavily - a strong paradigm shift has occurred. In fact, the number of European leading edge IC–manufacturers has decreased. However, a new spectrum of European produced devices is rapidly growing and can be summarized by More-than-Moore devices, power devices and 3D-devices. Such semiconductor devices require that paradigm shift in processing technology as well as in equipment, in materials and in manufacturing.

To maintain and to increase the percentage of Integrated Devices produced in Europe, a bunch of supporting activities along the whole supply chain has been conducted in the past. Accompanied by regional and national micro- and nanoelectronic programs, several Framework Programs of the European Commission as well as focused research and technology activities like MEDEA and CATRENE, or Public-Private Partnerships like ENIAC and ECSEL were founded.

The first period strongly supported the research and development for lithography and its periphery, followed by other tool development projects. One of the most successful programs succeeded and started almost 20 years ago: SEA–Semiconductor Equipment Assessment partly accompanied, but mainly followed by an impressive number of processing tool assessment.

An overview of historical projects, followed by a detailed description of recent activities will be given with a focus on thin film deposition tools and thin film metrology equipment. Examples and results from the latest European SEA projects SEA-NET, SEAL and SEA4KET will be presented which demonstrate the great benefit that can be achieved by the dedicated collaboration of equipment suppliers, research institutes and end-users. In addition, innovative strategies in the implementation into manufacturing will be presented.

IS22

Electrochemical Synthesis of Iron-Based Superconductor FeSe Films

Satoshi Demura

Tokyo University of Science, 1-3 Kagurazaka, Shinjuku-ku, Tokyo, 162-8601, Japan

demura@rs.tus.ac.jp

We have successfully synthesized the iron-based superconductor FeSe by electrochemical deposition. This electrochemical synthesis is not only a fast and low-cost method to fabricate thin films over large areas but also easy to apply to the superconducting tape fabrication and coating. In addition, FeSe has a high upper critical field and the simplest structures with less toxicity. Therefore, the synthesis of FeSe using electrochemical deposition is a promising method for superconducting applications. Here, we report the fabrication of FeSe using the electrochemical synthesis. These obtained samples were measured by powder x-ray diffraction and energy dispersive x-ray spectrometry to find the appropriate conditions. The composition ratio of Fe and Se can be controlled by the synthesis voltage and pH value. As a result, FeSe with the composition ratio of Fe : Se = 1 : 1 was fabricated at a voltage of -0.9 V and pH 2.1, and exhibited the superconducting transition at 8.1 K. Furthermore, FeSe deposited on Fe Plate shows zero resistivity after annealing in evacuated quartz tube. This result suggests that FeSe tapes can be fabricated using the electrochemical synthesis. We will present the detail of the electrochemical deposition of FeSe.

IS23

THz Quantum Cascade Lasers

John Reno

Sandia National Laboratories Dept. 1131, MS 1303 , Albuquerque NM, 87185, United States

jlreno@sandia.gov

Terahertz (1-10 THz, or 4-40 meV, or 30-300 μm) frequencies are among the most underdeveloped electromagnetic spectra, even though their potential applications are promising for spectroscopy in chemistry and biology, astrophysics, plasma diagnostics, remote atmospheric sensing and imaging, noninvasive inspection of semiconductor wafers, and communications. This underdevelopment is primarily due to the lack of coherent solid-state THz sources that can provide high radiation intensities (greater than a milliwatt). The recent progress of the THz quantum cascade laser (QCL) makes it an attractive candidate for this application because of its compact size and high output power. We will present results ranging from MBE growth with monolayer precision, to laser design and fabrication, to basic laser physics studies, to demonstrations of systems such as a frequency comb and real time video. This wide range of results comes from a group of CINT users spread over numerous institutions and locations.

IS24

Quantitative Atomic Force Microscopy for the Characterisation of Thin Films

David Haviland

Royal Institue of Technology, Albanova, Roslagstullsbacken 21, Stockholm SE-10961, Sweden

haviland@kth.se

Recent advances in the field dynamic Atomic Force Microscopy (AFM) have enabled a calibrated and quantitative measurement of tip-surface force at every pixel of an image produced while scanning and normal speeds (1 line per second). This progress opens the door to a new understanding of tip-surface interaction, and new methods of characterisation of thin films. This talk will describe the basic problems associated with reconstructing tip-surface force from a measurement of cantilever deflection. We describe a method based on interpreting the non-linear response of the oscillating cantilever which makes optimal use of the enhanced force sensitivity in the frequency band near a high quality factor resonance. The application of this method to probe the mechanical response of soft liquid-like polymer surfaces will be given. It will also be demonstrated how the reconstruction of electrostatic forces is used to map the optical activity of photovoltaic materials.

References:

Intermodulation Atomic Force Microscopy, D. Platz and E. A. Tholén and D. Pesen and D. B. Haviland, Appl. Phys. Lett. 92, 153106 (2008).

Reconstructing Nonlinearities with Intermodulation Spectroscopy (article)
Author, C. Hutter and D. Platz and and E. A. Tholén and T. H. Hansson and D. B. Haviland, Phys. Rev. Lett., 104, 050801 (2010).

The role of nonlinear dynamics in quantitative atomic force microscopy,
Daniel Platz and Daniel Forchheimer and Erik A. Tholén and David B. Haviland,
Nanotechnology, 23, 265705 (2012).

Model-based extraction of material properties in multifrequency atomic force microscopy, D. Forchheimer and D. Platz and E. A. Tholén and D. B. Haviland, Phys. Rev. B, 85, 195449 (2012).

Interaction imaging with amplitude-dependence force spectroscopy, D. Platz and D. Forchheimer and E. A. Tholén and D B. Haviland, Nature Comm. 4, 1360 (2013).

IS25

Laser and Thermal Annealing Studies of a-$Si_{1-x}C_x$:H Thin Films Deposited by PECVD

D.K.Basa[1], G.Ambrosone[2] and U.Coscia[2]

[1]*Department of Physics, Utkal University, Bhubaneswar-751004, India*
[2]*Dipartimento di Fisica, Complesso Universitario di Monte S Angelo, via Cintia, I-80126 Napoli, Italy*

Hydrogenated amorphous silicon carbon films of different carbon content deposited by plasma enhanced chemical vapour deposition (PECVD) technique, were subjected to excimer laser annealing as well as thermal annealing by varying laser power density Ed from 123 to 242 mJ/cm^2 and annealing temperature Ta from 250 to 1200 °C respectively. The films were characterized by X-ray diffraction, Raman ,Fourier transform infrared spectroscopies and also field emission scanning electron microscopy, before and after annealing treatment in order to understand the role of carbon content, laser power density and the annealing temperature on the properties of these films. It is demonstrated that for the laser annealed films cubic silicon carbides are formed for carbon content ≥ 0.18 as well as for the laser power density ≥ 188 mJ/cm^2 respectively. For thermal annealed samples, on the other hand, micro crystalline SiC and polycrystalline hexagonal SiC are observed for the annealing temperature at 800 and 1200 °C respectively. Finally, it is shown that the crystallization is confined to very thin top layer for the laser annealed films while it is extended to the entire sample for the thermal annealed films.

IS26

Understand High-Power Impulse Magnetron Sputtering (HiPIMS) through Plasma Discharge Modeling

Daniel Lundin

KTH Royal Institute of Technology, Division of Space and Plasma Physics, School of Electrical Engineering, Stockholm 100 44, Sweden

daniel.lundin@liu.se

High-Power Impulse Magnetron Sputtering (HiPIMS) is a novel sputtering-based ionized physical vapor deposition technique. The major difference between HiPIMS and conventional sputtering techniques, such as DC magnetron sputtering (DCMS), is that HiPIMS has the added advantage of providing substantial positive ion formation of the sputtered material. This results in improved quality of the film/substrate interface, denser coatings, and better deposition on complex geometries (non-flat surfaces). However, the physical mechanisms operating in the HiPIMS plasma are still far from being completely understood. Examples of these scientific challenges are: 1) Highly energetic ions, which are somehow accelerated in the HiPIMS plasma, 2) substantial depletion of the process gas leading to a reduction of ions available for sputtering, and 3) increased process stability/process window during reactive thin film deposition as compared to DCMS.

In this talk I will address some of these issues and show how we can tackle them through computational modeling benchmarked with experiments. First a time-dependent, zero-dimensional (i.e. volume averaging) plasma chemical model (IRM) will be used, which calculates the time evolution of neutral and charged species in sputtering magnetron discharges. It follows both the internal collision-induced reactions and the particle fluxes across the boundaries. Using the IRM, gas depletion as well as the onset and development of self-sputtering in HiPIMS have been studied. Details on the internal mechanisms and reactions will be presented. Furthermore, a kinetic 3D model (OMEGA) for the transport of particles out into the bulk plasma towards the substrate will also be presented, and it will be shown that simulated velocity distributions (vdf:s) of the sputtered particles agree well with experimentally obtained profiles using laser-based diagnostics.

IS27

Effects of Structural Properties and Morphologies of Ga-doped ZnO Thin Films on Their Optoelectronic Characteristics

Ray Hua Horng

National Chung Hsing University, 250, Kuo Kunag Rd. Taichung, Taiwan

huahorng@nchu.edu.tw

Ga-doped ZnO (GZO) thin films were fabricated. When the Ga concentration was sufficient, it partially converted the crystalline structure from (002) ZnO to (100) and (101) ZnO. The internal stress due to the replacement of Zn with Ga could be the origin of this dominant crystalline structure. Rapid thermal annealing (RTA) enabled the GZO thin films to improve their crystallinities that could be cause by stress releasing. Crystalline and optical transmission properties of GZO samples, studied by high-resolution X-ray and N&K techniques, were consistent. Likely RTA treatment provided sufficient energy for Ga elements in some of the samples to transfer from the interstitial sites the main lattice sites. This phenomenon was explored by a photoluminescence spectroscope. The resisitivities of the RTA- treated GZO, recorded by a Hall measurement was decreased, which conforms the decrease in the work function obtained by ultraviolet photoelectron spectroscopy.

IS28

Lattice Engineering and Growth Mechanism Control of HTS Thin Films and Heterostructures by MOCVD and by Spin Coating

Kazuhiro Endo

Kanazawa Institute of Technology, 3-1 Yatsukaho Hakusan, Ishikawa 924-0838, Japan

kendo@neptune.kanazawa-it.ac.jp

High temperature superconductors (HTS) have a high potential for device applications such as SQUID, Josephson junction and terahertz devices. In order to realize these devices, high quality epitaxial (in-plane) HTS thin films and/or heterostructures with controlled out-of-plane orientation are necessary. Orientation control is important because HTS have a large anisotropy that can be exploited for the design and fabrication of new devices.

In our presentation we shall focus on the aspects of orientation control through the lattice mismatch between the substrate and the film(s). Some details are concerned with lattice mismatch anisotropy engineering. Also some other growth approaches, e.g. using artificially patterned steps on the substrates for the precipitate-free growth or the modification of the growth mechanism from a 2D layer-by-layer to a step flow type for the roughness decrease and improvement of the morphology uniformity when switching from flat to vicinal substrates will be presented. A two-temperature (template) growth will be also discussed. Some specifics of the MOCVD and of the related MOMBE, as well as of spin coating methods will be introduced in a comparative manner. Our presentation allows a better understanding of the perspectives and some challenges in thin films growth.

As a result of different growth approaches and their combinations, various top quality thin films with different orientations were obtained. Thin films were used to fabricate heterostructures with c-axis and non c-axis orientations and some examples will be addressed illustrating some key details of structural and chemical compatibility between the composing layers of a heterostructure.

IS29

Theoretical and Experimental Two Terminal Memristors: Preliminary Findings for Future Applications

Hasan Efeoglu

Ataturk University, Faculty of Engineering, Department of Electric and Electronics, Erzurum, Turkey

hefeoglu@atauni.edu.tr

Memristor is known the fourth passive device in electronics after theoretical prediction by Chou in 1971 without physical example. Lately, in 2008, memristive behaviour of Pt/TiO_2/Pt realised for the first time by HP researchers. In ideal case memristor is defined by a state-depended Ohm’s Law. Theory says that the resistance of memristor has to change when ever current pass over it and remain constant if current is set to zero. In literature resistive ram (RRAM) is called to be the next generation memory with high density which is beyond present limits. Physical processes causing to switching in ion-migration based memristors are drift-diffusion-thermophoresis and Mott transition in locally active structures. Mathematical models used in simulations are too complex for analytical and numerical solutions. In simple form memristor having gradual resistance change with ion diffusion. At first glance this property giving us an opportunity to direct data storage with multilevel resistance setting, similar to biological systems. But current used to read the resistance value causes to resistance change and that results uncertainty and then data lost by the time. This restricts the direct multilevel data storage but it is to be solved by proper signal polarity and symmetry. In this talk experimental findings from metal/TiO_2/metal structures to be discussed.

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IS30

From HTS Thin Films Growth to Single Crystal Objects Growth

Petre Badica

National Institute of Materials Physics, Atomistilor 105bis, Magurele 77125, Romania

badica2003@yahoo.com

Thin films of different oxidic materials, in general, and of high temperature superconductors (HTS), in particular, are intensively studied. These films and their layered heterostructures are of much interest for different applications. However, in the last years different crystalline objects (sometimes at nanoscale) are gaining more attention and their potential is investigated, among others, for electronics and sensors applications.

In the HTS systems, ribbon-like whiskers have been grown and used for applications such as Josephson junctions, SQUID, terahertz devices and qubit memories, and others. In the case of thin films, the substrate is an intrinsic part of the substrate-film system, while for the whiskers they have the advantage of being 'free of the substrate'. This degree of freedom is highly necessary if targeting observation of the effects that are controlled by the size decrease to nano-scale as well as by the shape of the whisker-like object.

In this presentation we explore growth details and growth mechanism for a better understanding of the key criteria for the controlled growth of single-crystal-like objects of HTS. However, some other materials and their crystal objects will be also presented for a comparative analysis. HTS objects such as 1D straight whiskers, bows and rings and attempts to decrease the 'diameter' of the whiskers through the growth under elevated magnetic fields, are introduced. Growth defects will be also reviewed.

The typical growth mechanism of the HTS whiskers and objects is by solid-liquid-solid mechanism and for such a growth there are advantages and disadvantages when compared to the growth of thin films by vapor-solid methods. This analysis contributes to evaluation of the HTS whiskers and objects potential in their use for applications so that some emerging directions of future studies are identified.

SPECIAL SESSION

SI01

Coating technologies for the flat glass industry

SENER OKTIK

Türkiye Şişe ve Cam Fabrikaları A.Ş, İş Kuleleri Kule 3, Kat: 22, 34330 4.Levent İstanbul/34330 Turkey

seoktik@sisecam.com

The world's flat glass industry uses the Pilkington float process (invented by Sir Alastair Pilkington in 1952). The first "Pilkington Process License" was signed by PPG in 1962 and followed by several others well known glass companies such as Glaverbel, Boussois, Saint Gobain, Saint Roch and LOF, Asahi, Nippon Sheet glass, Ford and Mexican Vitro, Sklo Union (in Czech Republic) and Bor (in Russia), Central Glass(Japan). Up to mid-1980's, the float glass industry has been mainly located in Europe, USA & Japan. After Pilkington patent was expired, many engineering companies design, build and start up new float lines across the world. In 1988 the number of float lines in Western Europe, North America and Japan was about 87 (%75 of World production). Since the beginning of industrialization in China in 1997, the number of float lines in china has been growing exponentially reaching to 197 in 2013 over passing the float lines either Europe or the USA. In 2013 total float lines in the World is 397 with ? 70 million tons/year capacity.In attempt to meet the various requirements and needs of the construction, automotive and solar industry, flat glass is often coated by thin or thick films and/or annealed to improve/change optical, electrical, mechanical, chemical and decorative properties. The global market for coated flat glass is about $21 billion in 2013 ($10billion in Europe)and expected to have a compound annual growth rate (CAGR) of 5.5% in the next five years reaching nearly $29.2 billion by 2019 (BCC Research).In this short review, vapor deposition technologies such as; physical vapor deposition (PVD), chemical vapor deposition (CVD) and also chemical and electrochemical techniques such as dip-coating techniques, spray coating techniques, spin coating process, capillary coating (Laminar flow coating), and roll coating are briefly described. An up-to-date analysis of developments in the two most common industrial flat glass coating technologies, sputtered physical vapour deposition and pyrolotic chemical vapour deposition are comparatively discussed.

SS01

Temperable solar low-e coatings: from laboratory to industrial production

Seniz Turkuz*[1], A. Sezgin[1], O.Tuna[1], A. Parlar[1], O. Özer[2], E. Acar[2], K.Gören[*3] and H.İsmail[3]

[1]*ŞİŞECAM Science and Technology Center, Cumhuriyet Mah. Şişecam Sok. No:2 Gebze, Kocaeli 41400Turkey*
[2]*TrakyaYenişehir Cam San.A.Ş.*
[3]*Trakya Glass Bulgaria EAD*

sturkuz@sisecam.com

As there are ones of increasing demands for indoor comfort in commercial and residential buildings, the use of solar and low-e coated glazings becomes more and more important. Regarding the modern fenestration with large glazing areas, the solar heat gain, mechanical risks and wind loads require mechanical properties beside the thermal insulation and optical performances. So, the usage of the tempered glazings is inevitable. Those kind of temperable coatings with low emissivity have been developed in Şişecam Science and Technology Center, and the technology is transferred to the large area production. The steps of development and transfer to the production line will be outlined.

SS02

Thin Film Coated Architectural Glasses and Properties

Gul Pekisik

ŞİŞECAM Science and Technology Center, Cumhuriyet Mah. Şişecam Sok. No:2 Gebze, Kocaeli 41400Turkey

gpekisik@sisecam.com

Glass as an environmentally friendly and transparent building material has always inspired architects. It has been used in buildings for providing separation and allowing natural light and a view of the outdoors. Today, transparent glass facades in buildings lead to modern architecture. But besides transparency, modern architecture focuses on zero energy buildings which are energy efficient. Therefore the architects design the buildings accordingly, and expect glass to meet zero energy buildings' needs. With the developments in glass technology especially thin film coatings, glass has become a multifunctional building material. Enhanced energy efficiency can be provided with the thin film coatings applied on glass. As buildings account for 40 % of energy consumption, energy efficiency of the building is very significant. For energy efficiency of the building, effective thermal insulation and sometimes solar control are needed as well. For windows have a major impact on the energy efficiency of the building, glass used in a window is expect to lower the heating and cooling needs of the building. Low-E coatings applied on glass offer enhanced thermal insulation and solar control as well as transparency for both residential and non-residential buildings. When safety and security is also a design parameter then post temperable low-E coated glass range is preferred.With the outstanding properties achieved by thin film coatings, glass has become the most exciting and flexible material available to architects. Thin film coated architectural glasses can meet the design parameters of today's modern buildings and will be ready for the building facades of the future with the recent developments in thin film coatings.

SS03

Nano-mechanical behaviours of thin films on glasses

Lukas Simurka[1] and Tuncay Turutoğlu[1]

[1]*ŞİŞECAM Science and Technology Center, Cumhuriyet Mah. Şişecam Sok. No:2 Gebze, Kocaeli 41400Turkey*

lsimurka@sisecam.com

The mechanical properties of PVD-derived multi-layer stack and sol-gel single layers on glass have been characterized by nanoindentation and scratch testing. Results for hardness, elastic modulus and scratch resistance of materials for different application will be presented. Layer thickness and materials elasticity will be discussed as important topics in nanoindentation of thin layers. Thermal annealing of PVD multi-layer stack will be presented as an example where scratch testing can provide valuable information.

SS04

Functional Coatings on Glasses by Sol-Gel Technology

Refika Budakoglu[1], Anıl Özen[1] and Volkan Günay[1]

[1]Şişecam Bilim ve Teknoloji Merkezi, Cumhuriyet Mahallesi, Şişecam Yolu Sok. No:2 Çayırova, 34010 Kocaeli, Turkey

rbudakoglu@sisecam.com

Novel functional coatings by Sol-Gel Technology has attracted great interest, mainly due to their low cost and potential applications on various commercial purposes. Sol-gel chemistry plays a significant role in the development of coatings having functionalities such as hydrophobic, hydrophilic, antifogging, anti-reflecting, self-cleaning, UV-absorbing, dichroic, colouring and mechanical property improvement. Commercial SLS (soda-lime-silicate) type glasses are produced by Şişecam in various forms (such as; flat glass, container glasses and household glasses). This paper, describes by way of examples, the research performed on sol-gel functional coating on glasses in ŞİŞECAM Science and Technology Centre.

Contributed Talks

CT01

CZTS as Photovoltaic Material

Kuei-Hsien Chen

IAMS, Academia Sinica, PO Box 23-166 Taipei, 10617 Taiwan

E-mail of Corresponding Author: chenkh168@gmail.com

The advent of CIGS has make thin film solar cell to be above 20% efficiency. However, the rarity of element indium and gallium undermines the applicability of the CIGS solar cell. To address the abovementioned issue, $Cu_2ZnSn(S, Se)_4$ (CZTS) with earth abundant elements is a potential solution. In this paper, we report a facile solution process for the synthesis of Cu2ZnSn(S, Se)$_4$ (CZTS) thin films. Based on simple spin-coating process, a SLG/Mo/CZTS/CdS/ZnO/ITO cell can be fabricated to achieve above 5.7% efficiency. Detailed analyses including SEM, TEM, TGA, Raman, XRD, UV-Vis, admittance spectroscopy, and IES have been applied to understand the performance of the cell.

CT02

Structuring surface of crystalline Si solar cell for efficient light harvesting

Rasit Turan

Center for Solar Energy Research and Applications (GÜNAM) Middle East Technical University Dumlupinar Blvrd No 1Ankara, 06800Turkey

E-mail of Corresponding Author: turanr@metu.edu.tr

Crystalline Si solar cell technology has reached an extremely well maturity level with well-optimized material and process conditions. Further improvements in the cell efficiency and the cost should be based on new and exotic approaches employing new material types and device structures. Among such efforts, light management on the cell surface are attracting special attention due to the potential improvements both in the cell efficiency and material cost. Light trapping techniques aims at increasing the path length and the number of scattering events of the incident photons, thereby increasing the light absorption. Both reflection and transmission through the cell are significantly reduced in this way. Traditionally, surface texturing and anti reflection coatings have been commonly used for this purpose. Alternatively, Si nanostructures are being extensively studied for light trapping applications in crystalline and thin film solar cell systems. Si nanowires can be formed as vertically aligned and integrated arrays on the surface, which was found to bring remarkable light trapping strength. In addition, various photonics structures employing metal and semiconductor nanostructures have been incorporated onto the surface of the device to improve the light conversion properties Among them silver nanoparticles have attracted special attention for their favorable plasmonic behavior in the visible part of the solar spectrum. In this work, we have studied light management properties of Ag nanoparticles and vertically aligned Si nanowires incorporated to the Si solrar cells and thin film devices. After a detailed parametric study, they were applied to industrial size (156 mm x 156 mm) solar cells. The reflectivity of the device surface was reduced to almost zero for the whole visible spectrum including the blue-violet region. This has blackened the cell’s surface completely. Standard solar cell fabrication procedures have been followed to produce cells with and without nanowires. We found that the nanowire-decorated solar cells reach similar efficiency values as the standard pyramid textured cell, showing the potential of the technique. In the case of Ag nanoparticles, we have shown that they can easily been fabricated by so-called de-wetting technique on very large areas. We have analyzed the light management properties of them by optical measurements. We have also shown that photocurrent enhancement can be obtained in thin film Si through plasmonic scattering from Ag nanoparticles.

CT03

The Growth of Group III-V Compound Nanowires on Si Substrates by Molecular Beam Epitaxy

Uğur Serincan[1] and Burcu Arpapay[2]

[1]*Anadolu University, Department of Physics, Turkey*
[2]*Nanoboyut Research Laboratory, Department of Physics, Faculty of Sciences, Anadolu University, 26470, Eskisehir*

E-mail of Corresponding Author: userincan@anadolu.edu.tr

Various growth parameters were investigated to achieve growth of group III-V compound nanowires (NWs) on silicon substrates by molecular beam epitaxy system. Both group III-assisted and self-assisted procedures were performed for optimizing the parameters of NW growth. To observe the effect of native silicon oxide on NW growth process, two sets of samples were prepared. The growth of one set was carried out on silicon substrates with native oxide. Similar growth parameters were applied to another set where an oxide desorption process was conducted. During the growth, the process was monitored by reflection high energy electron diffraction. Following the growth, all samples were examined by scanning electron microscopy and selected samples were analyzed by transmission electron microscopy. The results indicate that among group III (Al, Ga, In) elements Ga has a crucial role on group III-V compound NW growth. It is also demonstrated that the growth temperature is important to control the length and density of NWs. Finally, it is shown that native oxide on the silicon substrate has a role in initiating the NW growth process.

CT04

Forming Canted Magnetic Anisotropy and Orientation in Epitaxially Grown Magnetic Thin films

Fikret Yıldız[1], Salih Akbulut[1], Adem Parabaş[1], Bekir Aktaş[1]and Mustafa Ozdemir[2]

[1]*Gebze Institute of Technology, Department of Physics, Gebze*
[2] *Marmara Universitiy, Department of Physics, Istanbul*

Email of corresponding author: fyildiz@gyte.edu.tr

Investigation of new spin configurations and magnetic anisotropy is one of hot topic in magnetic society because of the scientific curiocity and potential for technological applications. In most cases magnetic easy axis lies down in the film plane. And some cases because of the volume or surface anisotropy, magnetic easy axis becomes in the direction of the film normal [1]. On can combine these two behaviors, where the easy axis of the following layers is oriented orthogonally or in very special case non-orthogonally. The procedure how to get such magnetic configurations can be found elsewhere [2-3]. It was predicted switching magnetic orientation by less energy in this kind of magnetic structure [4]. In this study we tried to tailor the direction of the magnetic anisotropies in epitaxially grown single magnetic layers and multilayered magnetic structures. Introducing surface reconstruction and/or interlayer exchange coupling, canted magnetic orientations were formed in the magnetic thin film or in multilayered structure. Epitaxy and structural properties of the films were investigated by LEED, RHEED and XRD. Magnetic properties and orientation of magnetization direction of magnetic layer were studied by ferromagnetic resonance (FMR) and magneto-optical Kerr effect (MOKE). Particularly FMR is layer sensitive technique and allows figuring out each magnetic layer separately.

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[1] F. Yildiz, M. Przybylski, X.D. Ma, J. Kirschner, Physical Review B 80, 064415 (2009)
[2] F. Yildiz, M. Przybylski, and J. Kirschner, Phys. Rev. Lett. 103, 147203 (2009).
[3] J.-M. Tonnerre, M. Przybylski, M. Ragheb, F. Yildiz, H. C. N. Tolentino, L. Ortega, J. Kirschner, Phys. Rev. B 84, 100407(R) (2011)
[4] A. Taga, L. Nordstro¨m, P. James, B. Johansson, and O. Eriksson, Nature 406, 280 (2000).

CT05

Photocatalytic Activity of TiO_2 Thin Films by Hydrogen DC Plasma

Mohamad Reza Mohamadizadeh[1], M. Bagheri[2], S. Aghabagheri[3], Y. Abdi[4]

[1]*University of Tehran, Physics, Iran*
[2]*Department of physics, University of New Hampshire, Durham, NH, 03824 USA*
[3]*Superconductivity Research Laboratory (SRL), Department of Physics, University of Tehran, North Karegar Ave., P.O. Box 14395-547, Tehran, Iran*
[4]*Nanophysics Research Laboratory, Department of Physics, University of Tehran, Tehran, Iran*

E-mail of Corresponding Author: zadeh@ut.ac.ir

Thin layers of anatase titanium dioxide were coated on glass by spray pyrolysis method. The layers were hydrogenated by hydrogen DC plasma at room temperature up to 350^{o}C. Application of hydrogen plasma at low temperatures, leads to decrease in surface roughness. H-doping concentration decreased by time due to hydrogen desorption. Surface roughness increased by increasing plasma temperature and some oxygen vacancies were formed in the bulk by degasing of hydrogen from the structure. Layers' band gap was decreased as much as 0.13 eV by applying plasma at highest temperatures. Hydrophilicity and photocatalytic properties of layers under plasma, at 150 to 200^{o}C, were improved noticeably. Plasma application at temperatures above 200^{o}C was lead to weaken the degree of hydrophilicity and photocatalytic activity of TiO_2 layers. The reason is forming of oxygen vacancies (OV) in the inner layers that act as centers of charge carriers' recombination.

CT06

Luminescent Si Nanocrystals Synthesized by Reactive Pulsed Laser Deposition

Takayuki Hama[1] and Tsutomu Iwayama[1]

[1]*Aichi University of Education, Department of Physics, Japan*

E-mail of Corresponding Author: tiwayama@auecc.aichi-edu.ac.jp

After first reports on room temperature visible photoluminescence (PL) in the early 1990s, great interest in the optical properties of Si nanocrystals has grown over the last decade because of their potential applications toward Si-based integrated optoelectronic devices. Our group has focused on the formation of silicon nanocrystals, and developed the first examples of luminescent Si nanocrystals inside of SiO_2 using ion implantation. Nowadays, different types of Si nanostructures have been synthesized by various method, including chemical vapor deposition, sputtering, pulsed laser deposition, and so on. It is well known that Si nanocrystals produced by various methods show PL peaking in the near infrared or visible spectrum (between 1.4 eV and 1.8 eV).

In this work, we report the optical properties of Si nanocrystals embedded in a SiO_2 synthesized by reactive pulsed laser deposition (PLD) in an oxygen atmosphere. Si sub-oxide (SiO_x, $0<x<2$) films were firstly deposited on Si wafers, by suing conventional PLD system with 2nd-harmonic YAG laser (532nm, 10Hz) under controlled low oxygen pressure (0.4Pa – 1.2Pa). After deposition in the oxygen ambient, the SiO_x films were annealed for 4 hours at 1050^oC in nitrogen ambient to induce the formation of Si nanocrystals. The PL spectra of samples were obtained at room temperature, excited with a He-Cd laser (325nm, CW). PL intensity increases with increasing oxygen gas pressure, and then decrease. We found that the maximum intensity can be obtained with oxygen pressure of 0.6Pa. It is also noted that the peak energies of the PL are affected by ambient oxygen pressure. Based on our experimental results, we discuss the effects of oxygen pressure during PLD on the formation of Si nanocrystals and the PL."

CT07

Al Doping Induced Optical and Electrical Properties of Sol-Gel Prepared ZnO Thin Films

Ebru GÜNGÖR[1], Sevcan ERCAN[2] and Tayyar GUNGOR[1]

[1]*Mehmet Akif Ersoy University, Faculty of Engineering and Architecture, Energy Systems Engineering Department, 15030 Burdur, Turkey*
[2]*Mehmet Akif Ersoy University, Faculty of Science and Arts, Physics Department, 15030, Burdur, Turkey*

Email of corresponding author: egungor@mehmetakif.edu.tr

This paper reports the results of electrical and optical characterization of Al-doped ZnO thin films were prepared on glass and ITO (Indium Tin Oxide) substrates by Ultrasonic Spray Pyrolysis (USP) method. The substrate temperature was kept at 400°C. The concentration of zinc acetate was 0.05 M and Al/Zn ratio in the solution varied from 0 to 20 at. %. Optical transmittance spectrum of the films in the form of film/glass and film/ITO/glass were used to determine the film thickness and optical band gaps. The optical transmission of Al:ZnO/glass samples was higher than 80% in the visible and near infrared region. The optical band gaps of Al:ZnO films onto ITO substrate are decreases with increase of Al content. Similar behaviour is also observed for the samples deposited onto glass substrate. In order to obtain the average sheet resistance of the films the current and voltage through the probes have been measured for five different position by four-point probe method. The results showed that the sheet resistance of Al:ZnO/glass samples increases with the Al concentration. However, the electrical resistivity of Al:ZnO/ITO samples according to Al doping concentration is not effected seriously. The sheet resistance of the layered structure such as Al doped ZnO onto the ITO can be expressed as parallel combination of each layer resistance. Here ITO is dominant for this layered structure. Considering the film thickness and geometric factor, the electrical resistivity were computed. The electrical resistivity was obtained $10^{-6}\Omega$m and $3x10^{-1}$ Ωm for the Al:ZnO/ITO and Al:ZnO/glass samples, respectively.

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CT08

Transition Metal Oxides as Hole Selective Interlayers in Organic Photovoltaics

Maria Vasilopoulou[1], Nikos A. Stathopoulos[2], Stelios A. Savaidis[2] and Dimitris Davazoglou[3]

[1]National Centre for Scientific Research "Demokritos" Institute of Nanoscience and Nanotechnology, Greece
[2]Department of Electronics, Technological Educational Institute (TEI) of Piraeus, Greece
[3]Institute of Nanoscience and Nanotechnology (INN), National Centre for Scientific Research "Demokritos", Greece

Email of corresponding author: mariva@imel.demokritos.gr

Organic photovoltaic (OPV) cells based on organic semiconductors (OSCs) can display the remarkable combination of low-cost fabrication, flexibility and performance characteristics tunability. Transition metal oxides (TMOs) have been recognized as one of the most advantageous classes of materials used as anode and/or as cathode interfacial layers to enhance charge extraction between electrodes and organic molecules. Especially molybdenum (MoO_x) and tungsten (WO_x) oxides have drawn enormous attention, due to the considerably ameliorated performance of OPVs, when they are employed as a hole extraction layers (HELs). Here, we demonstrate the beneficial incorporation in OPV cells of molybdenum and tungsten oxides, deposited in hydrogen environment using a simple and cost-effective hot-wire deposition method. These oxides were found to be under-stoichiometric with precise stoichiometry, electronic properties and increased n-type conductivity. Indeed, deposition of Mo oxides in hydrogen environment significantly reduces the electrical resistivity of the films. At room temperature the resistivity values for stoichiometric MoO_3 and under-stoichiometric MoO_{3-x} 10 nm thick films, deposited in oxygen and hydrogen environment respectively, were found 400 Ohm•cm and 6.0 Ohm•cm, respectively, which are about two orders of magnitude different. Moreover, resistivity of under-stoichiometric Mo oxides increases with temperature, which is an evidence for metallic-like behaviour, while for MoO_3 the opposite trend was observed. To take advantage of the increased conductivity of under-stoichiometric Mo oxides, next polymer solar cells based on poly(3-hexythiphene) and [6,6]-phenyl-C71-butyric acid methyl ester blended active layer (P3HT:PC71BM) and incorporating Mo oxides as hole selective interlayers were fabricated and characterized. The devices presented large improvement in their short-circuit current (Jsc), open-circuit voltage (Voc), fill factor (FF) and external quantum efficiency (PCE) when embedding the under-stoichiometric MoO_{3-x} compared to the devices with MoO3 HELs (from 6.4 mA cm^{-2}, 0.52 V, 0.35, 1.05 % to 10.4 mA cm^{-2}, 0.65 V, 0.50, 3.4 %. Similarly, large improvement in OPVs embedding under-stoichiometric WO_{3-x} for hole extraction was observed.

Acknowledgments

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CT09

Photocatalytic Proproperties of TiO_2 Thin Films and Fibers

Mehtap Ozdemir Koklu[1], Metin Kurt[2], Gulnur Aygun[2] and Lutfi Ozyuzer[2]

[1]*Gediz University Mechanical Engineering, Turkey*
[2]*Izmir Institute of Technology*

Email of corresponding author: mehtap.koklu@gediz.edu.tr

Titanium (IV) oxide or titania (TiO_2) is one of the most common materials for a variety of applications such as catalytic devices, sensors, solar cells, and other optoelectronic devices. TiO_2 is a wide bandgap semiconductor with many interesting properties, including transparency to visible light, high refractive index and low absorption coefficient. Other than these properties, it has been known to be an excellent catalyst in the field of photocatalytic decomposition of organic materials. TiO_2 is known to have three natural polymorphs, i.e. rutile, anatase, and brookite. Only anatase is generally accepted to have significant photocatalytic activity. TiO_2 can be synthesized by various techniques, such as chemical vapor deposition, precipitation, hydrothermal, glycothermal methods and electrospinning. In the present research, TiO_2 nanofibers were successfully produced from a solution of Ti-alkoxide, glacial acetic acid, ethanol and polyvinylpyrrolidone (PVP) using a combination of sol–gel and electro-spinning techniques. Also, TiO_2 thin films were fabricated by reactive magnetron sputtering. They were heat-treated to form TiO_2 phase at 600 °C for 2 hours in air. The morphology of the fibers and film were evaluated by SEM analyses. The phase structures of them were obtained using XRD and the chemical bonding structure was determined by FTIR. The chemical state and atomic concentration were determined by XPS.

CT10

First Steps Towards the Growth of Single-Crystal $SrTiO_3$ on Si(001) by Pulsed-Laser Deposition: Formation of a Strontium Buffer Layer

Dejan Klement[1], Matjaž Spreitzer[2] and Danilo Suvorov[1]

[1]*Advanced Materials Department, Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia*
[2]*Advanced Materials Department, Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia*

E-mail of Corresponding Author: dejan.klement@ijs.si

$SrTiO_3$ is the most studied complex oxide on silicon (001) and can be grown with the highest degree of crystallinity. One of the key reasons for the epitaxial growth of $SrTiO_3$ on Si is the fairly small lattice mismatch between them. Such an interest in the deposition of epitaxial STO films on silicon is related to its potential use as a thin template layer, which would enable various functional oxide thin films to be integrated in the epitaxial form with silicon substrates.

Before the growth of $SrTiO_3$ is initiated, the native SiO_2 layer has to be removed from the Si surface since its amorphous structure prevents the epitaxial growth of the deposited material. The resulting reconstructed Si surface is extremely reactive and has to be passivated in order to avoid any reaction with oxygen during the deposition of the $SrTiO_3$. The passivation is performed by the formation of an appropriate buffer layer on a silicon surface that is not only chemically stable in an oxygen-rich environment, but is also structurally compatible with the silicon and the oxide. This buffer layer, which is based on ½ ML of strontium (Sr), was made possible by fabrication techniques such as molecular-beam epitaxy (MBE) that allow very precise deposition control at the atomic level. Since MBE is an industrially less-appropriate tool, alternative manufacturing routes are required.

We demonstrate experimentally, for the first time, the possibility of preparing such a buffer layer with the pulsed-laser deposition technique (PLD), which for this method reveals a new path towards the epitaxial integration of $SrTiO_3$ and other functional oxides with Si. We are able to monitor surface-reconstruction changes during the PLD deposition of Sr with reflection high-energy electron diffraction (RHEED) and thus control, very precisely, the surface coverage at the atomic level.

CT11

Growth of Gadolinium Doped Cobalt Titanium Ferrite Thin Films by Pulsed Laser Deposition

Mohamed Hafez[1], Aya alamy[1], Mohamed A. Hafez[1], Hisham M. Imam[1] and Mohamed A. Khedr[1]

[1]*National Institute of Laser Enhanced Sciences - Cairo University, Laser sciences and its interactions, Egypt*

E-mail of Corresponding Author: mhafez8@yahoo.com

Cobalt ferrite films are receiving increasing interest in applications such as magnetic sensors, microwave devices, and high-density recording media due to their high permeability, high Curie temperature, and chemical stability. In this work, a series of Gd doped Co-Ti ferrite ($Co_{1.1}Ti_{0.1}GdFe_{1.76}O_4$) thin films on quartz and silicon substrates by pulsed laser deposition (PLD) are studied at different substrate temperatures in high vacuum of ~ $2*10^{-6}$ Torr. The samples are prepared by Nd:YAG laser (1064 nm) with 10 Hz repetition rate and 6 ns pulse duration. The target and substrate is kept at distance of ~ 6 cm. The structure, morphology, and magnetic properties of the films are characterized by X-ray diffraction (XRD), scanning electron microscope (SEM), transmission electron microscope (TEM), Raman spectroscopy, and vibrating sample magnetometer (VSM). Due to the complexity of the crystal structure of ferrites, growth temperatures, surface substrates, and deposition time influence the magnetic and electronic properties of the films. The samples are heat treated with in situ heating of the substrate up to a temperature of 600 ^{o}C and thermal treatment applied after the deposition process (post annealing). The high density deposition rate and stoichiometry of the PLD affect the films surface structure.

CT12

Vibratationnal Properties of Kinetic Monte Carlo Simulation of Semiconductor Heteroepitaxy on Perfect Substrates

Hassan KASSEM[1, 2]

[1] *Lebanese University*
[2] *Al Manar University of Tripoli, Fac of Engineering, Lebanon*

E-mail of Corresponding Author: has_kas@hotmail.com

Interdiffusion, formation of islands and dislocations constitutes a source of perturbation on electronic and/or optical properties of electronic devices. In the case of heteroepitaxial growth with large lattice mismatch, these phenomena allow a better relaxation of the deposited layers resulting defect densities in the films.

In this study, we explore these phenomena of compounds as function experimental conditions (lattice mismatch, temperature, deposited layer rate ….). Our simulations are based on Monte Carlo algorithms organized around elementary atomic processes. Strain is introduced as elastic energy terms in the approximation of valence force fields. The stress is relaxed after each step of the simulation.

We are interested by macroscopic properties like layer compositions as function of interface distance and the global strain after relaxation as a function of these experimental conditions. Then, we study their effects on the vibrationnal properties of these simulated compounds and the Raman spectroscopy.

CT13

In-situ Spectroscopic Ellipsometry and Structural Study of HfO_2 Thin Films Deposited by RF Magnetron Sputtering

Gulnur AYGUN[1], Ayten CANTAS[1], Deepak Kumar BASA[2]

[1] Department of Physics, Izmir Institute of Technology, Urla, 35430 Izmir TURKEY
[2] Department of Physics, Utkal University, Bhubaneswar-751004, INDIA

E-mail of Corresponding Author: gulnuraygun@iyte.edu.tr

We have investigated the reduction of unwanted interfacial SiO2 layer at HfO2/Si interface brought about by the deposition of thin Hf metal buffer layer on Si substrate prior to the deposition of HfO2 thin films for possible direct contact between HfO2 thin film and Si substrate, necessary for the future generation devices based on high-κ HfO2 gate dielectrics. Reactive rf magnetron sputtering system along with the attached in-situ spectroscopic ellipsometry was used to predeposit Hf metal buffer layer as well as to grow HfO2 thin films and also to undertake the in-situ characterization of the high-κ HfO2 thin films deposited on n-type <100> crystalline silicon substrate. The formation of the unwanted interfacial SiO2 layer and its reduction due to the predeposited Hf metal buffer layer as well as the depth profiling and also structure of HfO2 thin films were investigated by in-situ spectroscopic ellipsometry (SE), Fourier Transform Infrared (FTIR) and Grazing Incidence X-ray Diffraction (GIXRD). The study demonstrates that the predeposited Hf metal buffer layer has played a crucial role in eliminating the formation of unwanted interfacial layer and that the deposited high-κ HfO2 thin films are crystalline although they were deposited at room temperature.

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Keywords: In situ SE, HfO_2, high-κ dielectrics, reactive rf sputtering, GIXRD, FTIR

CT14

Study of Interface Layers in PbTe(Ga)/BaF_2/CaF_2/Si Heterostructures by Rheed and High Resolution TEM

Alexander Samoylov[1], Evgeniy Belonogov[1], Valentine Iyevlev[2], Alexander Klimov[3] and V. Shumsky[3]

[1] *Voronezh State University, 394006, Voronezh, Universitetskaya Sq., 1, Russian Federation*
[2] *Moscow State University, 119991, Moscow, Leninskie Gory, 1, Russian Federation*
[3] *Russian Academy of Science, Institute of Physics of Semiconductors, 630090, Novosibirsk, Acad. Lavrentyev Ave., 13, Russian Federation*

E-mail of Corresponding Author: samoylov@chem.vsu.ru

Lead telluride thin films on Si substrates are very perspective heterostructures for production of the wide range of infrared (IR) optoelectronics devices [1]. However, because the significant value of lead telluride and silicon lattices parameters mismatch the technological problems of fabrication high-effective functional PbTe/Si heterostructures are not solved yet. Doped with Ga PbTe films have an especial importance for preparation of hybrid integrated circuits with IR detected signal registration and processing functions [2].

The main purpose of this work is to determine morphology of PbTe(Ga)/BaF_2/CaF_2/Si (111) epitaxial multilayer heterostructures, to study the real microstructure of interface layers, and to recognize the mechanism of PbTe(Ga) films formation.

In this work PbTe(Ga)/BaF_2/CaF_2/Si (111) epitaxial multilayer heterostructures were fabricated by molecular beam epitaxy (MBE) technique during two-stage technological procedure. MBE apparatus is equipped with high energy electrons diffraction adjustment, quartz balance for growing layer's mass measurements, and thermocouple manipulator mechanism for the control of substrate surface temperature.

At first stage single crystal Si (111) wafers previously treated by RCA cleaning technique and annealed at T = 1125 K in vacuum were used as substrates for deposition of CaF_2 (T_{sub} = 973 K) and BaF_2 (T_{sub} = 1023 K) layers. The thickness of CaF_2 and BaF_2 films was within interval 200 - 300 nm.
At second stage on BaF_2/CaF_2/Si (111) substrates were grown PbTe(Ga) films (thickness varied from 1,500 nm to 7,000 nm) at T_{sub} = 590 - 620 K. During this procedure were activated two vapour sources with ground single crystal PbTe and heterogeneous Ga1-□xTex mixture.

X-ray diffraction patterns have shown a strong (111) orientation of PbTe(Ga) layers. Studied by SEM the relief surface of PbTe(Ga) films is caused by thermal etching of dislocations with density to 3×107 $см□^{-2}$ which were formed during process of crystallite growing on BaF_2/PbTe interface because these materials are characterized by lattice mismatch. Another possible reason of the dislocation appearance is the stacking faults arising at the final stage of the crystallite coalescence.

As it can be seen from RHEED patterns at PbTe/BaF_2 interface boundary the epitaxy orientation ratio (111) [1-10] PbTe || (111) [-110] is realized. This fact indicates the mirror arrangement of crystallites: PbTe(Ga) film is formed as twin crystal orientation relative to BaF_2 layer. The value of lead telluride and barium fluoride lattice mismatch calculated according to positions of (333) PbTe(Ga) and (333) BaF_2 reflections makes average 3.5 percent, which is little less than the value of the same parameter (4.1 percent) for PbTe and BaF_2 single crystals with stoichiometric ratio of the components.

References

1. M. Rahim et all. Appl. Phys. B, 2011, 100, 261-264
2. A.M. Samoylov et all. J. of Crystal Growth, 2012, 351, 149-154"

CT15

High Performance Cu_2O/ZnO Core-shell Nanorod Samples

Cheng-Hsun Chu[1,2], Yung-Sheng Chen[1,2], Hsiang-Chen Wang[1,2], Che-Hao Liao[3], Yu-Lun Chueh[4], Chih-Chung Lai[4], Li-Yin Chen[5], A. K. Chu[5] and Chie-Tong Kuo[6]

[1]*National Chung Cheng University, Graduate Institute of Opto-Mechatronics, Taiwan*

E-mail of Corresponding Author: hcwang95@gmail.com

Nanoimprint technology is used to synthesize a series of nanostructures with hexagonal holes on a nGaN baseplate. Hydrothermal growth is then used to produce 1.5 μm n-type ZnO nanorods. Radio frequency reactive magnetron sputtering is finally employed to grow a 50 nm thick layer of cuprous oxide film over the nanorods to form a p-n Cu_2O/ZnO core-shell structure. Based on the different imprint widths and intervals obtained, Cu_2O/ZnO heterostructure samples A, B, C, and D showed aperture ratios of 0.0627, 0.0392, 0.0832, and 0.0537, respectively. Scanning electron microscopy and atomic force microscopy indicated that a 50 nm Cu_2O film coated the ZnO nanorods to form a core-shell structure. X-ray diffraction and x-ray rocking curve (XRC) analysis showed that the Cu_2O lattice structure has polycrystalline characteristics. The lattice planes of Cu_2O are (111) and (220), and sample C has the narrowest XRC half-height full-width value. Therefore, among the samples obtained, sample C has the best material properties. Measurement of the optical properties of the samples demonstrated that the luminous peak of the samples do not change with variations in temperature. Sample C also showed optimal optical properties. High-resolution transmission electron microscopy indicated the presence of a midlayer in the Cu_2O/ZnO junction. This midlayer has direct impacts on the Cu_2O lattice arrangement in the top, corner, and side faces of the ZnO nanorods. The sample with the largest aperture ratio showed the best optical and material properties. The novel structure obtained shows potential use in solar cells.

CT16

Optical, Magneto-Optical and Electrical Characterizations of Co-sputtered ZnO:Ni Thin-Films

Gokhan Ozgur[1], Mehmet Ali[1], Murat Serhatlioglu[1] and A. Esad Ozmetin[1]

[1]*Meliksah University, Electrical and Electronics Engineering, Turkey*

E-mail of Corresponding Author: gozgur@meliksah.edu.tr

Ferromagnetic metal and zinc-oxide composite films have been recently investigated for their magnetic and electrical properties [1, 2] and they have great potential for device applications requiring special magneto-optical properties. Zinc-oxide is a transparent material used for many optoelectronic applications and has higher refractive index than silica. Ferromagnetic materials in such structures provide the element for high saturation magnetization with low coercivity. In this study ZnO:Ni composite thin films on silicon and quartz substrates have been investigated. These films were prepared by RF and DC magnetron co-sputtering of ZnO (%99.9) and Ni (%99.9) targets, respectively. Nickel concentrations in these films were varied from 5% (wt.) to 40% (wt.) by keeping the RF power for ZnO deposition constant and changing the DC power for Nickel deposition. After deposition at room temperature, films have been annealed in vacuum at temperatures from 400 to 900 Celsius. Optical, magnetic-optical and electrical properties were studied for annealed and as-grown films. Optical characterization was done by spectroscopic ellipsometry. Magneto-optical properties were investigated by Kerr ellipsometry and electrical characterization was done by four probe method.

[1] L. Wang, Z. Xu, F. Zhang, L. Lu, X. Xu, J. Nanosci. Nanotechnol. Mar; 10(3), p. 1852-6 (2010).
[2] K. Kyoung-Tae, K. Gwan-Ha, W. Jong-Chang, K. Chang-Il, Surface & Coatings Technology 202, p. 5650 (2008).

CT17

Effect of Wafer Curvature on Post-CMP Nitride Uniformity

Suha Sipahi[1], Oktay Yarimaga[1], Tarik Akyol[1], Muırat Pak[1], Sema Imrahorilyas[1]

[1]*TUBITAK, BILGEM, TURKEY*

E-mail of Corresponding Author: oktay.yarimaga@tubitak.gov.tr

Chemical Mechanical Polishing (CMP) is of great importance in silicon fabrication process since it removes excess of deposited oxide and attains a planar surface for succesive process steps. Despite advances in Shallow Trench Isolation (STI) CMP technology, wafer curvature due to film stress causes large post –CMP nonuniformity. This directly affects the thickness of the remaining fill oxide. In case of concave wafer shape, edge-to-center removal rate difference leaves some oxide on nitride at center dies. This remaining oxide masks the underlying nitride layer during hot phospohoric acid nitride strip and needs to be polished further. This extra polishing time causes excess removal of nitride near the edges of the wafer. In this paper, experiments were conducted with wafers of varying curvature amount. Wafers with max. 41um bowing are compared to the planer surface wafers. IPEC372M CMP tool is used with IC1000/SubaIV polishing pad and ceria based high selectivity slurry (HSS). STI and active regions are inspected under Focused Ion Beam, curvature of the wafers are measured with KLA INS3000 microscope.

Removal process of thin films from the backside of the wafer should be organized carefully especially when the oxide is thick. If backside STI fill oxide is wet etched right after the deposition before CMP, wafers tend to bow up to 41 um. We present the results of the CMP process on the samples with varying bowing conditions.

CT18

CO_2 Responsive ZIF-8 Ultrathin Nanofilms

Joanna Cookney[1,2,3], Wojciech Ogieglo[1], Ivo Vankelecom[2], Vlastimil Fila[3], Nieck E. Benes[1]

[1] *Inorganic Membranes, Department of Science and Technology, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands*
[2] *Centre for Surface Chemistry and Catalysis, KU Leuven, Kasteelpark Arenberg 23, 3001 Heverlee, Belgium*
[3] *Department of Inorganic Technology, Institute of Chemical Technology Prague, Technicka 5, 16628, Czech Republic*

E-mail of Corresponding Author: jocookney@yahoo.co.uk

Zeolitic imidazolate frameworks (ZIFs) are materials that combine the unique properties of zeolites and metal-organic frameworks, such as high internal surface area, well-defined cavities accessible via small pore apertures, as well as high thermal and chemical stability. The prototypical ZIF-8 is synthesised via the assembly of tetrahedrally coordinated zinc ions and 2-methylimidazole organic linkers to form three-dimensional open structures. Interest in ZIF-8 thin films stems from their potential in vapour sensing, low-Ƙ-dielectrics and membrane-based gas separation. Successful development of well-intergrown ZIF-8 thin films is crucial as the presence of transverse grain boundary defects and inter-grain porosity significantly degrade thin film performance.

We show that a step-by-step dip-coating approach enables the synthesis of uniform, dense, and defect-free ZIF-8 nanofilms. By varying the withdrawal speed the dip-coating can be carried out in the draining, the intermediate or the capillary regime. This enables accurate control of the film thickness, from 106 to 217 nm. The films exhibit comparatively high refractive indices, ca. 30% higher as compared to films presented in the literature. The high refractive indices reported in our work are associated with the absence of mesoporous inter-particular voids. The dynamic film response upon exposure to various CO_2 concentrations has been monitored by in-situ spectroscopic ellipsometry. An increment in the CO_2 partial pressure results in a sharp stepwise increase of the refractive index, which can be quantified in terms of the amount of CO_2 sorbed. The sharp film response demonstrates the potential of developed ZIF-8 nanofilms in, amongst others, the field of gas sensing.

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CT19

Construction and Hydroxyapatite Coating of Meso-Nanoporous Titania Surfaces Using Electrochemistry

Feride Sermin Utku[1], Eren SECKIN[2], Gultekin GOLLER[2], Candan TAMERLER[3], and Mustafa URGEN[2]

[1]*Yeditepe University Biomedical Engineering, Turkey*
[2]*Istanbul Technical University, Turkey*
[3]*The University of Kansas*

Email of corresponding author: bilgenfe17@yahoo.com

Surface morphology and bio-interfaces are essential elements of biocompatibility of orthopaedic and dental implants. In this study, the surface chemistry and morphology of commercially pure titanium plates were modified using electrochemistry. Titanium oxide substrates were prepared by an alkaline treatment using 0.1M KOH in an electrochemical cell with a stainless steel cathode and an anodic voltage of 40 V at 20°C for 3 minutes. SEM characterization revealed meso-nanoporous anodized titania surfaces, which were coated by hydroxyapatite using a simulated body fluid and pulsed electrochemical deposition at 80ºC, while cp titanium surfaces were the controls. The calcium phosphate deposit on meso-nanoporous titania was characterized as carbonated hydroxyapatite using XRD, FTIR and FE-SEM, while carbonated apatite was deposited on flat titanium surfaces. Since the shear strength of the hydroxyapatite deposited titania was $38^{+/-10}$ MPa, the plain and hydroxyapatite coated meso-nanoporous titania surfaces may thus be suitable for both biological and chemical fixation of medical implants.

References

[1] L.L. Hench, J. Wilson, eds. An introduction to Bioceramics, World Scientific Publishing Co., Singapore, 1993.
[2] Kar, K.S. Raja, M. Misra, Electrodeposition of hydroxyapatite onto nanotubular Ti02 for implant applications, Surf. Coat. Tech. 201 (2006) 3723-3731.
[3] H. Wang, C. Lin, R. Hu, Effects of structure and composition of the CaP composite coatings on apatite formation and bioactivity in simulated body fluid, Applied Surf. Sci. 255 (2009) 4074-4081.
[4] S. Ban, S. Maruno, Effect of temperature on electrochemical deposition of calcium phosphate coatings in a simulated body fluid, Biomaterials 16 (1995) 977-981.
[5] T. Kokubo, H.M. Kim, M. Kawashita, T. Nakamura, Bioactive metals: preparation and properties, J. Mat. Sci. Mater. Med. 15 (2004) 99-107.

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CT20

Effect of the Surface Modification of Ni-Ti Smart Alloys on the Electrochemical Deposition of Calcium-Phosphate Coatings

Mohamadreza Etminanfar[1] and J. Khalil-Allafi[2]

[1]*Sahand University of Technology, Materials engineering, Tabriz, Iran*
[2]*Advance Materials Research Center, Faculty of Materials Engineering, Sahand University of Technology, Tabriz, Iran*

E-mail of Corresponding Author: mr.etminanfar@gmail.com

In this study the effect of the chemical surface modification of Ni-Ti alloys on the subsequent deposition of calcium-phosphate coatings was investigated. For the surface modification, Ni-Ti super elastic alloys were chemically etched and then soaked in boiling water. For the characterization of the samples roughness measurements, Differential Scanning Calorimetry, SEM, XRD analysis, and Grazing Incident Beam XRD were used. Results show that the surface modification of the alloy contributes to the partial depletion of Ni from the surface and titanium oxides are formed. Also this operation results in the negative value of surface roughness parameter of Rsk. This condition offers better adhesion of calcium-phosphate coatings. In addition, DSC and GIB-XRD results show that after the surface modification aging of samples in the 450 °C for 30 min, converts the oxide film of samples to the stable compositions of TiO_2. This surface condition results in higher crystallinity and stability of calcium-phosphate coatings and the formation of coatings with the morphology of nano-sized needles. This observation can be attributed to the Ti-hydroxides, which are formed in the surface of the oxide film.

CT21

Plasma Electrolytic Oxidation of Aluminium and Titanium Alloys by Microsecond Current Pulses

Vladimir Egorkin[1], S.L. Sinebryukhov[2], I.E. Vyaliy[2] and S.V. Gnedenkov[2]

[1]*Institute of Chemistry FEB RAS Laboratory of Non Stationary Surface Processes*
[2]*Institute of Chemistry FEB RAS*

E-mail of Corresponding Author: egorkin@ich.dvo.ru

Plasma electrolytic oxidation (PEO) – one of the most effective methods of surface treatment, which allows formation of the multi-functional protective and decorative coatings. These coatings are formed in the result of brief plasma microdischarges realized at the metal surface/electrolyte interface. PEO-coatings consist of oxidized forms of metal and electrolyte's components. Substantial part of the published works is dedicated not only the study of the physicochemical properties of the formed layers, but the study of the relationship between the shape of the current pulses and the characteristics of the coating's formation process.

Our experimental results enable us to ascertain the essential influence of polarizing signal duration on quality of the formed coatings. It was noted that the reduction in the pulse duration significantly reduces the porosity of the coatings, and as a result, their physical and chemical properties are improved.

An additional advantage of the high-frequency power source is the ability to increase the power of the microdischarges while reducing the duration of its action. This allows forming high-temperature phases of oxides, which usually leads to improved protective characteristics of coatings. The investigated coatings were formed by means of current source that is able to apply and control the duration of pulses till five microseconds.

One of the advantages of the high-frequency power supplies is the possibility to increase the power of the plasma discharge by both the shortening pulse duration and increasing of the forming voltage. This might lead to formation of the high-temperature oxides, which are capable to increase protective properties of the coatings in whole.

The results of influence of the 5 μs polarizing pulses on the process energy consumption as well as on morphology and protective properties of the formed PEO-coatings on commercially pure titanium VT1-0 and AA5154 aluminium alloy have been presented.

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CT22

Influence of the Defects on Magnetic Properties of Glass-Coated Microwires

V. Zhukova[1], E. Shuvaeva2, M. Churyukanova[2], S. Kaloshkin[2], A. Talaat1, M. Ipatov[1], A. Zhukov[1,3,*]

[1]*Dpto. Fisica de Materiales, UPV/EHU, 20018 San Sebastian, Spain*
[2]*National University of Science and Technology «MISIS», Moscow, 119049, Russia*
[3]*IKERBASQUE, Basque Foundation for Science, 48011 Bilbao, Spain*

E-mail of Corresponding Author: arkadi.joukov@ehu.es

Composite glass-coated ferromagnetic microwires exhibit magnetic properties quite attractive from the point of view of technical applications, such as magnetic bistability, excellent magnetic softness and giant magneto-impedance, GMI, effect [1]. Most of studies are deal with optimization of magnetic properties choosing adequate chemical composition of the metallic nucleus and minimizing the magnetoelastic anisotropy coming from the rapid solidification process of fabrication of the composite microwires [1,2].

Indeed strong correlation of magnetic properties and the magnetoelastic energy has been reported elsewhere [1-2]. Therefore tailoring of the magnetoelastic energy, Kme, is essentially important for optimization of magnetic properties of glass-coated microwires.

On the other hand, the proper technological procedure of glass-coated microwires fabrication involves complex metallurgical processes related with the melting of the metallic ingot by electromagnetic field of the inductor, the chemical interaction between the metallic alloy and the glass coating at elevated temperatures and simultaneous rapid solidification of metallic nucleus surrounded by the glass shell. These problems have been studied for the same technology but in non-magnetic (mostly Cu and Ag-rich) alloys [1]. But it is obvious that the character of interaction depends on chemical composition of the ingot as well as on properties and composition of the glass used for the casting process [3].

We present studies of correlation of features and density of defects and magnetic properties of glass-coated microwires. We observed that the domain wall dynamics of glass-coated microwires correlates with the inhomogeneities related with of the fabrication technique involving rapid solidification of metallic alloy surrounded by glass coating from the melt.

We observed different kind of defects, such as gas bubbles, glass coating thickness inhomogeneities, indications of the chemical interaction between the glass shell and the metallic nucleus. We showed that the existence of such bubbles might be the origin of the spontaneous fluctuations of the local nucleation field.

Understanding of the origins of the interfacial layer and defects may help for improvement of the existing technology for thin composite wires fabrication and enhancing of their magnetic properties.

References

1. M. Vazquez, H. Chiriac, A. Zhukov, et.al., Phys Stat Sol. A 208, 493 (2011).
2. A. Zhukov and V. Zhukova, «Magnetic properties and applications of ferromagnetic microwires with amorphous and nanocrystalline structure", Nova Science Publishers, Inc. 400 Oser Avenue, Suite 1600 Hauppauge, NY 11788, 162 p. 2009, ISBN: 978-1-60741-770-5.
3. A. Zhukov, E Kostitcyna, E. Shuvaeva, et.al., Intermetallics 44, 88 (2014)

CT23

Ultrathin Metallic Layers for THz-QCLs Technology

A. Szerling[1], K.Kosiel[2], M.Szymański[3], K.Gołaszewska[2], M.Borysiewicz[2], P.Prokaryn[2],A.Łaszcz[2], M.Płuska[2], K.Pągowska[2], M.Walczakowski[4], N.Pałka[4], A.Nawrocka[5], E.Kamińska[2] and A.Piotrowska[2]

[1]Institute of Electron Technology Department of Micro- and Nanotechnology of Wide Bandgap Semiconductors Poland
2 Inst. of Electron Tech., Al.Lotników 32/46, 02-668 Warsaw,Poland
[3] Warsaw Univ. of Life Sciences, Faculty of Applied Informatics and Mathematics, ul.Nowoursynowska 159, 02-776 Warsaw,Poland
[4] Military Univ. of Tech., ul.Kaliskiego 2, 00-908 Warsaw,Poland
[5]Inst. of Agrophysics, PAS, ul.Doświadczalna 4, 20-290 Lublin,Poland

Email of corresponding author: szerling@ite.waw.pl

The Far-Infrared (FIR) is still a relatively underdeveloped region of radiation in the context of lack of effective FIR generators. The THz-emitting quantum-cascade lasers (THz-QCLs) are promising radiation sources, anyway their maximum operating temperatures (Tmax) still do not exceed 200K, so they are still incapable of dealing with the commercial development and true applications. That is why the theoretical and experimental efforts are ongoing also in our team to find the appropriate solution, so that the operation with thermoelectric-cooling can be possible. One of the main problems on the way to this goal are relatively high in the THz range waveguide losses (□w) on free-carriers - a cause of QCLs Tmax decrease. For the modal confinement in THz-QCLs the metal-metal (M-M) plasmonic waveguides are commonly used. Processes of formation of ultrathin metallic layers are a very important part of their technology. In particular, they play also a crucial role of constituents of electric metal-semiconductor contacts. We have already used the Ti/Au waveguides for modal confinement of a three-quantum-well-designed laser heterostructure with resonant-phonon depopulation of the laser's lower state. Good morphology and 10nm-low roughness for alloyed Ti/Au contact were revealed by TEM and AFM. THz reflectance of the layers was >99%. The specific contact resistivity of $1.5\times10\text{-}5\Omega cm^2$ was found by CTLM method. During wafer bonding the most stable connection was obtained for comparable thicknesses of Au (~300nm). These steps enabled fabrication of QCLs operating above cryogenic temperatures with $Jth<1,5kA/cm^2$. Our calculations indicate however that the □w can be even decreased by application of other metals than Au for M-M waveguide formation, when optimized thicknesses of the layers are used. For M-M waveguide structures we have studied theoretically the influence of the applied metallic structure on the resulting electrical field distribution profile and the threshold gain. The QCL can be approximated as a 1-D planar waveguide supporting the fundamental TM mode. The total electromagnetic field can be calculated using the Helmholtz equation with a step-like function describing the profile of refractive index n. The complex values of refractive indices of constituent materials are calculated according to Drude-Lorenz model. The transfer matrix method leads to the dispersion equation for neff. To compare different waveguides we solve this equation numerically finding neffs of fundamental TM modes and calculate the □w. In the paper, selected issues concerning the technology of Ti/Au, Ti/Ag and Ti/Cu systems in which the thicknesses of individual layers are in the range of a few to a few hundred nm, will be presented. Their deposition was performed on GaAs surfaces. The structures were studied by optical microscopy, AFM, SEM, TEM, profilometers, EDXS, X-ray, and FTIR, as a part of elaborated technology of AlGaAs/GaAs QCLs designed for ~100µm emission.

CT24

Dual-Band Perfect Metamaterials Absorbers for Solar Cell Applications

Cumali Sabah[1] and Patrick Rufangura[2]

[1]Middle East Technical University – Northern Cyprus Campus, Department of Electrical and Electronics Engineering, TRNC / Mersin 10, Turkey
[2]Middle East Technical University – Northern Cyprus Campus, Kalkanli, Guzelyurt, TRNC / Mersin 10, Turkey

E-mail of Corresponding Author: sabah@metu.edu.tr

The efficiency of photovoltaic cells (PV) has been one of the major problem impeding its global adoption as a sustainable substitute to fossil fuel based technologies. Metamaterial (MTM) based solar cells offers a unique opportunity towards increasing the system efficiency by enhancing the total absorbed solar radiation incident on solar PV cells. In this study, a nanostructure based MTM perfect absorber has been designed and simulated. By adjusting geometrical parameters and MTM properties of the structure, nearly perfect dual-band resonances were obtained. The two bands peaked at 524.5 THz and 655 THz with corresponding absorption of 99.99 % and 99 %, respectively. The proposed structure is simple and more flexible for adjustment, which lead to achievement of multiple bands. Implementation of the designed structure can effectively lead to the realization of more efficiency PV solar cells.

CT25

Combined Synthesis-Transport Technique for Copper Films Deposition

Maxim Polyakov[1], Aram Badalyan[1] and Igor Igumenov[1]

[1]*Institute of Inogranic Chemistry of RAS Department of chemistry of coordination, cluster and supramolecular compounds, Russia*

Email of corresponding author: maxpol@niic.nsc.ru

One of the most applied method for deposition of copper films on different surfaces is chemical vapor deposition (CVD). In the broadest sense CVD involves the formation of a thin solid film on a substrate by a chemical reaction of vapour-phase precursors. Metal-organic chemical vapour deposition (MOCVD) is a specific type of CVD that uses metal-organic precursors. We developed an original approach for the deposition of thin metallic films. Combined Synthesis-Transport technique (CST) is recently developed in order to modify well-known MOCVD and PE CVD technology.

The main point of the CST-method consists on union of two technological processes within the same volume of reactor chamber, such as the synthesis of volatile metal-complex precursor and its transfer onto a substrate, where it decompose on metal and gaseous compounds. This technique is based on heterogeneous reaction between volatile reagent and solid metal-contained compound. Heating of synthesis-zone and substrate provides effective synthesis and sublimation. Then synthesized complex, deposited on a heated substrate, decomposes to the metal, forming a thin film, and gases, removed from the reactor by pumping system.

Proposed approach have some profits, such as:

1. possibility of generation and using ligands in the form of short-lived (free-radical, ionized and/or excited) statements of precursors to be deposited under soft conditions.
2. generation of metastable volatile precursors that synthesis is difficult at ordinary conditions in order to increase purity of the films.
3. synthesis and using of small-sized metal complexes consisting of 2-5-atomic ligand molecules to metallize nano-sized pores and complicated surface reliefs.

Metallic copper thin layers are deposited by means of a modified MOCVD method via passing formic acid vapor through a finely dispersed powder of a solid metal-containing reactant (Cu/CuO or Cu_2O/CuO) under thermal and plasma activation.

To characterize the deposited copper films the X-ray photoelectron (XPS), infrared (FTIR) and UV-vis spectroscopy, scanning electron microscope (SEM), and diffraction of synchrotron radiation (DSR) methods analyses were used. The films were found to be nanocrystalline and have a nanoscale grain structure with parameters depending on the experimental conditions and chemical composition with a predominant content of copper in the metallic state Cu0. Notable that influence of plasma on the CST-process effects to decrease of the average grain size twice under the same condition. Summarizing obtained results we can conclude that the Combined Synthesis-Transport technique should be advanced and it could be technically versatile, convenient, effective for metallization of complicated surface reliefs and prospective for applying in nowadays micro- and nanotechnology.

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CT26

Characterization of Advanced k1.9, 2.0 and 2.2 Ultra-porous SiOC(H) Films Deposited by Plasma-Enhanced Chemical Vapor Deposition

Murad Redzheb[1], Silvia Armini[2], Mikhail Baklanov[2] and Pascal Van Der Voort[3],

[1]*Gent University Inorganic and Physical chemistry , Belgium*
[2]*IMEC*
[3]*UGent*

Email of corresponding author: Murad.Redzheb@ugent.be

The semiconductor industry has spent a significant effort in order to engineer ultra-porous low-κ inter-level dielectrics which can withstand the plasma and mechanical damages induced during the interconnect integration scheme. Obtaining an integrated dielectric constant below 2.6 has turned out to be challenging. Additionally, the synthesis of integration-suitable low-k films with dielectric constant around and below 2.3 through plasma-enhanced chemical vapor deposition (PE-CVD) is considered to be unattainable.

In the present work, we consider new PE-CVD ultra-low-κ SiCHO films with pristine κ values as low as 2.2, 2.0 and 1.9. The chemical composition of the films was investigated with Fourier transform infrared (FTIR) spectroscopy. The spectra indicate hydrophobic films. Additionally, the surface water contact angle of each film was found to be higher than 100°. As a result, the films were not modified by dilute HF treatment for dipping time longer than 5 minutes, showing a good chemical stability. Ellipsometric porosimetry measurements showed a correlation between larger pore size and increased porosity, indicating porogen agglomeration. Together with the low refractive indices, comprised in the range between 1.22 and 1.26, it is important to note that the ellipsometric fitting resulted in non-zero extinction coefficients, indicating the possible presence of sp^2 C, which could be correlated with the presence of residual porogen in the films. Absorption in the UV region gives a better insight on the presence or absence of sp^2 C. Therefore, spectroscopic ellipsometric measurements were performed in the wavelength range between 150 and 900 nm. Finally, the dielectric constants were determined from the capacitance values observed for metal-insulator-semiconductor (MIS) structures.

CT27

Laser Induced Oxidation of Titanium Metal Thin Film on Glass Substrate Using Femtosecond Laser

Lebogang Kotsedi[1], L. Kotsedi[2], Z.Y. Nuru[2], M. Maaza[2], R. Ramponi[3], S. Eaton[3] and S. Lo Turco[3]

[1]Nanosciences African Network, iThemba LABS-National Research Foundation, 1 Old Faure road, Somerset West 7129, PO Box 722, Somerset West, Western Cape.
[2]UNESCO-UNISA Africa Chair in Nanosciences-Nanotechnology, College of Graduate Studies, University of South Africa, Muckleneuk ridge, PO Box 392, Pretoria-South Africa
[3]Physics Department, Politecnico di Milano, Piazza Leonardo Da Vinci, 32, 20133 Milano, Italy

E-mail of Corresponding Author: kotsedi@tlabs.ac.za

Thin films of titanium metal was deposited on a glass substrate using electron beam evaporator. The samples were then irradiated with the Ti:Sapphire femtosecond laser. The beam was focused just above the surface of the film. The power of the incident laser was varied in order to study the effect of the resultant morphology of the formed oxide. The UV-Vis-NIR reflectance plot of the irradiated films show the evolution of the film in relation to the laser power. The HRSEM micrographs showed the titanium oxide formed crystallized into nano-grains, the preferred orientation of these nano-grains were characterized using x-ray diffraction technique, where the Bragg peaks confirmed the formation of an oxide as confirmed from the JCPDS card.

CT28

Effect of Deposition Conditions on the Morphology and Properties of Manganese, Iron and Zinc Oxide Films

Ugur Unal[1]

[1]*Koc University, Chemistry Department, Turkey*

E-mail of Corresponding Author: ugunal@ku.edu.tr

In our group, we focus on the electrochemical synthesis of metal oxides under hydrothermal conditions and utilization of these films in water splitting, solar cell and supercapacitance applications. Oxides of transition metals are very popular for such applications and research conducted in this field is directed towards improving the properties to get the highest possible performance. The electrochemical synthesis of metal oxide films, particularly Zinc, Iron and Manganese oxides under hydrothermal conditions was presented and their properties were discussed in this study. ZnO and Fe_2O_3 were utilized in solar energy applications. Different morphologies for doped or undoped films can be obtained by changing the synthesis conditions. Manganese oxide films are presented for their supercapacitative behavior. Manganese oxide films deposited under hydrothermal conditions demonstrated superior supercapacitative behavior to the films deposited at conventional methods.

CT29

Nanostructured Tungsten Trioixde Thin Films Using a Novel Technique

Ashrit Pandurang[1], M. Jacques Thibadealt[2] and Bassel Abdel Samad[2]

[1]*Université de Moncton Department of Physics & Astronomy Canada*
[2]*Thin Films and Photonics Research Group, Department of Physics & Astronomy, Université de Moncton*

E-mail of Corresponding Author: pandurang.ashrit@umoncton.ca

Thin films of Tungsten trioixde (WO_3) have gained increasing importance due to their interesting chromogenic properties and for their high application potential in electrochromic devices. It is very well known that their electrochromic switching properties depend very sensitively on the nanostructure of the thin films. Hence, a vast majority of the research work carried out in this domain is dedicated to the various techniques of nanostructuring the WO_3 thin films in order to increase their electrochromic efficiency.

In the present work we have carried out a detailed and systematic work on the nanostructured WO_3 thin films where a novel technique of varying the source-substrate distance in a sublimation-condensation method is proposed. This technique has been found to be very efficient in controlling the grain size and the nanostructure of the deposited films. A correlation is established between the optical and electrochromic properties of the WO_3 films and the induced nanostructure. The electrochromic properties are studied both by the dry lithiation process as well as by the electrochemic method. Hence, the films are deposited on both glass susbtrates as well as indium tin oxide (ITO) coated glass substrates. The results are used to fabricate high efficiency electrochromic devices.

CT30

The Effect of Inorganic Filler on the Properties of Polyimide Hybrid Films

Merve Bicen[1], Atilla Gungor[1], Nilhan K. Apohan[1] and Sevim Karatas[1]

[1] *Marmara University, Department of Chemistry, 34722 Göztepe, Istanbul/TURKEY*

E-mail of Corresponding Author: mervebicen87@marun.edu.tr

Polyimides are high performance polymers that have been widely used as interference filters, separation membranes, coatings, adhesives, dielectric and packaging materials in the microelectronics industry [1].

Organic hybrid films in which inorganic fillers such as zeolites, silane derivatives [2] are involved into polyimides have gained much attention because of the fact that they exhibit good thermal and mechanical stabilities, as well as low energy consumption [3].

The interaction between organic-inorganic phases can be improved by the surface modification of inorganic fillers prior to the incorporation of them into polymer matrix. The present work contains the preparation of polymer films filled with unmodified and modified inorganic fillers. The effects of modification and filler content of the hybrid films on the thermal, mechanical and morphological properties were investigated. Electrical study such as dielectric constant measurements are in progress.

References:
[1] Liu, W.D.; Zhu, B.K.; Zhang, J.; Xu, Y.Y. Polym. Adv. Tech., 2007, 18, 522.
[2] Metin, D.; Tihminlioğlu, F.; Balköse, D.; Ülkü, S. Composites: Part A 35, 2004, 32.
[3] Zhang, J.; Zhu, B.K.; Chu, H.J.; Xu, Y.Y. J. Appl. Polym. Sci., 2005, 97, 20.

CT31

Structural, Electrical and Optical Properties of SnO_2 nano films by spin-coating method

Bengu Ozugur Uysal[1] and Umit Ozlem Akkaya Arier[2]

[1]*Kadir Has University, Faculty of Engineering and Natural Sciences, Turkey*
[2]*Department of Physics, Mimar Sinan Fine Arts University, Bomonti, Sisli, Istanbul 34349, Turkey*

E-mail of Corresponding Author: bozugur@khas.edu.tr

In this work, tin oxide (SnO_2) nano films were deposited on glass substrates with different water content using the sol–gel spin-coating method. SnO_2 is a wide band gap semiconductor and it belongs to a variety of transparent conductive oxides known as TCOs. The influence of the water content and the heat treatment temperature on the structural and optical properties of the thin films is characterized by X-ray diffraction (XRD), atomic force microscopy (AFM), UV–vis spectroscopy (UV), and scaning electron microscopy (SEM). Crystal sizes of nano SnO_2 films was controlled by $SnCl_2$:water ratios. The most significant characteristic of nano materials is as particle size decreases, surface area increases. XRD studies showed that the formation of tetragonal rutil phase was initiated at annealing temperature close to 450 $^{\circ}$C. The activation energy of nano SnO_2 films for partical growth was calculated. The quantum size effect of nano particles was confirmed by the band gap energy shift, using ultraviolet–visible spectroscopy (UV–vis). SnO_2 have been considered as the most promising functional materials due to their wide direct band-gap, and excellent electrical and optical properties. Due to this properties of SnO_2 films is used in electronic and optoelectronic devices like gas sensors, solar cells and lithium batteries etc.

CT32

Copper Electrodeposition on a Magnesium Alloy (AZ 80) with a U-shaped Surface

Yu Hu Yeh[1], Ching An Huang[1], Che Kuan Lin[1] and Chen Yun Hsieh[1]

[1]*Chang Gung University, Department of Mechanical Engineering , Taiwan*

E-mail of Corresponding Author: gfehu@mail.cgu.edu.tw

Cu electrodeposition was performed on a cylindrical AZ80 substrate with a U-shaped surface. A uniform deposition of Cu was achieved on an AZ80 electrode via galvanostatic etching, followed by Cu electrodeposition in an eco-friendly alkaline Cu plating bath. Improper wetting and lower rotational speeds of the AZ80 electrode resulted in an uneven Cu deposition at the inner upper site of the U-shaped surface during the Cu electroplating process. This wetting effect could be deduced from the variation in the anodic potential during the galvanostatic etching. The corrosion resistance of the Cu-deposited AZ80 electrode can be considerably improved after Ni electroplating.

CT33

Vortices Depinning and Critical Current in a Superconducting Slab with Linear Defects

Valeriy Fedirko[1,2], A.L. Kasatkin[3] and S.V. Polyakov[4],

[1]*Moscow State University of Technology "Stankin", Moscow*
[2]*National Research University of Electronic Technology "MIET", Moscow Applied Mathematics Russia*
[3]*Kurdyumov Institute for Metal Physics, National Academy of Sciences of Ukraine, Kiev*
[4]*Keldysh Institute for Applied Mathematics, Russian Academy of Sciences, Moscow*

E-mail of Corresponding Author: vfed@mail.ru

We have studied an equation for a bound state of an Abrikosov vortex at an extended linear defect in a thin superconducting slab in the presence of a transport current. We use the model of an elastic vortex string in the potential well of linear defect under the impact of of the Lorentz force. Theoretical analysis allowed us to find the condition for a vortex depinning and thus to estimate the critical current density. Numerical study of the pinned vortex stability has been performed which confirms the theoretical estimations. It has shown that the depinning evolves through a threshold scenario due to the bifurcation of the system. The critical current dependence on a slab thickness is calculated. The results are in good agreement with experimental data for high temperature superconductors.

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CT34

Functional Organic Coatings with Polymer Brushes

Manfred Stamm[1]

[1]*Leibniz-Institut für Polymerforschung, Dresden, Nanostructured Materials*

E-mail of Corresponding Author: stamm@ipfdd.de

Functional polymer brushes may be used at surfaces for functional organic coatings with adaptive properties and in connection with inorganic nanoparticles can serve as responsive and versatile functional layers. A fairly robust way for the generation of such nanoscopic coatings is the attachment of polymer chains to the surface by covalent bonding. Nanoparticles are attached by adsorption or covalent binding at the end of the chains. At high grafting density a brush-like layer will be formed, and surface properties can be changed significantly while bulk properties are largely unchanged. Utilizing mixed polymer brushes the surface properties can be switched between different states, and it is even possible to switch between ultra-hydrophobic and ultra-hydrophilic behavior [1]. Depending on solvent conditions, one or the other polymer chain occupies the surface layer and thus determines surface properties, which depend on the outermost surface layer. The properties depend also on glass transition and mobility in the layer, where in particular the switching and responsive behavior is influenced. This effect can be used to control the location of nanoparticles at the top or inside the layer. Layers are characterized in different ways including contact angle measurements, x-ray-photoelectron-spectroscopy, ellipsometry, quartz-crystal-microbalance and scanning force microscopy.

The switching of surface properties with mixed polymer brushes can be used for water repelling textiles, which can be ultra-hydrophobic in everdays use, but will switch to hydrophilic behavior during washing in the washing machine [2]. In sensing applications fluorescent nanoparticles attached to the polymer brush chains will be close to the surface or further away depending on environmental conditions, and thus may serve as a sensitive optical sensor for the degree of swelling. By surface enhanced Raman scattering a chemical sensing is achieved [3]. Similarly the hydrophobic nature of a mixed brush layer can be changed by pH, ion strength or temperature, which allows to control the adsorption of polyelectrolytes and protein molecules depending on the state of the brush [4]. We acknowledge financial support by DFG/NSF and BMBF for this work.

[1] S. Minko et al., Nature Materials 9 (2010) 101;
[2] M. Messerschmidt et al., Macromolecules, 46 (2013) 2616;
[3]R. Contreras-Caceres et al., Chemistry of Materials, 25 (2013) 158;
[4] E. Bittrich et al., Langmuir, 28 (2012) 3439

CT35

Formation and Properties of Films Based on Polyvinyl Alcohol and Doped with Silver Nanoparticles

Aleksey Potapov[1], O. A. Daineko[1], N.A. Ivanova[1], V, E. Agabekov[1] and M. Ben-Xussain[2]

[1]*Institute of chemistry of new materials of National Academy of Sciences (ICNM NASB)*
[2]*King Abdulaziz City for Science and Technology (KACST, Saudi Arabia)*

E-mail of Corresponding Author: Potapov555@tut.by

At present scientists worldwide actively produce and study the specific properties of new composite materials, in particular polymers with implemented in it noble metal in the form of nanoparticles (NPs) of nanofibres and nanowires [1-2]. Polymer films with NP of Ag can be used in stealth technology for creation thermophotovoltaic elements, for radiative cooling / heating of optoelectronic devices and for construction of photodetectors [3-5].

The laboratory of optical anisotropic films ICNM NASB is engaged in creating film polarizers and other optical films based on polyvinyl alcohol (PVA) for different purposes including films with NP of Ag, Au [6]. The aim is to obtain materials with feedback effect of refraction and the creation of "perfect lens" to overcome the diffraction limit.

It was developed the technique of producing PVA films doped with NP of Ag, as a result of dried PVA composition containing precursors NP - silver nitrate and "mild" reducing agents - quaternary ammonium compounds. Drying speed of PVA film was evaluated on the basis of weight loss of the film and on the change in the electrical resistance (minimum Rsq of wet film during the evaporation of water from the PVA composition was 20-25 kiloohms).

The influence of the PVA composition, as well as external influences (eg, UV irradiation, passing through the film DC) were studied respect to change of optical characteristics of the films on Ag NP size and density of their distribution.

It is established that the size of NP depends on a combination of factors, the amount of reagents in the PVA composition entering into redox reaction is the key factor. For example, content reduction of Ag + conduce the increase of the size of the NP of Ag, and DC transmission - conduce their shift toward the cathode.

References

[1]Y.A.Krytyakov, A.A. Kydrinski, A.Y. Alenin, G.V. Lisichkin, Synthesis and properties of nanoparticles of Ag: achievements and prospects // Advance of chemistry. – 2008. – T. 77, № 3. – P. 242-269.
[2] Cesar A. Sciammarella, Federico M. Sciammarella Experimental Mechanics of Solids, John Wiley & Sons, 2012, 808 p.
[3] Kylee Korte Rapid Synthesis of Silver Nanowires, NNIN REU Research Accomplishments 2007, Page 27-28
[4] US 6608716 B1, Aug 19 2003, Optical enhancement with nanoparticles and microcavities, Robert L. Armstrong et al.
[5] CN 102303429 (A) Jan 04 2012, Tunable flat absorbing material for electromagnetic waves, Qiye Wen et al.
[6] V. Agabekov, N. Ivanova, V. Dlugunovich. I. Vostchula /Optical properties of polyvinyl alcohol films modified with silver nanoparticles // Journal of Nanomaterials. – January 2012 (Synthesis/Properties and Applications of Polymeric Nanocomposites). Article ID 206384.– 5 p.

CT36

The Effect of pH Solution and Bath Temperature on Electrodeposit-n-Cu_2O Thin Film

Mohamad Fariza[1], Akmal Abdul Kadir[2], Siah Siew Mei[2], Nik Hisyamudin Muhd Nor[3] and Masanobu Izaki[4]

[1]Universiti Tun Hussein Onn Malaysia, Department of Electronic Engineering, Faculty of Electrical & Electronic Engineering, Malaysia
[2]Faculty of Electrical & Electronic Eng., Universiti of Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia
[3]Faculty of Mechanical & Manufacturing Eng., Universiti of Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia
[4]Toyohashi University of Technology, Toyohashi, Aichi 441-8580, Japan

Email of corresponding author: farizamd@uthm.edu.my

Cu_2O-based heterojunction thin film solar cell has attracted increasing attention as future generation solar cell due to several advantages such as abundant materials, low fabrication cost, and environmental friendly. However, the highest conversion efficiency is still low until to date, which is far away from theoretical value of 18%. The Cu_2O based heterojunction have been prepared by using thermal oxidation, sputtering and electrodeposition method. Among these, electrodeposition is a versatile technique and has several advantages such as easy set-up, ambient pressure deposition, low fabrication cost, environmental friendly and possibility of large-scale deposition. The best approaches to enhance the conversion efficiency are to develop n-Cu_2O layer and construction of homojunction thin film. In this study the effect of bath temperature and pH solution were investigated on electrodeposit-n-Cu_2O layer. These two important parameters play a role in providing excellent properties of n-Cu_2O layer. A simple aqueous solution containing copper(II) acetate, acid lactic and potassium hydroxide was used and the pH was varied below 6.5. The electrochemical cell with conventional three electrodes was used to fabricate n-Cu_2O and several analyses were done to investigate the structural, morphological, and optical properties. The successful fabrication of n-Cu_2O was confirmed and the significant effects of bath temperature and pH solution were observed.

CT37

Growth of Mn-doped ZnO Thin Films by RF-Sputter Deposition

Noriaki Matsunami[1], M. Kato[1], S. Okayasu[2], M. Sataka[3], H. Kakiuchida[3]

[1]*Quantum Engineering Science, Nagoya University, Nagoya 464-8603, Japan*
[2]*Japan Atomic Energy Agency (JAEA), Tokai 319-1195, Japan*
[3]*National Institute of Advanced Industrial Science and Technology (AIST), Nagoya 463-8560, Japan*

E-mail of Corresponding Author: n-matsunami@nucl.nagoya-u.ac.jp

Zinc oxide (ZnO) is known that high-electrical-conductivity and ferromagnetism are achieved by doping of trivalent-element and Fe-group-element [1]. We have grown Mn-doped ZnO (MZO) thin films on SiO_2-glass, C-plane-cut Al_2O_3 and MgO (001) substrates for the substrate temperature (T_s) from room temperature (RT) to 550 ºC and deposition time of 6 min to 1 hr, by using a radio-frequency (rf)-magnetron sputter deposition (off-axis) method [2] with a $Zn_{1-x}Mn_xO$ (x≈0.05) sintered target. X-ray diffraction (XRD) shows that M ZO films are polycrystalline and has exceptionally a-axis predominant orientation for MgO at T_s above 400 ºC, and c-axis orientation otherwise. No diffraction peak was observed other than ZnO and substrate, indicating that crystalline Mn oxides are not present in the films. According to Rutherford backscattering spectroscopy (RBS) of 1.8 MeV He ions, Mn/Zn is 6 % and the composition is nearly stoichiometric. Also, the thickness of thin films is derived from RBS and deposition rate is obtained to be approximately 8.7 nm/min. As observed for AlN films [3], it is found that the XRD intensity decreases with increasing the stress for M ZO films on SiO_2-glass, where the stress is defined by the deviation of lattice parameter of thin films from the bulk value. Investigation of such a correlation is under way for M ZO films on C- Al_2O_3 and MgO substrates. M ZO films grown in this study have high resistivity (~1MΩcm) in contrast to In-doped ZnO [2] and paramagnetism.

[1] S. J. Pearton, D. P. Norton, K. Ip, Y. W. Heo, T. Steiner, Progress in Materials Science, 50(2005)293.
[2] N. Matsunami, J. Fukushima, M. Sataka, S. Okayasu, H. Sugai, H. Kakiuchida, Nuclear Instruments Methods B268(2010)3071.
[3] N. Matsunami, H. Kakiuchida, M. Sataka, S. Okayasu, Advances in Physics and Chemistry, 3(2013)101.

CT38

Photoelectrochemical Properties of Electrochemically Deposited Metal Chalcogenide/ZnO Films

Ceren Yilmaz[1], Ezgi Kısa[2] and Ugur Unal[3,4,5]

[1]*Koç University, Materials Science and Engineering, Turkey*
[2]*Department of Chemical & Biological Engineering, Koc University, Istanbul, Turkey*
[3]*Graduate School of Materials Science and Engineering, Koc University, Istanbul, Turkey 4Department of Chemistry, Koc University, Istanbul, Turkey*
5Surface Science and Technology Center (KUYTAM), Koc University, Istanbul, Turkey

E-mail of Corresponding Author: ugunal@ku.edu.tr

In recent years, metal sulfide sensitizers have been utilized to fabricate quantum dot-sensitized solar cells (QDSSCs). Mostly successive ion-layer absorption or chemical bath deposition is reported for preparation of the photoelectrodes. In this work, we study electrochemical deposition as a quicker and cheaper alternative to deposit CdS and Ag_2S coatings on ZnO nanorod arrays. We investigate effect of reaction parameters such as deposition technique, time, potential, presence of additives and precursor concentration on structure and photoelectrochemical properties of the films.

ZnO layers were grown on ITO (Indium tin oxide) coated glass electrode from aqueous nitrate bath. CdS, Mn_doped CdS and Ag_2S coatings were directly grown on ZnO films by cathodic deposition from DMSO bath in the presence of elemental sulfur and corresponding cations. X-Ray diffraction diagrams showed that ZnO crystals were grown mainly in (002) direction on ITO surface. Structural examination suggests phase of CdS deposited depends on substrate and deposition type. Ag_2S was obtained in acanthite form in all cases. XPS (X-Ray Photoelectron Spectroscopy) analysis was performed to determine metal to sulfide ratio. Photoreponse of the prepared films were studied in a three-electrode setup in the presence of polysulfide electrolyte under 1 sun conditions. Photoresponse tends to increase with deposition time for CdS coatings due to the increased amount of visible-light sensitive CdS on ZnO film. However, photocurrent produced is reduced by prolonged deposition. Reaction conditions were varied to optimize current-voltage characteristics. Doping CdS coating with Mn(II) ions is another strategy to optimize photoresponse. A short circuit current density of 1.42mA/cm^(-2) and an open circuit potential of -1.391V have been achieved for the annealed Mn_doped CdS/ZnO electrode resulting in an overall power conversion efficiency of 0.81%. Ag_2S /ZnO photoelectrodes exhibit considerably enhanced and widened light absorption but lower power-conversion efficiency. Optimization of reaction variables and deposition of a protective layer to improve efficiency of Ag_2S /ZnO films are also discussed. In this study, we present metal sulfide electrodeposition as a promising alternative to prepare cheap, efficient sensitizer layers for solar-energy conversion devices.

CT39

Study on the Atomic and Electronic Structure in Metal Nitride Films Using Modern Transmission Electron Microscopy

Zaoli Zhang[1], Rostislav Daniel[2], Christian Mitterer[2] and Gerhard Dehm[1, 3]

[1]*Erich Schmid Institute of Materials Science, Austrian Academy of Sciences, Austria*
[2]*Department of Physical Metallurgy and Materials Testing, Montanuniversität Leoben, Austria*
[3]*Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany*

Email of corresponding author: zaoli.zhang@oeaw.ac.at

Transition metal nitrides have found wide-spread applications in the cutting- and machining-tool industry due to their extreme hardness, thermal stability and resistance to corrosion. The increasing demand of these nitrides requires an in-depth understanding of their structures at the atomic level. This has led to some experimental and theoretical researches [1-6]. The films used in this study were deposited by reactive direct current magnetron sputtering of a Cr/V/Ti metal target in an Ar+N_2 atmosphere at a constant total pressure of 1 Pa, a target power of 6 kW, and a temperature of 350°C. A TEM/STEM JEOL 2100F operated at 200 kV and equipped with an image-side CS-corrector and a Gatan imaging filter (Tridiem) was utilized for characterizing the film structure.

In this paper, we will present some recent results on the atomic and electronic structures of metal nitride thin films (CrN, VN and TiN) on MgO and Al_2O_3 substrate using advanced TEM techniques, such as CS-corrected HRTEM/STEM, EELS/EDXS, quantitative atomic measurement and electron diffraction analysis as well as theoretical calculations. Interfacial detailed atomic and electronic structures are revealed and compared. Interface induced phenomena between nitride films and substrates are unveiled [2,3].

Particular study on the effect of N defects in the metal nitride (CrN) film has led to some interesting conclusions. Ordered nitrogen (N) vacancies were often found to well distribute at the {111} planes. Combining independent image analysis, such as atomic displacement/strain measurement using geometrical phase analysis, and spectrum analysis by examining the low loss and core loss, fine structure analysis, some generalized conclusions are drawn, which are: (i) a relationship between the lattice constant and N vacancy concentration in CrN is established [5], (ii) the change of ionicity in CrN crystal with the N vacancy concentration is shown; (iii) a relation between electronic structure change and elastic deformation in CrN films has been experimentally derived, revealing that the elastic deformation in CrN may lead to a visible change in the fine structure of Cr-L2,3 edge, i.e. L3/L2 ratio.

The effect of randomly distributed defects in the films has been explored in a quantitative way using quantitative electron diffraction, combined with HRTEM and EELS analysis. Quantitative electron diffraction analysis reveals that the intensity ratios of (111), and (200) reflections (I111/I200) sensibly varies with the defect densities. Some quantitative relations are established.

[1]. R. Daniel et al, Acta Materialia 58(2010), p. 2621.
[2]. Z. L. Zhang, et al Physical. Review B 82(R)(2010) 060103-4
[3]. Z. L. Zhang, et al Journal of Applied Physics, 110(2011) 043524-4
[4]. Z.L. Zhang et al Physical Review B 87 (2013)014104.
[5]. T.P. Harzer, et al Thin Solid Films 545 (2013) 154–160
[6]. A.S. Botana et al Physical Review B 85(2012), p. 235118

CT40

The Critical Thicknes of Prepared by MBE Technique $Pb_{1-x}Sn_xTe$ Nanolayers on BaF_2 (111) Substrates

Stanislav Ryabtsev[1], Alexander Samoylov[1], Alexander Klimov[2], Alexey Akimov[2], Vladimir Epov[2], Vladimir Shumsky[2]

[1] *Voronezh State University, 394006, Voronezh, Universitetskaya Sq., 1, Russian Federation*
[2] *Russian Academy of Science Institute of Physics of Semiconductors, 630090, Novosibirsk, Acad. Lavrentyev Ave., 13, Russian Federation*

E-mail of Corresponding Author: ryabtsev@niif.vsu.ru

At fabrication of a wide range of optoelectronic devices operating in infrared (IR) band of spectrum the lead chalkogenides and their solid solutions are the worthy collaterals of InAs and $Cd_{1-x}Hg_xTe$ alloys. According to preliminary calculations, in $Pb_{1-x}Sn_xTe$ and PbTe nanoscale films the transition from classic type size effects to size quantum effects would be watched within a thicknesses interval from 25 nm up to 150 nm [1].

The main purpose of the present work is to verify the possibility of size quantum effects in $Pb_{1-x}Sn_xTe/BaF_2$ (111) nanoscale heterostructures. For this purpose the evolution of electrical parameters of $Pb_{1-x}Sn_xTe$ films (x= 0.26) on BaF_2 (111) substrates has been studied depending upon their thickness and preparation procedure.

In this work $Pb_{1-x}Sn_xTe/BaF_2$ (111) epitaxial heterostructures were fabricated by molecular beam epitaxy (MBE) technique. MBE apparatus is equipped with high energy electrons diffraction (RHEED) adjustment, quartz balance for growing layer's mass measurements, and thermocouple manipulator mechanism for the control of substrate surface temperature. Before deposition of $Pb_{1-x}Sn_xTe$ layers the single crystal BaF_2 (111) wafers were treated by pre-epitaxy cleaning technique and annealed at T= 1125 K in vacuum. The measurements of conductivity and Hall coefficient were carried out by four-probe Van der Pauw technique within temperature interval 4.2 – 300 K. The experimental results were compared to the values of the same parameters of $Pb_{1-x}Sn_xTe/BaF_2$ (111) heterostructures with chalcogenides layer thickness d more than 1,000 nm.

In this work $Pb_{1-x}Sn_xTe/BaF_2$ (111) nanoscale heterostructures intended for electrical parameters measurements were prepared by two different procedures. First of them was the direct films deposition from the source with ground $Pb_{1-x}Sn_xTe$ single crystal and annealing at T= 680 K during two hours. The processes of $Pb_{1-x}Sn_xTe$ films deposition and annealing have been carried out under RHEED control of their real microstructure. The second procedure was thinning of previously formed $Pb_{1-x}Sn_xTe$ films with d> 1,000 nm up to nanoscale size by polishing in etching solution.

The analysis of the experimental results has shown that for $Pb_{1-x}Sn_xTe$ films with d< 300 nm the decrease in charge carrier mobility values occurred in temperature interval 4.2– 250 K in comparison with samples with d> 1,000 nm. In addition, at approximately the same thickness $Pb_{1-x}Sn_xTe$ films prepared by first technique are characterized by charge carrier mobility values, which were in 3- 8 times less than the values for layers fabricated by second technique. It has been assumed that the electrical parameters degradation with decrease in thickness of nanoscale films is caused by enhancement of the role of defect interface $Pb_{1-x}Sn_xTe/BaF_2$ layers during charge carrier transport processes.

References

1. D.I. Ryzhonkov, V.V. Levina et all. Nanomaterials, Moscow: Binom, 2010, 365 p.

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Technological and Physical Limits for Scaling of Silicon Devices in Integrated Circuits

Waldemar Nawrocki[1,*] and Yu. M. Shukrinov[1]

[1]*Poznan University of Technology, Faculty of Electronics and Telecom ul. Polanka 3, Poznan PL60965, Poland*

nawrocki@et.put.poznan.pl

In this paper some technological and physical limits for scaling of devices and conducting paths in of silicon integrated circuits (ICs) are discussed. Since 40 years only semiconductor technologies, mostly the CMOS, are used for fabrication of integrated circuits in the industrial scale. A forecast of the development of the semiconductor industry (ITRS 2012) predicts that sizes of electronic devices in ICs will be smaller than 10 nm in the next 10 years [1]. The physical gate length in a MOSFET will even amount 7 nm in the year 2024. At least 5 physical effects should be taken into account if we discuss the limits of miniaturization of integrated circuits [2]:

– quantization of both electrical (measured also in our experiments) and thermal (measured by other groups) conductance in narrow and thin transistors`channels and in conducting paths;
– spread of doping atoms in a semiconductor material; each dopant would induce a relatively high potential bump;
– propagation time of electromagnetic wave along and across a chip (IC);
– electrostatics; a loss of electrostatic control of the drain current vs the gate voltage;
– electron tunneling between a source and a drain inside a MOSFET through a insulation (oxide).

Most important limits are: quantization of electrical [3] and thermal conductance in nanostructures, a degradation of electrostatic control in the channel of MOSFET and tunneling along the channel of MOSFET. According to the state of the art the minimal length of gate in MOSFET in silicon ICs is around 3 nm. However technological limits allow to apply only the 10 nm-technology in the next 10 years.

References:
[1]International Technology Roadmap for Semiconductors, Edition 2011, update 2012, www.itrs.net/reports, published in January 2013.
[2] W. Nawrocki, Y. M. Shukrinov, Some quantum limits for scaling of electronic devices . estimations and measurements. - Metrology and Measurement Systems, vol. 19 (2012), p.481-488.
[3] R. Landauer, Journal of Physics: Cond. Matter, vol. 1 (1989), p. 8099-8110.

CT42

Electrochromic Properties of Tungsten Trioxide (WO_3) layers grown on ITO/Glass Substrates by Magnetron Sputtering

Ocal Tuna[1], A. Sezgin[1], A. Parlar[1], R.Budakoglu[1] and S. Turkuz[1],

[1]*ŞİŞECAM Science and Technology Center, Davutpaşa, 34010, İstanbul, Turkey*

E-mail of Corresponding Author: otuna@sisecam.com

Electrochromic materials are emerging technology in terms of their common application areas including smart windows, energy efficient buildings and architectural glazings. Among the other electrochromic materials, Tungsten Trioxide (WO_3) is the most interesting one due to its promising electrical and optical properties. In this study, the influences of the applied power on the electrochromic properties of the sputtered WO_3 on ITO/Glass substrates were investigated. X-Ray diffraction (XRD) and X-Ray reflectivity (XRR) measurements were used for structural characterizations. Electrochromic measurements were studied by Cyclic Voltmeter (CV), Chronoamperometry (CA) and lifetime cycle measurements. The growth power was varied from 0.7 kW to 1.5 kW with the step of 0.2 kW. XRD results revealed that as-grown WO3 layers were showing amorphous structure. By CV measurements, it was found out that the coloration efficiency and the switching time were strongly dependent on the growth power. The coloration efficiency increased from 55 cm^2/C up to 87 cm^2/C with a decrease in the power from 1.5 kW down to 0.7 kW. In addition, with decreasing growth power, the coloration and bleaching times shorten from 11.75 sec. to 5.93 sec. and from 17.35 sec. to 9.69 sec., respectively. The increase in coloration efficiency and the decrease in the coloration and bleaching times with decreasing growth power could be explained by enhancing kinetics of electrochromism associated with the film density.

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Microstructure, Colossal Magnetoresistance Effect and Thermal Infrared Property of Annealed $La_{0.7}Sr_{0.3}MnO_{3-\delta}$ Thin Films on Si(100)

Shaoqun Jiang[1]

[1]*Hohai University, College of Mechanics and Materials, China*

E-mail of Corresponding Author: sqjhit@126.com

The La0.7Sr0.3MnO3-δ thin films were deposited on Si(100) substrates by DC magnetron sputtering and followed by annealing at 973K for 0.5h~2h in air/oxygen atmosphere. The microstructure, reflectance at room temperature and magnetoresistance (MR) of the annealed films were investigated based on Glance angle X-ray diffraction (GXRD), Fourier transform infrared spectroscopy (FTIR) and resistivity measurement. The results indicate that all the films show the (100) preferred orientation, and the degree of (100) preferred orientation changes obviously with the changes of annealing time and annealing atmosphere. The films with highly (100) preferred orientation have a shorter Mn-O bond length. With the increase of temperature, the MR% of all the annealed films first decreases slowly in a wide temperature range, then increases, finally decreases rapidly. The maximum MR% of the films at 10K and room temperature is about 42.4% and 7.4%, respectively. The lengthening of annealing time results in the decrease of magnetoresistance in measuring temperature and the occurrence of order magnetoresistance (OMR) effect above the room temperature for the films annealed in air atmosphere. However, it can increase the metal-insulator transition temperature (TMI) and enhance the temperature stability of magnetoresistance between 50K~250K. In addition, the emittance of the films at room temperature can be adjusted by changing annealing time.

CT44

Si nanocrystals formation in SiO_2 on Si by Si ion implantation: The effects of RTA, excimer-UV and e-beam irradiation

Tsutomu Iwayama[1] and Takayuki Hama[2]

[1]*Aichi University of Education, Department of Physics, Japan*
[2]*Kanazawa University, College of Science and Engineering*

E-mail of Corresponding Author: tiwayama@auecc.aichi-edu.ac.jp

After first reports on room temperature visible photoluminescence (PL) in the early 1990s, great interest in the optical properties of Si nanocrystals has grown over the last decade because of their potential applications toward Si-based integrated optoelectronic devices. Our group has focused on the formation of silicon nanocrystals, and developed the first examples of luminescent Si nanocrystals inside of SiO_2 using ion implantation. Nowadays, it is well known that Si ion implantation into SiO_2 and subsequent high temperature annealing (more than 1000 oC) induce the formation of luminescent Si nanocrystals. The PL peaking in the near infrared or visible spectrum (between 1.4 eV and 1.8 eV) is evidently related to implanted Si nanocrystals formed by decomposition of the SiO_x phase and aggregation with high temperature annealing.

In this work, the potentialities of excimer UV-light (7.2 eV), rapid thermal annealing (RTA) and e-beam irradiation to enhance the PL and to achieve low temperature formation of Si nanocrystals have been investigated. The implanted samples were subsequently irradiated with an excimer-UV lamp. After the process, the samples were rapidly thermal annealed before furnace annealing (FA). PL spectra were measured at various stages at the process. We found that the luminescence intensity is strongly enhanced with excimer-UV lamp irradiation and RTA. Moreover, effective visible PL is found to be observed even after FA at 900 ^{o}C. Based on our experimental results, we discuss the effects of excimer-UV lamp irradiation and RTA process on Si nanocrystals related PL. The formation process of Si nanocrystals with UV, RTA and FA treatments can be explained with bond-breaking (Si-Si and/or Si-O), defect generation, de-nucleation, defect-initiated nucleation and frozen of individual states.

CT45

Lithium-Containing Silica-Organic Polymeric Electrolytes

Rinat Iskakov[1], M.Umerzakova[1], Y.Tolep[2], T.Akhmetov[3], Sezin Sayin[4], Z. Tuiebakhova[4] and R.Iskakov[1]

[1]*School of Chemical Engineering, KBTU University, Kazakhstan*
[2]*Institute of Chemical Sciences, KBTU University, Kazakhstan*
[3]*School of Chemical Engineering, KBTU University, Kazakhstan*
[4]*Yeditepe University, Istanbul, Turkey*

Email of corresponding author: r.iskakov@kbtu.kz

One of innovative approaches for Li-containing currency sources is wide application of polymeric electrolytes those leads to enhancement of energy and technical capacities.
Polymeric electrolytes, applied for Li-containing currency sources must meet all reasonable mechanical performance, high ionic and low electronic conductivities, wide range of electrochemical stability, as well as be intact to electrodes and their parts.
From point of content view the polymeric electrolytes could be divided for two large groups. The first group contains polymeric electrolytes without solvent and with as a rule the following content: polymer (macromolecules), salt of lithium, and sometimes non-organic fine-dispersed additive. This group is called usually solid polymeric electrolytes. The second group of polymeric electrolytes contains polymer, salt of lithium, additive and solvent additionally.

Remarkable disadvantage of polymeric electrolytes containing solvent is potential thermodynamic instability of their phase content, except microporous-structured membranes. Besides, common disadvantage of the second group of polymeric electrolytes is volatile solvent enabled to evaporation during substantial storage or work of batteries.
That is why now researches on Li-containing polymeric electrolytes with high ionic conductivity in wide temperature range and stability to electrochemical conditions or mechanical stress are prospective and highly applied especially for Lithium cations.
Some type of ionic conductive and elastic polymer electrolyte is one based on poly(ethylene glycol) (PEG) substrate. In this work a series of Silica-containing PEG films both blank and with various content of lithium salt were prepared.

CT46

Effect of the Cu-substrate Thickness on the Hardness Variation of Cr-C Deposits After Flame Heating

Chin Huo Chuang[1], Ching An Huang[1], Chien Chun[1], Chen Fu[1] and Yung Hsu[2]

[1]*Chang Gung University, Department of Mechanical Engineering, Taiwan*
[2]*Ming Chi University of Technology*

E-mail of Corresponding Author: gfehu@mail.cgu.edu.tw

Cr-C deposits were electroplated on a pure Cu substrate in a Cr+3-based plating bath. After electroplating, the Cr-C deposits with and without a Cu substrate were flame-heated for 2 s to increase their hardness. Experimental results show that the hardness and crack density of a flame-heated Cr-C deposit were strongly affected by the Cu-substrate thickness. The hardness of as-plated Cr-C deposit with a Cu substrate increased from 750 to 1600 Hv after flame heating, while the hardness value of a flame-heated specimen with a thin Cu substrate was 1100 Hv and the lowest hardness value of 970 Hv was detected from the flame-heated Cr-C deposit without a Cu substrate. Increase in hardness values of flame-heated Cr-C deposits is attributed to precipitation of crystalline diamond membranes. Fully crystalline diamond-like membranes were found in the flame-heated Cr-C deposit with a Cu substrate; while semi-crystalline diamond-like membranes were detected in the flame-heated deposit without a Cu substrate. The constraint effect of the Cu substrate induced a high internal tension stress in the Cr-C deposit during and after flame heating, leading to widening through-deposit cracks and increasing the deposit hardness.

CT47

Optical Perception of Few-layer Graphenes

Shi-hua Chen[1,2], Yung-Sheng Chen[1,2], Yi-Sheng Wang[1,2], Ya-Ping Hsieh[1,2], Hsiang-Chen Wang[1,2], Raymond Chien-Chao Tsiang[3], and Chie-Tong Kuo[4]

[1]*National Chung Cheng University, Graduate Institute of Opto-Mechatronics, Taiwan*

E-mail of Corresponding Author: hc-w@hotmail.com

Graphene has emerged to be an exciting material with potential applications. A remarkable feature of graphene is that it is a Dirac solid, with the electron energy being linearly dependent on the wave vector near the crossing points in the Brillouin zone. It also exhibits unusual fractional quantum Hall effect and conductivity behavior. The discovery of the fascinating properties of single-layer graphene has generated much interest in the physical and materials sciences. To distinguish graphene layers become a very important issue. Using the discriminant for each location of the RGB pixel, then calculate the colors of the graphene layers; it can distinguish the different layers of the image thought multi-spectral imaging technology. Therefore this method can save time for material characteristics measurements, such as Raman, TEM, and AFM. We quickly determine the layers of graphene samples from a microscope image.

CT48

Log Periodic Antenna Structures Fabricated from Bi2212 Single Crystals

Yasemin Demirhan[1], Tugce Semerci[1], Hakan Alaboz[1], Metin Kurt[1], Nobuo Miyakawa[2], Kazuo Kadowaki[3], Lutfi Ozyuzer[1]

[1] *Department of Physics, Izmir Institute of Technology, Urla, 35430, Izmir, Turkey*
[2] *Department of Applied Physics, Tokyo University of Science, Tokyo, Japan*
[3] *University of Tsukuba, Tsukuba, Japan*

E-mail of Corresponding Author: yasemindemirhan@iyte.edu.tr

Terahertz (THz) radiation is part of the electromagnetic spectrum lying between microwaves and the far-IR. This region has frequencies ranging from 0.1 – 10 THz and wavelengths from 3 mm to 0.03 mm. The military and other security organizations are requesting hand held Terahertz radar to remotely detect the presence of explosive materials, poison gases, ceramic weapons, and biological warfare agents like viruses and bacteria. The importance of developing passive and active devices which work in either terahertz or millimeter wave frequencies is ever more increasing in this popular field[1-2]. Devices fabricated with intrinsic Josephson Junctions are promising candidates to operate in the desired regime[3]. Detectors with high sensitivity, wide-band frequency coverage and large arrays are required for THz imaging. Superconducting devices are excellent candidates due to their distinctive advantages of extremely low noise, low power consumption and high frequency operation. In the study presented, we have investigated the Bi2212 log-periodic thin film antennas in order to understand the THz detection properties. A type of classical wide-band antenna is log-periodic antenna which is based on resonance effects where the logarithm of the frequency is periodically repeating. Generally, the THz signals intensity is low and the effective detection area of the sensors is very small. We have designed the log-periodic antenna structures with optimized geometrical parameters by CST microwave studio. In the experimental procedure; a 100-500 nm thick Bi2212 thin film on saphhire substrate is patterned into the arrays of log-periodic antenna using electron beam lithography and ion beam etching techniques. Finally the created structures will be characterized using time-domain THz spectroscopy (THz-TDS) and CW-THz measurement systems.

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[1]L. Ozyuzer et al., Science 318, 1291 (2007).
[2]H. B. Liu, H. Zhong, N. Karpowicz, Y. Chen, and X. C. Zhang 95, 1514 (2007).
[3]J. Du, A. D. Hellicar, L. Li, S. M. Hanham, J. C. Macfarlane, K. E. Leslie, N. Nikolic and K. J. Greene, Supercond. Sci. Technol. 22, 114001 (2009).
[4]J. Du, A. D. Hellicar, L. Li, S. M. Hanham, N. Nikolic, J. C. Macfarlane and K. E. Leslie Supercond. Sci. Technol. 21, 125025 (2008).

CT49

Computational Study of Metal-Organic Based Graphene Analogs

Suleyman Er[1], Martin Blood-Forsythe[1] and Alán Aspuru-Guzik[1]

[1]*Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA, USA*

Email of corresponding author: ser@chemistry.harvard.edu

Two-dimensional (2D) organic frameworks with highly conjugated units are promising new materials for future electronics [1,2]. The majority of the fully organic 2D systems, however, lack intrasheet π-conjugation and have poor chemically stability, which limit their applicability in core functions of organic electronics [3].

Utilizing metal ions to connect the electroactive organic units is advantageous for tuning the structural and electronic properties of the 2D systems. Structural modifications, in form of chemical functionalization of organic monomers and variation of inorganic metals, offer countless possibilities in tuning the key electronic properties of the two dimensional metal-organic frameworks (2D-MOFs) [4-6]. An atomistic study of bulk and thin film structures of the new 2D-MOF systems is useful in predicting and improving their electronic and optical properties.

We perform first-principles calculations at the level of density functional theory on layers of MOFs with different translations. We calculate the potential energy surface and accordingly predict the lowest energy configurations of a new type of 2D-MOF. In collaboration with Dinca Group (MIT), we show that metal atoms may effectively be used as mediators between the interesting electroactive organic molecules [7]. Furthermore, we show that the new metal atom mediated conjugated system have very promising electrical properties. The newly developed material is an initial example for the successful integration of key materials properties (i.e., stability, exotic electronic states, and ease of chemical modification) in 2D systems. To increase its potential future use in semiconductor device industry, we are currently working on tuning the electronic structure of the material in bulk phase.

References:

[1] R. Gutzler, and D. F. Perepichka. J. Am. Chem. Soc., 135, 16585 (2013).
[2] J. W. Colson, and W. R. Dichtel. Nat. Chem., 5, 453 (2013).
[3] J. Guo, Y. Xu, S. Jin, L. Chen, T. Kaji, Y. Honsho, M. A. Addicoat, J. Kim, A. Saeki, H. Ihee, S. Seki, S. Irle, M. Hiramoto, J. Gao, and D. Jiang. Nat. Commun., 4, 2736 (2013).
[4] M. Hmadeh, Z. Lu, Z. Liu, F. Gandara, H. Furukawa, S. Wan, V. Augustyn, R. Chang, L. Liao, F. Zhou, E. Perre, V. Ozolins, K. Suenaga, X. Duan, B. Dunn, B, Y. Yamamto, O. Terasaki, O. M. Yaghi. Chem. Mater., 24, 3511 (2012).
[5] T. Kambe, R. Sakamoto, K. Hoshiko, K. Takada, M. Miyachi, J.-H. Ryu, S. Sasaki, J. Kim, K. Nakazato, M. Takata, H. Nishihara, J. Am. Chem. Soc., 135, 2462 (2013).
[6] J. Cui, Z. Xu, Chem. Commun. 50, 3986 (2014).
[7] D. Sheberla, L. Sun, M. Blood-Forsythe, S. Er, C. Wade, C. Brozek, A. Aspuru-Guzik, and M. Dinca. J. Am. Chem. Soc. Article ASAP (2014). http://dx.doi.org/10.1021/ja502765n

CT50

a-Si:H/c-Si Heterointerface Study Using Solar Cell Simulation

S. Karatas, O.Pehlivan[2], O.Yilmaz[2], I. Iskender[1], A. O. Kodolbas[3]

[1]*Faculty of Electrical and Electronic Engineering, Gazi University, 06430,Çankaya, Ankara*
[2]*TUBITAK National Metrology Institute, 41470-Gebze, Kocaeli*
[3]*TUBITAK Marmara Research Center, Materials Institute, 41470-Gebze, Kocaeli*

E-mail of Corresponding Author: sonerkaratas@hotmail.com

The electronic quality of the a-Si:H/c-Si heterostructure interface has investigated using the numerical simulation tool automat for simulation of heterostructures (AFORS-HET) based on the surface passivation mechanisms to be able to reduce recombination losses at the crystalline silicon c-Si surface. It was seen that ratio of capture cross sections of electrons and holes and interface states density effected to solar cell efficiency. Different type of layers were used for buffer like a-Si:H and a-SiO_x:H to passivate interfacial defects in solar cells. Performance variations of the solar cells were discussed according to simulation results.

CT51

Growth and Characterization of Electrodeposited ZnO Thin Film

Hamide Kavak[1], Teoman Ozdal[1], Renna Taktakoglu[1], Mehmet Esen[1] and Havva Ozdamar[1]

[1] *Department of Physics, Cukurova University, Adana, Turkey*

E-mail of Corresponding Author: teomanozdal@hotmail.com

In this work, n-type ZnO thin films were deposited using two electrode electrochemical deposition technique. The ZnO thin films were grown on ITO coated glass and p-Si substrates employing standard DC power supply under normal atmospheric conditions. Crystal structure of the ZnO thin films were acquired by adjusting the deposition charge current which is dependent on the substrate surface area, amount of precursor material and solution temperature. In addition, by changing Zn^+ charge value on the substrates, various ZnO thin films were obtained in different thicknesses. In summary, compared to expensive production techniques in the literature, the low cost, transparent and conductive n-ZnO thin films were produced. Finally, by performing the physical characterization techniques, the effects of production methods on the film quality were investigated.

CT52

Effect of Potential on Structural, Morphological and Optical Properties of ZnO Thin Films Obtained by Electrodeposition

Ayca Kıyak Yıldırım[1] and Barıs Altıokka[1]

[1]*Bilecik Şeyh Edebali University, Bilecik Vocational School of Higher Education*

E-mail of Corresponding Author: ayca.kiyak@bilecik.edu.tr

Polycrystal ZnO thin films have been deposited on ITO coated glass substrate in two different potential values -0,85 V and -0,95 V by electrochemical deposition technique with using 0.005 M Zinc Chloride ($ZnCl_2$) or 0.01 M Zinc nitrate ($Zn(NO_3)2.6H_2O$) at 72 ± 2 OC and with supporting electrolyte 0.1 M Potassium Chloride (KCl) aqueous solutions. Under these conditions the solution was saturated with oxygen by passing oxygen through the growth cell. The energy band gap obtained from absorbance measurements was estimated to be between 3.46 and 3.63 eV. X-ray diffraction (XRD) results showed that all the films have a hexagonal structure. It was obtained by XRD that the crystallite sizes of the films are between 46 and 54 nm. Morphological characterization of the ZnO thin films was characterized from the Scanning Electron Microscopy (SEM) images. It is seen from the SEM images that the surface of the films are leafy and fibrous form.

CT53

Effect of r.f. Power Variaton on Gallium Doped Zinc Oxide Thin Films

Nilufer Evcimen Duygulu[1], O. Yilmaz[2], O. Pehlivan[2], A. O. Kodolbas[3] and A. Ekerim[1]

[1]*Yildiz Technical University, Department of Metallurgical and Material Engineering, Türkiye*
[2]*TUBITAK National Metrology Institute (UME), Kocaeli, okan.yilmaz@tubitak.gov.tr*
[3]*TUBITAK Marmara Research Center, Materials Institute, Kocaeli*

E-mail of Corresponding Author: niluferduygulu@gmail.com

Nowadays, photovoltaic applications of zinc oxide (ZnO) based transparent conductive oxides (TCO) are increasing, rapidly due to their enhanced properties. They have high optical transmission, good electrical conduction, cheap value, and absence of toxicity. Especially, ZnO thin films are doped with the Group-III elements such as; aluminum (ZnO:Al) and gallium (ZnO:Ga), in order to increase the conductivity by one or two orders of magnitude. They can be deposited using various techniques such as; thermal evaporation, spray pyrolysis, sol–gel process and magnetron sputtering. Among these techniques sputtering permits work at low temperatures and gives deposits of better adhesion and higher density and takes its place in industrial process. Moreover, various investigations exhibited that sputtering parameters such as deposition rate, r.f. power, target substrate heating, process pressure etc. have great influence on the film characteristics. Therefore, in the present study we focused on understanding the influence of r.f. power variation on ZnO:Ga thin films.

All ZnO:Ga thin films were deposited by using r.f. magnetron sputtering system. ZnO target mixed with 3 wt. % Ga_2O_3 (99.99% purity, 100 mm diameter, Kurt J. Lesker) was sputtered on 100 mm diameter Corning 1737F glass. The substrate cleaning procedure was carried out by applying isopropyl alcohol (IPA), acetone and deionized (D.I.) water, respectively. All depositions were done at room temperature conditions, without intentionally heating. The target-to-substrate distance (DTS) was maintained as 45 mm and argon pressure was set as 0.4 Pa. The base pressure in the chamber was evacuated around 1 x 10-5 Pa using a diffusion pump. To remove any contaminants, pre-sputtering was applied for 5 minutes and deposition was carried for 30 minutes. The influence of r.f. power was investigated from 150 W to 350 W. Achieved results were analyzed with the help of XRD, AFM, SEM, HRTEM, four point probe and optical transmittance measurement techniques. Both the obtained data were compared with ZnO and ZnO:Al thin films characteristics.

The achieved results revealed that the r.f. power variation played a critical role on ZnO:Ga thin films. Especially, the deposition rate increased from 80 Å/min to 300 Å/min, while resistivity values obtained around 10-4Ω.cm. According to XRD results, all the thin films were oriented with the crystallographic c-(002) axis perpendicular to the substrate surface. Also, the crystallite size of the ZnO:Ga films were larger than ZnO and ZnO:Al thin films. The optical transmittance increased from 87 % to 93 % with the increase of r.f. power values. Moreover, the surface roughness (RMS) values were raised from 2.12 nm to 15.70 nm.

CT54

Solar Cell Processing by Nanosecond Pulsed Fiber Laser Amplifier

Yigit Ozan Aydin[1,2,3], Firat Es[2,3], Mona Zolfaghari[2,3] and Alpan Bek[2,3,4]

[1]*FiberLAST Inc, ODTU Teknokent Galyum Z3, 06800, Ankara Turkey*
[2]*Middle East Technical University, Micro and Nanotechnology Program, 06800, Ankara, Turkey*
[3]*Middle East Technical Univeristy, GUNAM – The Center for Solar Energy Research and Applications, 06800, Ankara, Turkey*
[4]*Middle East Technical University, Department of Physics, 06800, Ankara, Turkey*

Email of corresponding author: bek@metu.edu.tr

The laser material interaction is one of the ever-growing fields of science for years and progresses parallel to designing new laser systems. Material processing with lasers has several advantages compared with traditional methods. One of the main advantages is the ability to control laser beam and its energy exposed on the material with high precision. The second main advantage is that the processing techniques with laser are very cost effective since laser processing is non-contact and eliminates tool wearing. Third, it is a chemical free application, thus can be considered a clean technique for processing materials. Fourth, it is possible to remove parts of the processed material by adjusting the wavelength or intensity; selective material removal is possible without damaging the under layer.

In this work, modification of several types of materials are studied by a 60 W nanosecond pulsed fiber laser amplifier which has recently been developed by our group . By taking advantage of independently adjustable repetition rate and pulse duration of laser beam, we aimed to show the effects of laser pulses on precise material processing applications, especially in solar cell technology. The impact of the laser parameters on bulk and thin film processing were investigated in various applications. Firstly, solar cell edge isolation process with fast processing speed was performed to achieve high quality isolated zones and the effects of the laser beam with variable parameters on Si based cells have been determined. After pulsed laser isolation process, we achieved an extra ~2% efficiency on a full scale wafer while processing the wafer with 2000 mm/s scanning speed. Secondly, a scribing application on thin film was demonstrated. For this purpose, laser beam removal of molybdenum and indium tin oxide thin film layers from substrates has been characterized. The laser amplifier is capable of ablating the materials from the surfaces of the substrates by using a high intensity laser beam to vaporize the material from surface. In the first application, we have taken advantage of the laser's high average power and energy to achieve an increased scan speed compared with commercially available industrial lasers. In the second application, we have taken advantage of the independently adjustable pulse duration and repetition rate to achieve a high quality thin film removal.

CT55

PIC Based Boxcar Averager System Design and Application

Tayyar Gungor[1] and Mustafa Ari[2]

[1]*Mehmet Akif Ersoy University Energy System Engineering, Turkey*
[2]*Mehmet Akif Ersoy University, Electronics Technology Program, Burdur Vocational School, 15030, Burdur, Turkey*

Email of corresponding author: tgungor@mehmetakif.edu.tr

A low cost, easy to construct, PIC (Programmable Interface Controllers) based system for transient spectroscopy measurements is described. The main feature is that it allows the transient measurement by double gate technique like boxcar averager. PIC based boxcar system consists of three parts such as pulse generator unit (PG), time base generator unit (TBG) and signal processing unit (SP), respectively. TBG unit, constructed with PIC18F4550. PIC uses stable and accurate 8 MHz crystal oscillator. TBG unit can be triggered by the rising or falling edge signal depending on the desired measurements. Clock signal is generated for desired time base in the range of 1 μs and 1 s with a 25 different steps (1, 2, 4, 8, 10, 20, 40, 80, 100, 200, 400, 800 and 1000 μs and ms) is selectable from the keypad of the TBG unit. Key pad unit is consist of 3 rows and 5 columns and it was constructed using normally open swicthes. This system divides observation time interval of 32 rate windows. In order to read the signal corresponding desired two rate windows are stored using built-in analoque digital converter of microcontroller and sent to computer via USB interface. The biggest advantage of this system is simple and inexpensive and has the flexibility to use for different studies such as Deep Level Transient Spectroscopy (DLTS), Photo-Induced Current Transient Spectroscopy (PICTS) studies. System was tested using the triangular test voltage wave form generated using by HP8116 pulse generator for different amplitude and duty cyle of test wave form, respectively.

CT56

Preparation and Characterization of Cu_2ZnSnS_4 Absorber Layer on Metalic Flexible Substrates

Sebnem Yazici[1], M. Ali Olgar[2], F. Gulsah Akca[1], Metin Kurt[1], Gulnur Aygun[1], Ekrem Yanmaz[2] and Lutfi Ozyuzer[1]

[1]*Izmir Institute of Technology, Physics, Turkey*
[2]*KTU*

E-mail of Corresponding Author: sebnemyazici@iyte.edu.tr

Cu_2ZnSnS_4 (CZTS) is a p-type, quaternary compound semiconductor material. Despite the high conversion efficiencies of conventional thin film solar cells, the restrictions on heavy metal usage for Cd and limited source and high cost of In and Ga, restrict the production capacity of CdTe and chalcopyrite based thin film solar cells. CZTS is a preferable material which consists of Cu, Zn, Sn and S. CZTS has band gap energy around 1.5 eV, and has large absorption coefficient ($\geq$ 104 cm^{-1}) [1]. For CZTS based thin film solar cells, 12.6 % efficiency has been achieved in 2013 [2]. According to the Shockley–Queisser limit, CZTS solar cells theoretical conversion efficiency is above 30% [3]. Molybdenum (Mo) is the preferred element that is used as back contact layer on soda lime glass substrate. However, lately resultant studies revealed that Mo back contact has detrimental effects in CZTS solar cells [4]. Recent studies revealed that other transition elements can replace Mo element, since they have suitable thermal expansion coefficient, work function and high corrosion resistance. We used two stage methods to growth CZTS semiconducting thin film. Firstly, metallic layers were sequentially deposited on ceramic and flexible metallic foil substrates via dc- magnetron sputtering Then, this metallic precursor sulfurized in Argon (Ar) atmosphere above 500 ^oC by using sulphur powder, which is crucially important step to obtain CZTS structure. The details of the fabrication process will be discussed. Structural characterizations were done by Energy Dispersive Spectroscopy (EDS), X-Ray Diffraction (XRD) and Raman spectroscopy. EDS measurements revealed chemical characterization of the samples. Surface morphology was determined by SEM analysis. The (112) preferential plane was observed clearly in XRD patterns. We obtained Raman peaks at 336, 288, 252, 368 cm^{-1}, which refers to CZTS kesterite structure[5]. Also, electrical measurements indicated p-type semiconducting material behaviour. In conclusion, growth of CZTS compound semiconductor material on various substrates, were carried out succesfully.

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REFERENCES:

[1] H. Katagiri, et al., Solar Energy Materials and Solar Cells, 49,407, 1997.
[2] W. Wang., et al., Advanced Energy Materials, Online Published, 2013.
[3] Shockley W, Queisser HJ, J Appl Phys 32, 510, 1961
[4] J. J. Scragg, et al., Am. Chem. Soc., 134, pp. 19330, 2012
[5] P.A. Fernandes et al., Thin Solid Films, 517, 2519, 2009

CT57

Ferromagnetic Resonance Studies of Thin Films of Magnetic Oxides

Bulat Z. Rameev [1,2]

[1] Department of Physics, Gebze Institute of Technology, 41400, Kocaeli, Turkey
[2] *E. Zavoisky Kazan Physical-Technical Institute, 420029 Kazan, Russia*

E-mail of Corresponding Author: rameev@gyte.edu.tr

Ferromagnetic resonance (FMR) is known as one of the most effective methods to study magnetic and structural properties of various materials, including magnetic anisotropies, exchange energy, magnetic and structural uniformity, damping parameters, etc. FMR has been widely used to probe the nanoscale magnetic properties of spintronic (magneto-electronic) materials, which are the subject of the intense research nowadays.

In this work we give some examples of application of FMR technique to study the magnetic properties of thin films of half metallic ferromagnets as well as the magnetic oxides. It has been demonstrated that FMR provides important information on the magnetocrystalline anisotropies, including the effects of the strain anisotropies due to the lattice mismatch between epitaxial thin film and substrates. It has been also shown that in some cases multiple FMR modes can be observed due to the presence of the magnetic phases with different magnetic properties. Magnetic regions with different easy axis directions have been observed in the chromium dioxide as result of step-wise strain relaxation. Anisotropic ferromagnetism in the single crystal oxides implanted by transition metal ions (Co, Fe) has been revealed. It has been shown that the anisotropy in the magnetic properties of the TiO2 and ZnO thin films or plates, implanted by Co+ or Fe+ ions, may appear both as result of an intrinsic (substitutional ions) and extrinsic (magnetic nanoparticles) ferromagnetism. Multiple FMR modes have been observed in the systems, consisting of both intrinsic ferromagnetic phase and magnetic nanoparticles.

CT58

RF Magnetron Sputtering Deposited W/Ti and V_2O_5 Thin Films For Complementary All-Solid-State Electrochromic Device Application

Melek Kiristi[1], Ferhat Bozduman[1], Huseyin Deligoz[2], Aysegul Uygun Oksuz[1] and Lutfi Oksuz[1]

[1]*Suleyman Demirel University, Chemistry, Turkey*
[2]*Istanbul University,*

E-mail of Corresponding Author: melekkiristi@gmail.com

Electrochromic (EC) devices can change reversible and persistent their optical properties in the visible region (400–800 nm) upon charge insertion/extraction according to the applied voltage. A complementary type EC is a device containing two electrochromic layers, one of which is anodically colored such as vanadium oxide (V_2O_5) while the other cathodically colored such as tungsten oxide (WO_3) which is separated by an ionic conduction layer (electrolyte). The use of a solid electrolyte such as Nafion eliminates the need for containment of the liquid electrolyte, which simplifies the cell design, as well as improves safety and durability.

In this work, the EC device was fabricated on a ITO/glass slide. The WO_3-TiO_2 thin film was deposited by reactive RF magnetron sputtering using a 2-in W/Ti (9:1 %wt) target with purity of 99.9% in a mixture gas of argon and oxygen. As a counter electrode layer, V_2O_5 film was deposited on an ITO/glass substrate using V_2O_3 target with the same conditions of reactive RF magnetron sputtering. Modified Nafion was used as an electrolyte to complete EC device. The transmittance spectra of the complementary EC device was measured by optical spectrophotometry when a voltage of ±3 V was applied to the EC device by computer controlled system. The surface morphology of the films was characterized by scanning electron microscopy (SEM) and atomic force microscopy (AFM). The cyclic voltammetry (CV) for EC device was performed by sweeping the potential between ±3 V at a scan rate of 50 mV/s.

Key words: RF magnetron sputtering, electrochromic device

CT59

Characterization of Ag-Ga-In-Te Thin Films for Solar Cell

Ozge Bayrakli[1], Hasan Huseyin Gullu[1], Idris Candan[1], Emre Coskun[1] and Mehmet Parlak[1]

[1]*METU, Physics, Turkey*

E-mail of Corresponding Author: bayrakli@metu.edu.tr

This study is concentrated on Ag-Ga-In-Te (AGIT) polycrystalline structure which is quaternary chalcopyrite semiconductor belongs to the group of ternary III-V-VI_2 compounds. AGIT thin films were deposited onto well-cleaned soda lime glass and ITO coated soda lime glass substrates by thermal evaporation method by using the stoichiometric polycrystalline powder. During the deposition process, the substrate temperature was kept at about 200°C. Following to the deposition, the post annealing procedure was applied at the different temperatures. The thicknesses of the as-grown films were measured electromechanically by Dektak 6M profilometer as 930 nm. The composition of the films was determined by energy dispersive X-ray analysis (EDXA) and the percentage of atomic ratios were found as about Ag:Ga:In:Te ~ 2:18:22:58. The structure of the films was determined by X-ray analysis and high intensity reflection was obtained at the major peak 2θ ~ 25.50° which indicates the preferred orientation of AGIT films. It was observed as in the (112) phase orientation. The optical transmission was carried out in the wavelength range of 320–1100 nm. Then, the band gap values were calculated in between 1.45 and 1.55 eV depending on annealing temperature. The temperature dependent photoconductivity was measured under different illumination intensity. The nature of existing trap levels were studied by measuring the variation of photocurrent as a function of illumination intensity. AGIT thin film changes its behavior from sublinear to supralinear following to the annealing process.

CT60

Optical Properties of TiO_2 Based Multilayer Thin Films: Application to Optical Filters

Christopher Maghanga[1], Manasse Kitui[2], Frank Gaitho[2], Mghendi Mwamburi[3]

[1]*Kabarak University, Maths & Computing Sciences, Kenya*
[2]*Masinde Muliro University of Science & Technology, Kakamega, Kenya*
[3]*University of Eldoret, Kenya*

E-mail of Corresponding Author: cmaghanga@kabarak.ac.ke

Optical filters have received much attention currently due to the increasing demand in various applications. Spectral filters block specific wavelengths or ranges of wavelengths and transmit the rest of the spectrum. This paper reports on the simulated TiO_2 – SiO_2 optical filters. The design utilizes a high refractive index TiO_2 thin films which were fabricated using spray Pyrolysis technique and low refractive index SiO_2 obtained theoretically. The refractive index and extinction coefficient of the fabricated TiO_2 thin films were extracted by simulation based on the best fit. This data was then used to design a five alternating layer stack which resulted into band pass with notch filters. The number of band passes and notches increase with the increase of individual layer thickness in the stack.

CT61

Plasma Systems in Thin Film Coating

Lutfi Oksuz[1]

[1]*Suleyman Demirel University, Chemistry, Turkey*

Plasma technology is one of the advanced processing method to modify both conducting and non-conducting substrates and surfaces. Plasma is a solvent-free (dry), non-toxic, single-step process that provides thickness control for thin film depositions ranging from tens of angstrom to micrometers. It can be used for different applications such as etching, deposition, cleaning, sputtering, sterilization, research and as ion and electron sources for different applications. Recent studies includes atmospheric pressure plasma systems for similar applications and also health studies. The advantages of plasma processing can create various multidisciplinary studies. Plasma characteristics (pressure, density, temperature) and design (DC, capacitive, inductive, microwave… etc) plays a very important role for surface modification of surfaces. In this study, wide spectrum of plasma systems and characteristics as well as variety of applications and diagnostic techniques will be discussed.

CT62

Terahertz Imaging Using High T_c Superconducting BSCCO Bolometric Detector

Hasan Koseoglu[1,2], M. Kurt[1], T. Semerci[1], F. Turkoglu[1] and L. Ozyuzer[1]

[1]*Department of Physics, Izmir Institute of Technology, 35430 Urla Izmir, Turkey*
[2]*Department of Material Science and Engineering, Izmir Institute of Technology, 35430 Urla Izmir, Turkey*

E-mail of Corresponding Author: hasankoseoglu@iyte.edu.tr

Terahertz (THz) frequency region (0.3-10 THz) is the unexplored region of the electromagnetic spectrum and has a growing importance due to their variety of possible application areas such as defense security and the health sector. Their ability to pass through clothing, packaging materials such as fabrics, plastics, and cardboard, to reflect from metal and to absorbed by water host significant potential applications including shopping center and airport security [1]. Today, there are several deficiencies in different types of bolometers which are used for detection of THz waves or they require very difficult and costly cryogenic spending [2,3]. Their sensitivities to electrical interference and mechanical vibrations and most importantly changes in their performance with increasing frequency in THz region; at the same time, expensiveness and difficulty of having liquid helium that is necessary to reach temperatures as low as 4 K is directed us to work on this new type of detectors based on hot-electron effects of high-temperature superconductors (HTSs) [4]. Practically used detectors to image THz waves (e.g. Golay cell and Pyroelectric detector) generally have high time constants (>30 ms) and low sensitivities. Sensitive bolometers, which have NEP 10^{-13} W/sqrt(Hz), are not practical due to the requirements of liquid helium and also their time constants are greater than 5 ms. In this work, bolometer design which do not require liquid helium (simply cooled by liquid nitrogen), has the maximum NEP value of 10^{-10} W/sqrtHz, has the detectivity value 109 cm.sqrtHz/V, used for imaging purposes and has the sufficiently small characteristic time (reach under 100 micro-seconds) will be made. To make Imaging with THz waves, Using Bi2212 crystal from the bismuth family of HTS with the critical temperature T_c=90 K reduce working temperature about 77 K, so, cooling with liquid nitrogen become possible. Developed Bolometer chip will have antenna detecting waves between 0.3-10 THz and the sensitivity will be increased with the filter structures and THz absorbing coating. For this purpose, THz imaging system designed and imaging studies will be carried out with the produced bolometer. Moreover, Si composite bolometer working with liquid He and Golay cell will be used for comparison and calibration and response time of bolometer will be found. As a Terahertz source, WR1.5 AMC (Amplifier/Multiplier Chain) that covers the complete frequency band 500-750 GHz will be used.

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[1] M. Tonouchi, Nat. Photonics 97, 1 (2007)
[2] Luukanena and J. Pekola, Appl. Phys. Lett. 82, 3970 (2003)
[3] P. L. Richards, J. Appl. Phys. 76, 1 (1994)
[4] S. Cibella et al. J. Low Temp. Phys. 154, 142 (2009)

CT63

New Transfer Method of Exfoliated Thin $Bi_2Sr_2CaCu_2O_{8+\delta}$ Single Crystals on Sapphire for Hot Electron Bolometer

Hakan Alaboz[4], Y. Demirhan[1], T. Semerci[1], M. Kurt[1], G.Aygun[1], D. Pesen[2], N. Miyakawa[3], L. Ozyuzer[1]

[1]*Department of Physics, Izmir Institute of Technology, Urla, 35430, Izmir, Turkey*
[2]*Department of Molecular Biology and Genetics, Izmir Institute of Technology, Urla, 35430, Izmir, Turkey*
[3]*Tokyo University of Science, Tokyo, Japan*
[4]*Izmir Institute of Technology, Material Science and Engineering, Turkey*

E-mail of Corresponding Author: hakanalaboz@iyte.edu.tr

THz region first draw attention of astrophysicists and they use it for characterization of the rotational and vibrational resonances and thermal emission lines of simple molecules. Application area of THz region has expanded greatly such as security, drugs and explosive detection, gases fingerprints and imaging. This kind of applications requires powerful sources, sensitive and fast detectors. We have shown that intrinsic Josephson junctions of superconducting $Bi_2Sr_2CaCu_2O_{8+\delta}$ could be used as powerful THz source [1, 2]. On the other hand superconducting materials can be used for THz detection. There are several constraints in different types of bolometers which are used for detection of THz waves e.g. they require very difficult and costly cryogenic spending and have slow response times. Detectors such as pyroelectric and golay cell generally have high time constants and low sensitivity. Most of the sensitive bolometers requires liquid helium that is necessary to reach lower temperatures [3]. Using high temperature superconducting (HTS) crystal of $Bi_2Sr_2CaCu_2O_{8+\delta}$ that have 90 K critical temperature it can be cooled with liquid nitrogen. Hot electron bolometers (HEBs) are new type of bolometers and their sensitivity and low cost cryogenic spending makes them attractive [4]. HEBs are two terminal devices with a superconducting bridge between ohmic contacts. HEBs are also work well area above 1 THz, an area where heterodyne superconductor-insulator-superconductor (SIS) receivers no longer work well. $Bi_2Sr_2CaCu_2O_{8+\delta}$ high quality single crystals successfully exfoliated [5] and transferred onto sapphire substrate without using any kind of epoxy. Transferred crystal's surface properties investigated by AFM and SEM. Their thickness differs from several microns to 50 nm. Crystals surfaces are smooth, uniform and have an area of 200 μm X 200 μm. The process did not affect crystal surfaces or properties. Temperature dependence of in-plane resistance for a $Bi_2Sr_2CaCu_2O_{8+\delta}$ single crystal thin film measured. Electrical measurement clearly showed that superconducting behavior of crystals did not change after the transfer process. Area of the crystals is suitable for not only potential applications but also basic research.

Keywords: HEB, HTS, Bi2212, Mechanical Exfoliation, TSZF

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[1]L. Ozyuzer, A. E. Koshelev, C. Kurter, N. Gopalsami, Q. Li, M. Tachiki, K. Kadowaki, T. Yamamoto, H. Minami, H. Yamaguchi, T. Tachiki, K. E. Gray, W.-K. Kwok, U. Welp, Science 318, 1291 (2007)
[2] F. Turkoglu, L. Ozyuzer, H. Koseoglu, Y. Demirhan, S. Preu, S. Malzer, Y. Simsek, H. B. Wang, P. Muller, Physica C, 491, 7 (2013)
[3] B. S. Karasik, W. R. McGrath and R. A. Wyss IEEE Trans. Appl. Supercond. 9, 4213, (1999)
[4]A. Luukanen, J. P. Pekola, Appl. Phys. Lett. 82, 3970 (2003)
[5]A. K. Geim, Science, 324, 1530 (2009)

CT64

Lateral Diffusion in Tunsten Trioxide Oxide Thin Films

Nihan Arapoglu[1], Sultan Damgacı[1] and Ismail Karakurt[2],

[1]*Department of Phyics, İstabul University, Vezneciler, İstanbul*
[2]*Department of Phyics, Işık University, Şile, İstanbul*

E-mail of Corresponding Author: ikarakurt@isikun.edu.tr

We present a new lateral diffusion process in tungsten trioxide thin films deposited on gold films. Tungsten trioxide is an electrchromic material whose optical, electrical and wetting properties can be modified reversibly. In this material, electrochromism involves ion/electron insertion and extraction. In our study, a dilute HCl solution was used as the ion source. We first observe a uniform and fast change of color in tungsten films which is consistent with other studies in literature, i.e., the H^+ ions diffuse into the oxide film in the direction perpendicular to the film's surface. This is a fast process and characterized in literature by a diffusion constant of about $7x10^{-10}$ cm^2/s. In addition to this vertical diffusion, as the ion insertion process continues, a new type of diffusion parallel to the surface occurs. We observe that this lateral diffusion starts a few seconds after the beginning of the ion insertion process and has a tendency to originate from the imperfections in the oxide films. This lateral diffusion process is much slower than the vertical diffusion and corresponds to a diffusion constant of about $3x10^{-5}$ cm^2/s. We additionally observe that the films which undergo this lateral diffusion lose their electrochromic reversibility.

CT65

Development and Characterization of Multiple Layer Silk Fibroin/hyaluronic Acid Film on CoCrMo Alloy

Ugur Turkan[1], Pınar Arpacay[2], Oguz Bayraktar[3] and Ipek Erdogan[4]

[1]*Gediz University, Biomedical Engineering, Turkey*
[2]*Nanotechnology master program, Gediz University*
[3]*Department of Chemical Engineering, Ege University*
[4]*Department of Chemical Engineering, İzmir Institute of Technolgy*

E-mail of Corresponding Author: ugur.turkan@gediz.edu.tr

CoCrMo alloys are metallic biomaterials and are broadly utilized as orthopedic implant materials. They are very stable materials and have been used since 1930. Silk Fibroin (SF) is a natural polymer biosynthesized by several of spiders and insects. The most defined silks are produced by the domestic silkworm Bombyx mori, which has been utilized in textile manufacture, clinical sutures and lately as a scaffold for tissue regeneration due to its noticeable mechanical properties. Hyaluronic acid (HA) is a natural and unbranched polymer consisted of disaccharide repeats of D-glucuronic acid (GlcUA) and N-acetylglucosamine (GlcNAc) connected alternately by β-1, 3 and β-1, 4 glycosidic bonds and frequently used in biomedical industry such as applications of orthopedic, antiadhesion, cardiovascular, dermatology and wound-healing. This research aimed to characterize the pH-induced complexation of multiple layer silk fibroin (SF) and hyaluronic acid (HA) films on CoCrMo alloys. In the present study, consisted of six, ten and fourteen layers of three type films which are called SF, SF/HA complex and SF/HA layer-by-layer (LBL) were coated on CoCrMo alloys. In the literature, it was known that SF and HA complexes were occurred within the pH-range of 2.5-3.5, disregarding of the biopolymer ratio, mixing order and total biopolymer concentration. To investigate the effect of pH on the morphology/properties of the films on CoCrMo alloys, three different pH values were chosen: 3.0, 3.5 and 5.5. Surface structures of films were investigated by Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR) and X-Ray Diffraction (XRD) and morphology of films were searched by Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM). All samples were treated with methanol, a conformation transition was aimed to stimulate from silk I to silk II to make the films insoluble and to increase the mechanical characteristics. Characteristic IR absorption peaks for silk I and silk II structures were observed by ATR-FTIR spectroscopy for all samples at pH 3.0, 3.5 and 5.5. The XRD spectra of fourteen layer of SF/HA complex and SF/HA layer-by-layer films on CoCrMo alloys at pH 3.5 showed that the films are amorphous structure due to the inorganic phase. SEM images showed that at pH 3.0 and 3.5, as the working pH values close to the isoelectric point of fibroin (IEP=3.9), SF molecules tend to aggregate. However, at pH 5.5, the fibres of SF are moved everywhere of the surface due to the working pH which is far away to the IEP of fibroin. As is seen for SEM images, at pH 3.5, colloidal particles are observed for all multilayer SF/HA complex and SF/HA layer-by-layer films on CoCrMo alloys due to the working solution pH close to IEP of fibroin in AFM images. AFM images also clearly indicated that the film thickness and surface roughness of LBL coated specimens is almost higher than those of complex coated films on the investigated specimens.

CT66

Numerical Simulation of Bias and Light Stress on Amorphous Indium-Gallium-Zinc-Oxide (a-IGZO) Thin Film Transistors

Nouredine Sengouga[1], Marwa Adaika[2] and Afak Meftahn[2]

[1]*Université de Biskra, Sciences de la Matière, Algeria*
[2]*Laboratoire des Matériaux Semiconducteurs et Métalliques, Université de Biskra, Biskra*

E-mail of Corresponding Author: n.sengouga@univ-biskra.dz

Thin film transistors (TFTs) are used in numerous electronic applications such as active matrix organic light emitting diodes (AMOLED), active matrix liquid crystal display (AMLCD). Although several materials such as amorphous silicon (a-Si), polycrystalline silicon (pc-Si) and organic semiconductors (OS) can be used as active layers for TFTs, there has been growing interest in amorphous oxide semiconductors (AOS) based on zinc oxide (ZnO) such as indium-gallium-zinc oxide (IGZO). a-Si and OS TFTs have a low field-effect mobility while pc-Si TFTs suffer from non-uniformity over large areas. IGZO TFTs have several advantages which include visible light transparency, large-area uniform deposition at low temperature, and high carrier mobility. Furthermore, the low temperature deposition allows building active matrix displays on plastic substrates. Flexibility is another major advantage.

However, the threshold voltage of IGZO TFTs, like in other TFTs, can be severely degraded by different types of stress such us negative or positive bias, temperature, exposure to light or even mechanical strain. This phenomenon is referred to as threshold voltage instability. It is believed that stress induced instability is due to defects created in different regions of the device. However the type of defects responsible for this instability is not clear yet. It is evident that that there a lot of non clarified issues in the effect of different types of stress on the electrical characteristics of a-IGZO TFTs. In particular which type of stress (optical, gate bias, drain bias, temperature, etcc..) creates which type of defects (interface, bulk, surface, discrete levels, continuous DOS, etc…). This paper is an attempt to elucidate a particular side of this issue. We have assumed that stress, whatever its nature is, creates either an interface defect between the active channel (a-IGZO thin film) and the dielectric material, a bulk defect in the active channel (as a Gaussian acceptor or increase the initial Gaussian donor) or a bulk defect in the dielectric. The transfer characteristics of the a-IGZO TFT under these different assumptions are numerically calculated using the SILVACO TCAD software. It was found the threshold voltage shift in a-IGZO TFTs does not depend on interface states but it does depends strongly on the density of the deep sub-gap defects fixed charges inside the gate insulator.

CT67

Novel Selective Solar Absorber Coatings

A. Karoro[1,2], C. Kotsedi[1,2], Z.Nuru[1,2] and M. Maaza[1,2]

[1]UNESCO Africa Chair in Nanosciences-Nanotechnology, College of Graduate Studies, University of South Africa, Muckleneuk ridge, POBox 392, Pretoria-South Africa,
[2]NANOAFNET, iThemba LABS-NRF, Western Cape Province, South Africa.

E-mail of Corresponding Author: maaza@tlabs.ac.za

In solar thermal power (CSP) plants the incoming solar radiation is tracked by large mirror fields which concentrate the energy towards, generally, ceramic-metal absorber thin films deposited on steel, aluminium or copper substrates. Therefore the function of the selective absorber in a CSP solar collector is to transform the incident solar irradiation into heat while suppressing heat losses due to thermal radiations. These pivotal requirements of an effective solar absorber in terms of a maximum absorptance ($\alpha(\lambda)$)of the solar irradiation (in the wavelength range from 0.29 to 2.5 μm) and a minimum emittance ($\varepsilon(\lambda)$) in the thermal infrared spectrum (>2.5 μm) are met by applying a spectrally selective coating onto the absorber substrate material. For such, various configurations of the selective solar absorber thin films can be categorized into 6 distinct types: (i) intrinsic, (ii) semiconductor-metal tandems, (iii) multilayered absorbers, (iv) multi-dielectric composite coatings, (v) textured surfaces, and (vi) selectively solar-transmitting coating on a blackbody-like absorber. Intrinsic absorbers use a material having intrinsic properties that result in the desired spectral selectivity. This contribution reports on 2 novel types of selective absorber thin films; the first consists of oriented metallic nanocylinders embedded in electrically insulating host Alumina matrix while the second family is made of laser surface nano-structured and oxidized Chromium metallic surfaces. In both cases, the thin films behave as a ceramic-metal nanocomposites with a significant optical absorptance as in the standard selective solar absorbers.

CT68

Effect of the Interface Character on the Stability of Ferroelectricity in a Semiconductor Film

Burc Mısırlıoglu[1] and Mehmet Yildiz[1]

[1]*Sabancı University, Materials Science and Engineering, Turkey*

E-mail of Corresponding Author: burc@sabanciuniv.edu

In the first part of our work we study the effect of electrical and non-electrical boundary conditions on distribution of free carriers in a wide bandgap semiconductor ferroelectric thin film using a thermodynamic approach. We show that free carriers, namely holes and electrons from ionizable impurities or vacancies can accumulate near the film-electrode interface if ferroelectric polarization profile has a very steep change near the interfaces that is specified by the extrapolation length. Such an outcome is just the opposite of what happens in a Schottky junction in a partially or fully depleted film. This is also an entirely different effect than what has been often studied in similar structures where the work function and screening length of the electrode metal determines the character of the interface. Even for low-to-moderate densities of ionizable defects with states within the bandgap close to the band edges, high densities of carriers can localize close to the electrodes in a single domain state ferroelectric film when above a critical thickness. For low densities of such ionizable defects, short extrapolation lengths cause electrical domain formation with minimal carrier accumulation. In the latter, no carrier accumulation occurs near the interfaces because of the already weak depolarizing fields. This is also true for films below a critical thickness with low-to-moderate densities of ionizable impurities, i. e. electrical domains get stabilized regardless of defect density. The implications of our findings for polarization controlled Schottky-to-Ohmic transition of an interface and experimental results are discussed. We conclude that, for low-to-moderate ionizable impurity densities, it is the rate of change of polarization at the interface with position rather than solely its presence that leads to carrier accumulation and that both interfaces can become Ohmic-like with opposite signs of carriers.

In the second part, we analyze the effect of relaxation of misfit strains via the inhomogeneous strain fields of interfacial misfit dislocations on depletion charge formation, dielectric response and phase transition temperatures in submicron thick ferroelectric thin films. Understanding how the carriers due to impurities are distributed around imhomogeneities such as misfit dislocations is particularly important when considering leakage current mechanisms that are often a problem in ferroelectric thin film applications. We show that the different misfit strain relaxation states for films with various thicknesses have a direct impact on whether a ferroelectric film will be fully or partially depleted in the presence of ionized impurities. Implications of our results for experiments are discussed. "

CT69

Mechanical Properties Measurements of TiN Films Deposited by PACVD Technique

Abdolali Zolanvari[1], Z. Mohades[1], M. Raoufi[2] and J. Nezamdost[3]

[1]*Department of Physics, Faculty of Science, Arak University, Arak, 38156-8-8349, Iran*
[2]*Department of Materials Engineering, Faculty of Engineering, Arak University, Arak, 38156-8-8349, Iran*
[3]*Iranian Academic for Education, Culture and Research, Arak, 38156-8-8349, Iran*

Email of corresponding author: a-zolanvar@araku.ac.ir

In recent years, Plasma-Assisted Chemical Vapor Deposition (PACVD) has been identified as suitable technique to deposited hard coatings on tools of complex geometries. This study sheds light on the influence of the duty cycles on the surface residual stress of TiN coatings. A mixture of H_2, N_2, Ar and $TiCl_4$ was used to deposit a thin film of TiN on H13 steel. The residual stress of samples were studied using X-Ray Diffraction (XRD) and duty cycles gradient and were compared with microhardness conclusions. XRD analysis results indicate that TiN phase exist in the surface layer and exhibits a preferred orientation with (200) family planes. Residual stress value decreases with the decreases of duty cycle.

CT70

AGFM, FMR and BLS Studies of Co_xCr_{1-x}/Si(100) Thin Films

Ahmed Kharmouche[1]

[1]*Ferhat Abbas University Sétif1 Physics, Algeria*

Email of corresponding author: kharmouche_ahmed@yahoo.fr

Co and Co_xCr_{1-x} thin films are deposited under vacuum onto Si (100) substrates, x being the cobalt proportion. The hysteresis loops in the longitudinal and the polar configurations are obtained by means of an Alternating Gradient Field Magnetometer (A.G.F.M.) at room temperature. The magnetic force microscopy technique is used to observe domain configurations, especially for the thickest films. The magnetic anisotropy of the films is investigated using Brillouin light scattering (B.L.S) and ferromagnetic resonance techniques.

The thinnest films do not present any domain configuration whereas the thickest films exhibit clear stripe domains with a period sensibly equal to the film thickness. The magnetic anisotropy constants are computed using the static and the dynamic magnetic studies. The Ki values, issued from these techniques, are compared. These results and others are presented and discussed.

Keywords: Thin films; hysteresis; magnetic anisotropy.

References

[1] A. Kharmouche, J. Magn. Magn. Mater. 327(2013) 91.
[2] A. Kharmouche, S.-M. Chérif, Y. Roussigné, G. Schmerber, Appl. Surf. Sci. 255 (2009) 6173–6178.
[3] A. Kharmouche, S.-M. Chérif, G. Schmerber, and A. Bourzami, J. Magn. Magn. Mater. 310(2007) 152.
[4] R. D. Fisher, V. S. Au-Yeung, and B. B. Sabo, IEEE Trans. Magn.MAG-20, 806 (1984).
[5] Y. Endo, O. Kitakami, S. Okamoto, and Y. Shimada, Appl. Phys.Lett. 77, 1689 (2000).

POSTER SESSION A

PA001

Elaboration and Characterization of Copper Doped ZnO Thin Films by Sol Gel Method

Mourad Zaabat[1], Tarek Saidani[1], Ahlam Benaboud[1] and Azeddine Boudine[1]

[1]*University of Oum el Bouaghi Materials Sciences, Algeria*

Email of corresponding author: zaabat@hotmail.com

In this work, we prepared ZnO thin films doped with various concentrations of copper in the range of outlet (3, 5 and 10 %) on glass substrates by the Sol -Gel method from zinc acetate dissolved in a solution of ethanol. The objective of our work is to study the influence of doping with different concentrations on morphological, optical and electrical properties of ZnO thin films. For this, we used the atomic force microscopy (AFM) to determine the morphology of the surface of the ZnO thin films. The UV Visible spectroscopy for optical transmission and optical characterizations of the end technical Hall effect measured for the resistivity of the ZnO thin films.

The AFM study revealed that the increase of the concentration of Cu causes the growth of the grain size; it passes from 26 nm to 64 nm for pure ZnO and doped ZnO 10 % Cu respectively. Optical measurements have shown that all the deposited layers exhibited a transmission which is higher than 85 % in the visible region as well as increasing the optical gap with increasing Cu concentration. The resistivity of the thin film decreases with increasing concentration of copper.

Advances in Deposition Techniques

PA002

Characterization and Tribological Behavior of Electroless Ni–P–WC Composite Coated Iron Based P/M Parts

Ulaş Matik[1] and Ramazan Çitak[2]

[1]*Karabuk University, Mechine and Metal Technologies Department, Turkey*
[2]*Gazi University, Technology Faculty, Metallurgical and Materials Engineering Department, Turkey*

E-mail of Corresponding Author: matik@karabuk.edu.tr

Composite coatings were prepared using hypophosphite reduced electroless nickel bath containing 10 g/L submicron WC particles and their composition and microstructure were observed by EDS (energy-dispersive analysis), SEM (scanning electron microscope) and XRD (X-ray diffraction). The effect of heat treatment on hardness and wear characteristics of Ni-P alloy and Ni-P-WC composite coatings were investigated. The experimental results show that the Ni-P-WC deposits have superior hardness and adhesive wear resistance, and heat-treatment of these coatings at 400 ˚C for 1 h could further increase the microhardness and wear resistance.

Applications of Electrochemical and Electroless Depositions

PA003

Stress Controlling in Fe-Doped ZnO Nanostructures Synthesis by Convenient Electrochemical Techniques

Khalled Al-Heuseen[1] and K. Al-Heuseen[1]

[1]*Al-Balqa Applied University, Ajloun University College, Ajloun, Jordan.*

E-mail of Corresponding Author: kalhussen@yahoo.com

This paper reports the stress controlling in Fe-doped ZnO thin films deposited on gold coated glass substrates, using electrochemical deposition technique at room temperature for different concentration of Fe. X-ray diffraction (XRD), scanning electron microscopy (SEM), photoluminescence, and optical transmission were used to characterize the films. The effect of iron doping on structural, morphological, stress and optical properties of films was studied.

Applications of Electrochemical and Electroless Depositions

PA004

Influence of Phosphorus Contents on the Crystallization and Tribological Characteristics of Electroless Ni–P Films

Ulaş Matik[1] and Ramazan Çıtak[2]

[1]*Karabük University, Vocational School, Department of Machine and Metal Technologies, Karabük, TURKEY*
[2]*Gazi University, Technical Education Faculty, Department of Metallurgy, Ankara, Turkey*

Email of corresponding author: matik@karabuk.edu.tr

The effect of phosphorus contents on crystallization and tribological characteristics of Ni-P coatings was investigated in this study. For this aim, low, medium and high phosphorus coatings have been applied on AISI 1020 samples using three different solutions to apply different tests and analysis. DSC, SEM, EDS, XRD and microhardness tests have carried out. The crystallization temperatures of alloys with various phosphorus contents are examined by experiments under like conditions. It has been found that friction forces were decreased with increasing phosphor content. It has also been found that hardness and wear resistance were increased with decreasing phosphor content.

Keywords: Electroless plating; Nickel-phosphorus; Phase transitions; Wear

Applications of Electrochemical and Electroless Depositions

PA005

Structural and Optical Investigations of Ag Thin Films Deposited on Porous Silicon

Mehmet Ozdogan[1], Alper Cetinel[1], Gokhan Utlu[1], Nurcan Artunc[1], Gundogdu Sahin[2] and Enver Tarhan[2]

[1]*Department of Physics, Ege University, Turkey*
[2]*Department of Physics, Izmir Institute of Technology, Turkey*

E-mail of Corresponding Author: memetozdogan.85@gmail.com

In this study, the structural and optical properties of porous silicon (PS) and silver (Ag) deposited PS layers have been investigated. All samples were formed on lightly P-doped n-type silicon (100) wafers with 1-10 ohm.cm resistivity. PS samples were prepared by electrochemical etching method at a concentration of 10% hydrofluoric acid and ethanol in the volume ratio 1:3 by using a two-electrode configuration in a Teflon tank. The samples were obtained by varying the current densities (20, 40, 60, 80, 100 mA/cm^2) and constant etching time of 15 min. A platinum wire was used as cathode and Si wafer as anode. All samples were illuminated from the backside of Si substrate with halogen lamb during etching process. After than Ag thin films were deposited on PS layers in order to enhance the luminescence properties of PS by using thermal evaporation in a vacuum of $1x10^{-6}$ torr. The thickness of the Ag thin films were selected 10, 50 and 100 nm, respectively. The structural properties of all the samples were studied by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray (EDX) and Raman spectroscopy and the optical properties investigated by employing photo-luminescence (PL). SEM results show that pore size of PS layers increases as the current density increases while thickness of pore walls decreases. The photo-luminescence spectra of PS layers indicate that the peaks show blue shift with increasing current density. The observed PL intensities of Ag/PS samples were higher than PS samples. It was found that the structural and optical properties of PS strongly depend on etching parameters.

Applications of Electrochemical and Electroless Depositions

PA006

Electroless Deposition of Dense Pd Membranes on the Ultrasound-Assisted-Activated Alumina Support for Hydrogen Separation

Ting-Kan Tsai[1], Y. F. Cheng[1], J. K. Chen[1], J. H. Li[1] and J. S. Fang[1]

[1]*National Formosa University, Materials Science and Engineering, Taiwan*

E-mail of Corresponding Author: dktsai@nfu.edu.tw

Dense Pd membranes exhibited good H_2/N_2 permselectivity and excellent thermal stability were prepared by an ultrasound-assisted activation followed by electroless deposition of Pd on porous α-alumina support. The distributions and morphologies of Pd nuclei on the α-alumina activated by conventional activation (c-Al_2O_3) and the α-alumina activated by ultrasound-assisted activation (u-Al_2O_3) have been investigated. The gas permeation measurement was carried out in a stainless-steel permeation cell under temperature ranges of 623-773 K and transmembrane pressure ranges of 70-345 kPa. The Pd membrane on the u-Al_2O_3 support was dense and more uniform than that on the c-Al_2O_3 support, and the H_2/N_2 selectivity of the Pd/u-Al_2O_3 composite membrane with 3 μm-thick Pd membrane was higher than that of the Pd/c-Al_2O_3 composite membrane with Pd membrane of the same thickness. The H_2/N_2 selective fact approached to infinite was obtained when the thickness of Pd membrane in Pd/u-Al_2O_3 composite membrane was increased to 7 μm. Furthermore, the Pd/u-Al_2O_3 composite membrane with 7 μm-thick Pd membrane have undergone a thermal stability test performed at 673 K and transmembrane pressure 276 kPa for 200 h without significant changes in hydrogen permeation flow. The ultrasound-assisted activation pretreatments improved the deposition of Pd membranes on porous α-alumina supports and enhanced the H_2/N_2 permselectivity and thermal stability of the Pd/Al_2O_3 composite membrane.

Applications of Electrochemical and Electroless Depositions

PA007

Optical and Electrochemical Properties of Tungsten Oxide (WO_3) Thin Films

Sani Demiri[1] and Fatma Özütok[2]

[1]*Çanakkale Onsekiz Mart University, Materials Science and Engineering, Turkey*
[2]*Çanakkale Onsekiz Mart University, Physics Department, Turkey*

E-mail of Corresponding Author: fatmaozutok@comu.edu.tr

In the 21th century, necessity of the new materials increasing day by day. Among them, electro-chromic materials are used different devices, such as antiglare mirrors for cars, IR dedectors, photo-conductors, cholesterol biosensors i.e.

In these type materials, to maintain the optical performance of the working electrode the ion storage layer should be as transparent as possible. Generally this transparent part is thin film form because of its excellent properties.

There are many studies of electrochemical oxidation-reduction reactions and optical changes, but desirable electrochromism and long-term coloring is still problem. Hence, it was observed that some 50 to 100 papers were published annually.

There are many electrochromic thin film materials for the utilized electchromic devices, such as Prussian blue, WO_3, NiO ve V_2O_5. In order to get the WO_3 thin films, we know that many methods used by the scientists. Among various deposition techniques, chemical bath deposition (CBD) yields stable, uniform and hard films with good reproducibility by a relatively simple process.

In this study, we used chemical bath deposition (CBD) for synthesized WO_3 thin films. After the deposition process, we invesitaged optical and electrochemical properties of these films. And also, we measured the thickness of these films and who analyzed all the results.

In the future, WO_3 thin films increasingly attracted in the scientific and industrial range for developing the electrochromic device technology. As the decreasing the device price and increasing device performance, the modern society infinitely tend to this topic.

Applications of Electrochemical and Electroless Depositions

PA008

Synthesis and characterization of polyaniline PANI quartz crystal microbalance QCM prepared by electrochemical method

Malika BEROUAKEN[1] and GABOUZE Noureddine[1]

[1]*CRTSE, CMSI Algiers*

Email of corresponding author: malika.berouaken@gmail.com

Polyaniline (PANI) has attracted considerable attention as candidate materials for several applications, such as sensors [1], corrosion protection [2], and electronic devices [3], due to its high stability, simplicity of synthesis, low cost and unique electrochemical properties.

In the present work, Polyaniline (PANI) doped with sulfuric acid (H_2SO_4) and hydrochloric acid (HCl) were prepared by cyclic voltammetry (CV) method onto the quartz crystal microbalance QCM in different reaction conditions. The structure and the morphology of PANI samples (QCM coating) were characterized by Fourier transform infrared spectroscopy (FTIR), contact angle measurements and electrical conductivity using four probe. These structures can be used for gas detection.

Applications of Electrochemical and Electroless Depositions

PA009

Ultrasound improves the anticorrosive performance of electrolss Ni-P coating on the mild steel

Mohammad Entezari[1] and Zahra Sharifalhoseini[1]

[1]*Ferdowsi University of Mashhad Chemistry, Iran*

Email of corresponding author: moh_entezari@yahoo.com

Electroless Ni-P coating has been widely developed as a simple, low-cost and an easy technique. In spite of the desirable properties of the binary Ni-P coatings such as high corrosion and wear resistance, good ductility and surface uniformity, improvement in their structure and corrosion protection has been studied by many scientists. In the present research, the specific effects of ultrasonic irradiation and its direction on the final morphology of coated layer and its anticorrosive performance have been subjected. The resultant sonochemically electroless films on the mild steel have been also compared with the classical one which produced in the absence of ultrasound waves. The morphology of the final surfaces has been characterized and the chemical composition has been determined. The corrosion behavior for all samples has been studied by electrochemical techniques including the linear polarization resistance, Tafel extrapolation and electrochemical impedance spectroscopy. The results confirmed that the final characteristic of the fabricated surfaces was depended on two determining factors including the presence of ultrasonic waves during coating and the location of the plate with respect to the horn of ultrasonic apparatus. The analysis indicated that the Ni-P layer prepared by sonication has smoother surface with higher anticorrosive property in comparison with the classical one specially when the plate was situated in a perpendicular position with respect to the horn.

Applications of Electrochemical and Electroless Depositions

PA010

Fabrication and Characterization of Superconducting Bi2212 Bolometer for the Detection of THz Waves

Metin Kurt[1,*], Tugce Semerci[1], Hasan Koseoglu[1], Yasemin Demirhan[1], N. Miyakawa[2], H. B. Wang[3], and Lutfi Ozyuzer[1]

[1]*Department of Physics, Izmir Institute of Technology, Urla, 35430, Izmir, TURKEY*
[2]*Tokyo University of Science, Tokyo, JAPAN*
[3]*National Institute for Materials Science, Tsukuba, JAPAN*

E-mail of Corresponding Author: metinkurt@iyte.edu.tr

Since terahertz (THz) waves can pass through materials like clothing, plastic, wood, ceramic, leather and without any harm to the body [1]. It can be used for characterization, detection and 3D imaging of these materials. THz application area expands day by day such as high-speed wireless communications, medical imaging, security in airports and shopping centers and detection of chemical and biological materials [2]. Rapidly increasing applications of the electromagnetic waves (EM) in the under developed terahertz frequency (0.1-10 THz) range requires a well understandings of efficient terahertz wave detection. Today, there are several deficiencies in different types of bolometers that are used for detection of THz waves and they require very difficult and costly cryogenic spending [3, 4]. An intense, coherent and continuous electromagnetic wave source is obtained by High-T_c superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi2212) single crystal. At the same time Bi2212 single crystal can detect THz waves in suitable conditions. In this study, single crystal of Bi2212 is cleaved to layer by layer by scotch tape until the necessary thickness is reached. Afterwards, it is pasted on a sapphire substrate and the scotch tape is etched with the aid of chloroform solution and ultrasonic cleaner. Then, the samples were annealed at 600^{o}C for 1 hour in order to adjust the oxygen doping level. Later, it was deposited with 150 nm Au layer by thermal evaporation. Afterwards they were annealed again at 425^{o}C for 30 minutes to decrease the contact resistivity. In the clean room process, our log-periodic antenna design was formed on the crystal by using e-beam lithography and Ar-ion beam etching step by step. For electrical characterization, four probe wires were connected to the two contact paths on the log-periodic antenna by silver epoxy. Finally, the temperature dependence of a-b axis resistivity (R-T) for Bi2212 single crystals were performed.

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[1] Kawase, K. 2004. *Optics and Photonics News*, 15:34-39, 2004

[2] M. Tonouchi, *Nature Photonics*, 97, 1 2007

[3] Luukanena and J. Pekola, *Applied. Physics Letter,* 82, 3970, 2003

[4] P. L. Richards, *Journal Applied Physics,* 76, 1, 1994

PA011

Study of the Physical Properties of Nanostructure ZnO:Cu Thin Films Obtained by Spray Pyrolysis Technique

Maryam Sarhadi[1] and S.M.Rozati[1]

[1] *Physics Department, University of Guilan, Iran*

E-mail of Corresponding Author: smrozati@guilan.ac.ir

In this work, the effect of Cu doping on physical properties of ZnO thin films prepared by spray pyrolysis technique under various deposition conditions have been studied.
The concentration of Cu as a dopant has been found to be the most important parameter in the preparation of the ZnO:Cu films. The ZnO films were deposited on glass substrates using the spray pyrolysis method. The minimum resistivity obtained for ZnO:Cu films was about 0.144.

Characterization and Instrumentation

PA012

Comparative Study of Humidity Sensor Based on ZnO Thin Films Prepared by Sol-Gel Process

S.Ghanem[1], A.Telia[1] and C.Boukaous[1]

1 Department of electronic, University of Constantine 1,
Laboratory of Microsystems and instrumentation (LMI)
Constantine, Algeria

Email of corresponding author: ghanemsalah1@gmail.com

In this work we present ZnO thin films prepared using different sol-gel method, structural, and electrical characterization, and finally humidity sensing test. ZnO sol was prepared using zinc acetate, 2-Methoxyethanol and monoethanolamine (MEA). Two different routes were used for the deposition of ZnO thin films; spin coating and dip coating on glass substrate. The crystal structure of the ZnO nanostructure have been characterized by X-ray diffraction. Surface morphology was investigated using scanning electron microscopy. Sensing humidity test exhibits better sensitivity for sensor prepared with film deposited using dip coating.

Characterization and Instrumentation

PA013

Characterization Physical Properties and Structural of Cu–Te–Se Chalcogenide Alloys

Farid Abdel-Rahim[1]

[1]*King Abdulaziz University, Physics, Saudi Arabia*

E-mail of Corresponding Author: farid.elkhateb@gmail.com

Bulk $Se_{90}Te_{10-y}Cu_y$ (for y=0, 0.5, 1.5 and 3.0 at %) chalcogenide glasses have been prepared by conventional melt quenching technique. Thin films of $Se_{90}Te_{10-y}Cu_y$ composition were deposited using thermal evaporation technique. As-prepared films were amorphous as studied by X-ray diffraction. The effect of the addition of Cu content on the glass transition and crystallization kinetics of amorphous $Se_{90}Te_{10}$ has been studied. Increasing Cu content at the expense of $Se_{90}Te_{10-y}Cu_y$ composition is found to affect the refractive index and the extinction coefficient of these films.

Characterization and Instrumentation

PA014

A Contribution to the Study of the Performance Improvement of a Capacitive Pressure Sensor Using Carbide Silicon Membrane

Fouad Kerrour[1], Salah Kemouche[1] and Abdelaziz Beddiaf[2]

[1]Laboratory Modeling of Renewable Energy Devices and Nanoscale- MoDERNa, University Constantine 1, Faculty of Science and Technology Electronics Algeria
[2]University Khenchela, Khenchela, Algeria

E-mail of Corresponding Author: f_kerrour@yahoo.fr

The sensors remain until now the most used devices in several areas, mainly capacitive pressure sensor, which has the advantage of very low thermal drift. In the design of these devices, materials other than silicon, are considered such as the silicon carbide-type 6H-SiC, especially in the case where the silicon is not entirely appropriate. The materials used in the membrane manufacture has an important role on the characteristics and the performances of these devices.

In this study, a simulation of the thermo mechanical behavior of capacitive pressure sensor has been carried out using multi physics COMSOL software. Analyses of the sensor response C (P, T), pressure sensitivity Sp (P) and temperature Tc (T) have been investigated. The results were in good agreement with those reported in the literature. A further study related to the influence of the constituting device materials was performed. Different types of materials were used for the design of the same features.

The obtained results showed that the silicon carbide type 6H-SiC sensor membrane was five times stronger than polysilicon one, which may reach a maximum pressure of 2.5 bar, gives a wider linear range up to 2 bar, has a high pressure sensitivity of 0.38 pF/bar and a low thermal drift of 23.73 ppm /°C. Therefore, the use of the silicon carbide type 6H-SiC as a sensor membrane material, contributes well to the improvement of sensor performances.

Characterization and Instrumentation

PA015

Capacitance–Voltage Characteristics of SiCN/Si(100) Prepared by HWCVD Method

Akira Izumi[1] and Shinya Morita[1]

[1]*Kyushu Institute of Technology, Engineering, JAPAN*

E-mail of Corresponding Author: izumi@ele.kyutech.ac.jp

Silicon carbon nitride (SiCN) is known as an insulator with a high dielectric constant of approximately seven. Further, SiCN films exhibit high transparency, high hardness, and superior wear resistance. SiCN films have been used in various applications as isolators, dielectrics, etch-stop layers, passivation layers, and optical coatings for various electronic and optoelectronic devices. Furthermore, they have enhanced properties such as increased high gas-barrier values. Therefore, SiCN films are considered to be very useful in electronic and optoelectronic device applications as well as weather-resistant coating films. In this work, SiCN films were deposited on Si (100) by hot-wire (HW) chemical vapor deposition method using hexamethyldisilazane, a non-explosive organic liquid source. Then, metal–insulator–semiconductor structures were formed by Al evaporation. Next, we evaluated the capacitance–voltage (C–V) characteristics. We performed ammonia radical treatments on the Si (100) before the deposition of the SiCN film. The ammonia radicals were generated by the HW method. We found that the ammonia radical treatment could yield a small flat-band voltage shift of the C–V curves. Moreover, we examined the C–V characteristics by changing the substrate temperature during the deposition of the SiCN film. As a result, when the SiCN film was deposited at 200°C, we obtained low fixed-charge and low interface state densities.

Characterization and Instrumentation

PA016

In the production of conductive carbon and graphite based nanocomposite coatings to increase conductivity by decreasing amount of additives

Metin Yurddaskal[1], Mustafa EROL[2] and Erdal CELIK[3]

[1]*Dokuz Eylül University, Center for Production and Applications of Electronic Materials (EMUM), Turkey*
[2]*Hitit University, Dept. of Metallurgical and Materials Engineering, Corum, Turkey*
[3]*Dept. of Metallurgical and Materials Engineering, Izmir, Turkey*

Email of corresponding author: metin.yurddaskal@deu.edu.tr

Carbon black and graphite based conductive polymer composites (CPCs) were produced successfully. CPCs were obtained by performing carbon and graphite additives in different contents into nonconductive polymers. The produced composites were characterized to demonstrate their structures through XRD, XPS, FT-IR, DTA-TG, SEM and electrical properties were investigated. High electrical resistance of the polymers was reduced to the levels of metal with the help of these additives. The conductivity provided with carbon black and graphite additives was determined 13 and 15 percent by weight, respectively. On the other hand, when carbon black and graphite additives were used within the same structure, the composites showed synergistic effect by showing higher conductivity with the contribution rate dropped more than half.

Characterization and Instrumentation

PA017

Preparation, optical and electrochemical gas sensing properties of Nickel doped lithium iron phosphate thin films

Patima Nizamidin[1] and Abliz Yimit[1]

[1]*College of Chemistry and Chemical Engineering Xinjiang University, China*

Email of corresponding author: abliz05@aliyun.com

A new gas sensitive material was introduced. $LiFe_{0.99}Ni_{0.01}PO_4$ was synthesized using hydro-thermal methods by one step, and the as prepared products were subsequently utilized in self assembled optical waveguide gases testing apparatus and WS-30A electro-chemical gas sensing apparatus for xylene detection. A glass optical waveguide gas sensor was fabricated by spin-coating a $LiFe_{0.99}Ni_{0.01}PO_4$ thin film on the surface of single - mode tin-diffused glass Optical Waveguide. The sensing elements for electro- chemical gas sensor were made by dip-coating a $LiFe_{0.99}Ni_{0.01}PO_4$ thin film on the surface of an alumina ceramic tube, assembled with platinum wire. The experimental results indicated that, at room temperature, $LiFe_{0.99}Ni_{0.01}PO_4$ thin film/tin- diffused optical waveguide sensing element exhibited higher response to xylene in the range of 0.1ppm to 100ppm; $LiFe_{0.99}Ni_{0.01}PO_4$ sensing film shows a small response (resistance change) to 100ppm of xylene, as measured by WS-30A electro-chemical gases sensing apparatus. After the Ni doping, $LiFePO_4$ thin film OWG sensor's gas sensitivity was improved.

Characterization and Instrumentation

PA018

Silver Coated Polymer Fibers by Roll to Roll Inverted Cylindrical Magnetron Sputtering

Adnan Tasdemir[1], Zeynep Meric[1], Mutlu D. Yaman[1], Cem Türkay[1], Gulnur Aygun[1] and Lutfi Ozyuzer[1]

[1]*Department of Physics, İzmir Institute of Technology, 35430, Urla, İzmir, Turkey*

E-mail of Corresponding Author: adnantasdemir@iyte.edu.tr

There is a huge demand in advanced materials enhanced with high technology. These materials have recently been of increasing interest to both the academic and the industrial research and application areas such as automobile, medical and health care. It is desirable to produce such textile materials with especially designed surface features to meet various needs. Textile products can be evaluated or functionalized by using metal thin film coated fibers. In order to modify textile materials Physical Vapor Deposition (PVD) has been widely used. For this aim, magnetron sputter coating can be used which is one of the most commonly used techniques in PVD. In this study to reach our aim, we used cylindrical magnetron sputtering with some modifications. In conventional magnetron sputtering system, substrates are planar and flat, so sputtering cathode and target are planar [1]. Ring shaped cathode and target are used to coat fibers as substrates in cylindrical magnetron sputtering system. In our design, we used three %99.99 pure silver targets to coat PP and PA fibers as substrates in our inward cylindrical magnetron sputtering system. Fibers whose diameters are in the range 60-150 μm pass through targets from a feeding bobbin to winding bobbin. Fibers moves through the targets 10 times circling at a constant rate by a rotator, and thus would be coated homogeneously. After evacuated the chamber to low vacuum, which is about 10-5 torr, Ar gass were flow into the chamber using mass flow controller. Power applied to each silver targets for the formation of plasma in the vacuum chamber by DC power supplies. The surfaces of synthetic fibers, such as PP and PA, coated with electrical conductor. In this study, silver is used because it has the highest electrical conductivity in metals and additionally it has antibacterial properties [2]. Textile fibers were coated in nanometer thickness and electrical conductivity is aimed to increase. These fibers weaved into fabrics in order to investigate antistatic and antibacterial properties. For characterization optical microscope and SEM images were taken. Besides, XRD, electrical results, mechanical strength tests were done. In order to determine optimum film thickness, by using three different methods coating thicknesses were investigated and results compared. Resistances of Ag on fibers were found and film thickness calculated from bulk Ag resistivity. The thickness was also calculated from deposited mass of silver. The both results were compared with independent thickness measurement on a glass substrate with a surface profilometer. The analysis of data commented surface scattering effect. When these fibers were weaved to become fabric due to these properties, fabrics will take place of technical textiles. Besides, the obtained fabrics have potentials to be used for electromagnetic shielding, radar absorbing materials and infrared camouflage.

Large Scale Coating and Industry

PA019

Design of Jaumann Type Radar Absorbing Composites using Thin Film Resistive Sheets

Mutlu D. Yaman[1], Lutfi Ozyuzer[1], Adnan Tasdemir[1], Serkan Kangal[2] and Metin Tanoglu[2]

[1]*Department of Physics, Izmir Institute of Technology, Urla, 35430, Izmir, Turkey*
[2]*Department of Mechanical Engineering, Izmir Institute of Technology, Urla, 35430, Izmir, Turkey*

E-mail of Corresponding Author: mutluyaman@iyte.edu.tr

In order to achieve the fabrication of microwave absorbing material, it is important to have ability to make materials with well-controlled properties such as shape, thickness, permittivity and permeability values. Good optimisation codes are required in order to achieve the best possible absorber design [1]. To achieve the maximum absoption, we calculated the optimum values of complex permittivity ($\varepsilon = \varepsilon' - \varepsilon''$) and permeability ($\mu = \mu' - \mu''$) theoretically with using transmission line theory [2]. In this study, in order to improve the electromagnetic absorbing properties of epoxy resin structure composites, we devised multi layer materials with using carbonyl iron mikro particles and thin film coated resistive sheets. To reach some certain values, for example thickness between resistive sheets or permittivity and permeability values, we modelled Labview program by using transmission line theory and run it to reach required parameters. For resistive sheets, we used planar magnetron sputtering system and coated thin film on the surface of the glass fiber fabrics. We characterized the resistance of these sheets. After designed our glass fiber reinforced epoxy composite structure, we manifactured it by using Hand-Lay up compression technique. We aimed the thickness of the material about between 0.5 and 0.8 cm. Also we added carbonyl iron powder in epoxy resin to change permittivity and permeability values of composites. We manufactured five different epoxy resin composite structures. Third of them has carbonyl iron additives with different concentrations. Additionally, we have one reference structure, which we did not add any resistive sheet or reinforced carbonyl iron. And the last one has only 4 resistive sheet only. Mechanical tests were done such as tensile, compression, charpy impact etc. Furthermore, absorbtion properties of the composite structures were measured between 1-20 GHz by using horn antennas.

Large Scale Coating and Industry

PA020

ITO Coated Thin Films and Its Optical and Electrical Characterizations

Cem Türkay[1], Mutlu D. Yaman[2], Adnan Tasdemir[2], Gulnur Aygun[2] and Lutfi Ozyuzer[2]

[1]Iztech Material Science and Engineering, Urla, 35430, Izmir, Turkey
[1]Department of Physics, Izmir Institute of Technology, Urla, 35430, Izmir, Turkey

E-mail of Corresponding Author: cemturkay@iyte.edu.tr

To make new smart materials or develope instruments especially for LCDs, LEDs, OLEDs, photovoltaics, heat reflecting mirrors and optical sensors we have needed Transparent Conducting Oxides (TCOs) [1]. One of them, ITO, is just the right thing because of its low resistivity (~ 104Ωcm) conversely high transparency (%90) even in infrared region. In this work ITO is deposited in a Large Area Magnetron Sputtering System [2]. Main quality of this system is that thickness, transparency and resistivity values could be decreased or increased optionally before deposition accurately. Another adventageous situation of this method can be defined as applications on both glass and polymer (policarbonate, poliethylene…) substrates. It is certainly known that annealing (made by ovens after deposition) glass surface makes the substrates highly oriented meaning more surface energy which leads better conductivity[3]. For characterization XRD analysis also is used to understand which planes (a kind of thin film) can be growth on tha substrate. Up to now, (222), (400), (440) are observed signing cubic forms. Chemical states are examined by XPS studies to determine the structure of surface layer. Electrical character of the film is defined by Four Point Probe method. After all, thickness is determined in clean room conditions with a help of profilometer.

Large Scale Coating and Industry

PA021

Enhancement of Optical and Electrical Properties of ITO Thin Films by Electro-Annealing

Hasan Koseoglu[1], Mutlu D. Yaman[1,2], Metin Kurt[1], Fulya Turkoglu[1], Fatime Gulsah Akca[1], Gulnur Aygun[1], Lutfi Ozyuzer[1]

[1]*Department of Physics, İzmir Institute of Technology, 35430, Urla, İzmir, Turkey*
[2]*Teknoma Technological Materials Ltd. IZTEKGEB, IYTE Campus, Urla, Izmir Turkey*

E-mail of Corresponding Author: hasankoseoglu@iyte.edu.tr

Transparent conducting oxides (TCOs) have wide range of application areas in industry and science [1]. Indium tin oxide (ITO) thin film is one of the most commonly used materials among the TCO thin films due to its relatively low resistivity and high optical transmittance in the visible region of the em spectrum due to its large bandgap of about 3.70 eV. Large area coating magnetron sputtering system is the commonly used and advantageous thin film growth method for the deposition the ITO thin films [2]. In our study, we used high vacuum-based large area magnetron sputtering system. Thermal heating is generally used for the annealing of TCOs to get high quality films [3]. As an alternative, a recent study indicated that self-heating by electric current shows promise in improving the efficiency of the heat treatment process [4,5,6]. Electro-annealing was performed at 0.5, 0.75 and 1.0 A and 1.25 and 1.5 A constant currents in air and vacuum ambient during 10 minutes. When an electric current is passing through ITO film, due to the Joule heating the film temperature will increase. Sample temperature increased during 10 minutes, then slowly decrease to the room temperature within 20 and 40 minutes without annealing currents. The structural characterization of the ITO films was carried out by an x-ray diffractometer (XRD) with CuKα radiation. The surface composition of ITO films was characterized by X-ray photoelectron spectroscopy (XPS). The optical properties of the ITO thin films were measured by a spectrophotometer in the 200–2600 nm wavelength range. The thicknesses of the films were measured by a surface profilometer. Sheet resistance (Rs) of as grown and electro-annealed ITO films in air and vacuum were measured by four-point probe method.

[1] C. W. Tang and S. A. Vanslyke, Appl. Phys. Lett., 51 913 (1987)
[2] O.Tuna, Y. Selamet, G. Aygun, L. Ozyuzer, Journal of Physics D: Applied Physics, 43 055402 (2010)
[3] L Kerkache, A Layadi, E Dogheche and D Remiens, J. Phys. D: Appl. Phys., 39 184-189 (2006)
[4] N. Rogozin et al., Appl. Phys. Lett., 89 061908 (2006)
[5] Y. Pei et al., Surface Review and Lett., 16 887-893 (2009)
[6] L. Dong-Ho et al., Applied Surface Science, 254 4650-4654 (2008)

Large Scale Coating and Industry

PA022

The Effect of Substrate Temperature and Biasing on Mechanical and Tribological Properties and Corrosion Resistance of CrN/Al 5083 Coatings

Kaykhosrow KHojier[1] and Lida Ahmadkhani[1]

[1]*Department of physics, Central Tehran Branch, Islamic Azad University, Tehran, Iran.*

E-mail of Corresponding Author: khojier@iauc.ac.ir

Aluminum alloys such as Al 5083 have primary potential for lightweight structural application in automotive and aerospace industries. This paper addresses the mechanical and tribological properties and corrosion resistance of chromium nitride coatings deposited on Al 5083 that can be used for development of applications of aluminum 5083 alloy. The CrN coatings of 1 μm thickness were deposited by DC reactive magnetron sputtering technique on the Aluminum 5083 wafers at different substrate temperatures (RT and 200 °C) and bias voltages (-200 and -400 V). A FESEM instrument was used for study of chemical composition, and cross-section and surface imaging. The surface physical morphology of samples was also investigated by an atomic force microscope. The mechanical and tribological properties of the films were measured by nano-indentation and scratch tests, respectively. The electrochemical behavior and corrosion resistance of the samples were examined in NaCl (3.5 %) solution using potentiodynamic method. The results showed that chromium nitride coatings caused improvement of Al 5083 properties. The results also showed the best mechanical and tribological properties and corrosion resistance for deposited coating at room temperature and -400 V bias substrate voltage. The morphological studies demonstrated that these behaviors were due to the smooth surface with compact and small grains.

Metallurgical Coatings

PA023

The Wear Properties of Low Carbon Steel Coated (St52) with ZrB_2 Nanoparticles by Laser Cladding

Tuncay Şimşek[1], Mustafa Bariş[2], Adnan Akkurt[3], Orhan Yilmaz[4] and Murat Bilen[4]

[1]*Hacettepe University, Department of Physics Engineering, Turkey*
[2]*Eti Maden Works General Management, Development of Technology Department, Ankara, Turkey*
[3]*Gazi University, Department of Industrial Design Engineering, Ankara, Turkey*
[4]*Eti Maden Works General Management, Ankara, Turkey*

E-mail of Corresponding Author: tsimsek@hacettepe.edu.tr

In this study, the wear properties of laser cladded low carbon steel layers coated with zirconium diboride nanoparticles were investigated. Mechanochemicaly synthesized ZrB_2 nanoparticles and two step laser cladding methods were used for a coating materials and coating method. At first step, ZrB_2 nanoparticles were mixed with phenolic resin and preplaced on the surface of low carbon steel St52. After that, precoated samples were vacuum dried at 25 mbar at 200 ^oC for 4 hours. At the second step, CO_2 laser operated at different laser power were melted the surfaces. The microstructure and phase content of coated layers were characterized with optic microscobe, XRD and SEM. When laser coated surfaces were examined, crack free and homogen coating layer were observed at 160-200 W laser power while microcrack and porosity were observed on the surface of steel at 75 and 125 W laser power. The wear behaviors of coated layers were investigated by ball-on-disc test and microhardness of layers were determined also. After that, the strength of coated layers were determined via micro scratch. Finally, the coated layers were cut with important advanced cutting methods like abrasive water jut, wire erosion, laser and abrasive cutting disk and the effect of these methods on the coated layers were investigated. Results show that the abrasive cutting methods were the best method.

Metallurgical Coatings

PA024

The Wear Properties of Low Carbon Steel (S235JRC) Coated with Co_2B Nanoparticles by Laser Cladding

Mustafa Bariş[1], Tuncay Şimşek[2], Adnan Akkurt[3], Orhan Yilmaz[4] and Murat Bilen[4]

[1]*Eti Mine Works General Management, Development of Technology Department, Turkey*
[2]*Hacettepe University, Department of Physics Engineering, Ankara, Turkey*
[3]*Gazi University, Department of Industrial Design Engineering, Ankara, Turkey*
[4]*Eti Maden Works General Management, Ankara, Turkey*
[4]*Eti Maden Works General Management, Ankara, Turkey*

E-mail of Corresponding Author: mustafabaris@etimaden.gov.tr

In this research, the wear behavior of composite layers obtained by laser cladding of Co_2B nanoparticles on the surface of low carbon steel were studied. Co_2B nanoparticles used as a coating powder was mechanochemically synthesized via planetary ball mill. Two step laser cladding method was used as coating method. At first step, Co_2B nanoparticles were mixed with a phonelic resin and precoated on the surface of low carbon steel surface (S235JRC). Then, the surface of S235JRC low carbon steel were irradiated with CO_2 laser at different laser power. The wear properties of coated layers were investigated by ball-on-disc wear test and scratch test. Results showed that, alloyed surface had good metallurgical bonding and consist of FeN0,0760, Fe15,1C, FeCo and $B_2C_5N_2$ phases. Hardness of the coated layers were increased from 200 HV to 680 HV due to the presence of hard phases. The wear resistance of the layers were improved significantly at 174 W and 220 W laser power irradiation. After that laser cladded samples were cut with laser, wire erosion, abrasive water jet and abrasive disc methods and effect of the these operations on the coatings were investigated. It was observed that the most suitable cutting method for coated materials is the abrasive disc cutting in the tests.

Metallurgical Coatings

PA025

A Comparative Study of the Processes at Sintering of Coated and Premixed with Graphite Fe-powders

Lubomir Anestiev[1], Jordan Georgiev[2] and Marcela Selecká[3]

[1]*Institute of Metal Science BAS, Physical Metallurgy, Bulgaria*
[2]*Institute of Metal Science, Equipment and Technologies with Centre for Hydro and Aerodynamics, Bulgarian Academy of Sciences, Sofia, Bulgaria,*
[3]*Institute of Materials Research, Slovak Academy of Sciences, Košice, Slovak Republic*

E-mail of Corresponding Author: lanestiev@ims.bas.bg

The present investigation is a comparative study of the processes at sintering of iron powders alloyed with carbon via two different methods; coating of the powder particles with a hydrocarbon layer (a new prospective method for the introduction of carbon into the green powder) and premixed with graphite iron powders (the classical approach). The influence of the way of alloying on; the sintering kinetics, the sinter' microstructure and the mechanical properties, are studied.

Metallurgical Coatings

PA026

Restoration of Protective Coatings on Details and Products that Have Been in Exploitation

Dmitry Mashtalyar[1], Sergey Sinebryukhov[2], Konstantine Nadaraia[2] and Sergey Gnedenkov[2]

1Institute of chemistry FEB RAS, Laboratory of nonstationary surface processes, Russia
2Institute of chemistry FEB RAS, Vladivostok, Russia

E-mail of Corresponding Author: madiva@inbox.ru

Thermal oxidation (TO) of shipbuilding details and products is one of the modern methods of creation of protective coatings on the surface of titanium alloys. From TO it is possible to obtain protective coatings with anti-corrosive properties (protection from galvanic corrosion of the alloys in contact in sea water with titanium) and wear resistance. Nevertheless, thermal oxidation has several major drawbacks: high energy consumption, labor-intensity and the duration of the process, as well as lack of restoration of the coatings on the details, which already were in operation. In view of these shortcomings of TO and increasing the quality requirements of the surface layer, the new technological processes are developed which are based on the latest achievements of science and technology. One of the most effective alternative methods of application of protective coatings on the surface of the items ship fittings and tools made of titani¬um alloys is plasma electrolytic oxidation (PEO). The main objective of this research is to restore the protective properties of the coating on titanium alloys by PEO.

With using of frameworks and approaches of the plasma electrolytic oxidation were chosen modes of formation of PEO-layers on the surface of products subjected to thermal oxidation.

Quality of protective properties of surface layers which were formed by PEO on the surfaces that were in operation was evaluated by electrochemical parameters and tribological properties. Analysis of the results of potentiodynamic polarization, electrochemical impedance spectroscopy and tribological tests allowed establish restoration of protective properties of the coatings on parts, which were processed by PEO. Moreover, for the restored protective layers observed ennoblement of free corrosion potential Ec, increase of corrosion resistance Rc, reducing of corrosion currents Ic and reduced friction coefficient μ as compared to thermally formed surface.

Thus, the plasma electrolytic oxidation method is suitable not only for the formation of protective layers on the surface of pure metals and alloys, but also to restore the coatings on articles that were in operation, which significantly reduces costs compared with the manufacture of new, often unique details.

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Metallurgical Coatings

PA027

Characterization of Electrochemically Deposited Ni–Mo Alloy Coatings

BEN TEMAM Hachemi[1] and E. GUETTAF TEMAM[2]

[1]*Laboratoire de Physique des Couches Minces et Applications chimie industrielle*
[2]*Laboratoire de Physique des Couches Minces et Applications Université Mohamed Khider- Biskra, Algérie*

E-mail of Corresponding Author: ha_bentemam@yahoo.fr

In the following research, adherent, compact and bright Ni-Mo alloy coating has been electrodeposited on pretreated steel substrates from tri-sodium citrate solution at different values of molar ratio Ni:Mo. The coatings deposited were uniform and adherent to the substrates. Potentiodynamique polarization curve shows that the deposited coatings significantly improve the corrosion resistance of the steel in both 0.6 M NaCl and 0.1 M HCl solutions. The optimal depositing condition is suggested in the given system. X-ray diffraction (XRD) studies of the Ni-Mo coatings indicated that they had a tow phases ($MoNi_4$ and Ni_3Mo) crystallites of nickel and molybdenum. The microhardness and wear resistance of the composite coatings are higher than the steel substrate and increase with the addition of organic inhibitor in the electroplating bath.

Key words: Nickel; Molybdenum; Potentiodynamique polarization; Ni-Mo coatings; Organic inhibitor.

Nanostructured Growth

PA028

The effects of Aluminum addition on TRD-NbN coated AISI M_2 Steel

Eray Abakay[1], Ibrahim Fatih Kekik[2], Saduman Sen[2] and Ugur Sen[2]

[1]*Sakarya University, Metallurgical and Materials Engineering, Turkey*
[2]*Sakarya University, Esentepe Campus, Engineering Faculty, Department of Metallurgical and Materials Engineering, 54187 Serdivan, Sakarya, Turkey*

Email of corresponding author: eabakay@sakarya.edu.tr

The coating baths with the addition of aluminum, provides significant improvements on the structural properties of the TRD coatings. In the present study, Al addition in the NbN coating bath was applied. In the process, pre-nitrided AISI M_2 steel subjected to NbN coating treatment by the thermo-reactive deposition technique in a powder mixture consisting of ferro-niobium, ammonium chloride and alumina with/without aluminum at 1000°C for 1–4 h. The coated samples were characterized by X-ray diffraction analysis, scanning electron microscope, raman spectroscopy, Rockwell-C adhesion test, atomic force microscope and micro-hardness tests. Nb-Al-N layers formed on the pre-nitrided AISI M_2 steel were compact and homogeneous. X-ray diffraction analysis showed that the phases formed on the steel surfaces are Nb_2CN, $NbN_{0.95}$, Fe_2W_2C, AlN, Fe_3Mo_3N and Fe_3C. The depth of the Nb-Al-N layer ranged from 5.18 µm to 8.64 µm, depending on treatment time. The higher the treatment time the thicker the Nb-Al-N layer observed. The hardness of the Nb-Al-N layer was changing between 2136.88 ± 94.61 $HK_{0.005}$ and 2445.88 ±140.71 $HK_{0.005}$ according to Al content in the coating bath. The adhesion quality of the coated samples decreases with increase in Al content in the coating bath.

Keywords: Nb-Al-N coating, Thermo Reactive Deposition, Hardness, Phase Analysis, Adhesion.

Metallurgical Coatings

PA029

Properties of TiAlON layers Deposited on Tungsten Carbide (WC) Substrate by Physical Vapor Deposition (PVD)

Gaber EL-AWADI

Jazan University Mech.Engineering KSA

Email of corresponding author: gaberelawdi@yahoo.com

Properties of thin films of titanium aluminium nitride (TiAlON) deposited on tungsten carbide substrate (WC-Co) by Magnetron Sputter Ion Plating (MSIP), phase formation, phase transition, hardness and film structure are affected by the percentage of oxygen reactive gas. In this work the properties of layers deposited at constant total vacuum pressure 10-2 mbar and constant percentage of nitrogen reactive gas fixed at 20 % and O_2 reactive gas ranging from 1 to 5% were studied. The results show that the maximum hardness of the layer of TiAlON was 32 Gpa. The investigations were carried out using, X-ray diffraction (XRD), Calotte measurement, nanoindentation, optical scanning microscope (OSM) and tribometer.

Metallurgical Coatings

PA030

A Novel Device Configuration Based on Multilayer a-SiC - Metal – a-SiC for Energetic and Photonic Applications

Aissa KEFFOUS[1,2]

[1]*CRTSE, CMSI, Algeria*
[2]*Physics*

E-mail of Corresponding Author: keffousa@yahoo.fr

In present work, SiC multilayer samples for energetic applications were successively prepared by alternating metal (Al, In, Pd,…) and amorphous silicon carbide (a-SiC) elaborated by thermal evaporation for the first one and by DC magnetron sputtering for the second one. Effect of thickness and nature of the metal on the optical, structural and electrical properties were investigated using secondary ion mass spectrometry (SIMS), photoluminescence (PL), UV-visible-NIR, Raman spectroscopy, infrared spectroscopy (FTIR) and electrical conductivity.

Nanostructured Growth

PA031

Study of Optical Anisotropy with Correlation Between the Structural and Electrical Properties of Sb-doped $CuInS_2$ Thin Films Nano-Engineered by Glancing Angle Deposition.

Ferid Chaffar Akkari[1]

[1]*LPMS-ENITunis, Génie industriel , Tunisie*

E-mail of Corresponding Author: ferid.chaffarakkari@fst.rnu.tn

Structural, morphological, optical and electrical properties of Sb-doped $CuInS_2$ thin films grown in particular conditions by the single source thermal evaporation on patterned Si and glass substrates using Glancing Angle Deposition (GLAD) have been studied. During depositions, the substrates was maintained at room temperature. Due to the shadowing effect, the GLAD technique can produce nano-rods tilted toward the incident deposition flux when the evaporated atoms arrive at the growing interface at a fixed angle θ measured from the substrate normal with stationary substrate. Continuous azimuthal substrate rotational speed fixed at 0.033 rev s^{-1} leads to the formation of vertical nanorods, which broaden anisotropically during subsequent growth with a stationary substrate. The refractive index, absorption coefficient, optical band gap, Urbach energy and birefringence, determined from optical transmittance and reflectance measurements, are also influenced by the orientation of the nano-columns. The four-point probe method was employed for measuring the resistivity for the obtained normal and tilted nano-rods. X-ray diffraction spectra indicated that all the deposited Sb-doped $CuInS_2$ films are amorphous for higher incident angle θ.

The present paper is devoted to nano-engineer Sb-doped $CuInS_2$ thin films by vacuum thermal method on to glass and Si substrates using the technique of glancing angle deposition, employing substrate motion during deposition with the vapor flux arriving at an oblique angle from the substrate normal.

Nanostructured Growth

PA032

Investigating effect of oxygen pressure on structural, optical and morphological properties of Eu^{3+-} doped Y_2O_2S thin film deposited by Pulsed Laser Deposition method.

Abdub Ali[1], FB Dejene[1] and HC Swart[1]

[1]*University of the Free state, Physics, South Africa*

E-mail of Corresponding Author: aliabdub@gmail.com

Eu3+- doping has been of interest to improve the luminescent characteristics of thin-film phosphors. Y_2O_2S: Eu3+ films have been grown on Si (100) substrates by using a pulsed laser deposition technique. The thin films grown under different oxygen deposition pressure conditions have been characterized using structural and luminescent measurements. The photoluminescence measurement indicate red emission of Eu^{3+} doped Y_2O_2S thin films appearing near 619 nm assigned to the 5D0-7F2 transition of Eu^{3+}. Oxygen pressure not only made the cubic crystalline phase more dominant compared to the monoclinic phase but also improved the grain size and surface roughness. The crystalline phases of $Y_2O_3S{:}Eu^{3+}$ films depended very much on the oxygen pressure and affected the morphology of the films. At 140 mTorr, the monoclinic phase for the Eu^{3+-} doped Y_2O_2S films was almost not present. This phosphor may be of good promise for application in the flat panel displays.

Keywords: Thin film, Phosphor, $Y_2O_2S{:}Eu^{3+}$, PLD, XRD, PL, FED

Nanostructured Growth

PA033

Morphological and Optical Properties of Cr-doped ZnO Thin Films Prepared by Sol–Gel Spin Coating Method

Omer Guler[1], Handan Aydin[2], Cihat Aydin[3], Seval Hale Guler[1], Fahrettin Yakuphanoglu[2]

1Department of Metallurgy and Materials Engineering, Engineering Faculty, Firat University, Elazig, Turkey
2Physics Department, Faculty of Science, Firat University, Elazig, Turkey
3Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey

E-mail of Corresponding Author: cihataydin_26@hotmail.com

The undoped ZnO and the Cr-doped ZnO nanomaterials were prepared by the sol–gel method. The sol was synthesized from zincacetate dihydrate ($Zn(CH_3COO)_2.2H_2O$) and Chromium(III) chloride hexahydrate ($CrCl_3.6H_2O$) dissolved in Methanol (CH_3OH) at room temperature. The gel was obtained at 60 °C for 2 h. Thin films were prepared by sol–gel spin coating method. The effects of Cr incorporation for various atomic ratios of 0%at, 0.1%at, 0.5%at,1%at , 2%at. and 5%at. on the morphological and optical properties of the Zinc oxide (ZnO) film were investigated. The ZnO samples were characterized by atomic force microscopy (AFM) and UV-VIS-NIR spectrophotometer. The thickness and surface morphology of thin films were investigated by atomic force microscopy (AFM). Atomic force microscopy results indicate that the Cr doped ZnO films have the nanostructure. The influence of the Cr doping on the film growth is resulted in a change of grain size. The optical band gap of the films was calculated by optical absorption method. The optical band gap of the ZnO films was significantly changed by Cr dopant. The obtained results indicate that the morphological and optical properties of ZnO films can be controlled with Cr doping.

Nanostructured Growth

PA034

Preparation and Characterization of NiMnZnO Nano-fiber Thin Films

Cihat Aydin[1], Handan Aydin[2] and Fahrettin Yakuphanoglu[2]

[1]*Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey*
[2]*Physics Department, Faculty of Science, Firat University, Elazig, Turkey*

E-mail of Corresponding Author: cihataydin_26@hotmail.com

As one of the transparent conducting oxide thin films, ZnO thin film shows a versatile combination of interesting optical, electrical, and magnetic properties and plays a role in various technological domains such as solar cells, thin film gas sensors, varistors , spintronic devices , photodetectors, surface acoustic wave devices and light emitting diodes. Because of its potential applications, ZnO thin films have been studied most widely and deeply during the last years. On the other hand, it is believed that the doping in ZnO thin films can improve crystalline quality or optical, electrical or ferromagnetic properties. (Mn and Ni) doped ZnO nanocrystals were synthesized by sol-gel method. Three different solutions were prepared using zinc acetate dehydrate, manganese (II) acetate tetra hydrate ($(CH_3COO)_2Mn.4H_2O$) and nickel (II) acetate tetrahydrate ($Ni(OCOCH_3)_2.4H_2O$) as a starting material. The solutions were stirred for different ratios (9.5:0.25:0.25/9:0.5:0.5/8.5:0.75:0.75/8:1:1) of Zn:Ni:Mn. The thin films were deposited on glass substrates via spin coating method. The optical properties and morphologies of the deposited undoped and doped ZnO thin films were investigated. Atomic force microscopy (AFM) and UV-VIS-NIR spectroscopy were used to examine the morphology and microstructure of the thin films. Optical properties of the thin films were determined by UV/VIS spectroscopy. The analyzed results indicate that the obtained nanofiber thin films are of good crystal quality and have smooth surfaces.

Keywords : *Nanofibers, Thin film, Mn and Ni co-doped ZnO, Sol-gel method*

Nanostructured Growth

PA035

Producing Nanocrystalline Silicon Suboxide Thin Films nc-SiOx:H (x<1) in PECVD

Kemal Rüzgar[1] and Akın Bacioglu[1]

[1] *Hacettepe University, Physics Engineering, TURKEY*

E-mail of Corresponding Author: kruzgar@hacettepe.edu.tr

We have produced hydrogenated nanocrystalline silicon suboxide (nc-SiOx:H; x<1) thin films in a radio frequency plasma enchanced chemical vapor deposition (RF-PECVD) system, with highly H_2 diluted gas mixture of SiH_4 and CO_2. The substrate temperature, chamber pressure and RF power density were kept constant as 150 ^{o}C, 1.9 Torr and 62 mW/cm^2 We scanned two different dilution ratios: 95% and 99%, at constant hydrogen flow of 100 sccm. The oxygen content of the samples were changed by varying the flow rate of CO_2 to SiH_4, from 0.2 to 5. The thin films were deposited on corning 1737F glass and single crystalline silicon substrates. For structural characterization we have performed Raman scattering measurements. We have also done optical transmission, temperature dependent dark conductivity and constant photocurrent method (CPM) measurements. The dark conductivity activation energies were found to vary between 0.95 and 1.2 eV. The band gap of the samples was found to be increasing from 2.07 to 2.2eV, with increasing CO_2 flow ratio.

Nanostructured Growth

PA036

Formation of Anatase TiO_2 Films with a Porous Structure and Enhanced Photoactivity by the Synergy of WO3 and Sodium

Giin-Shan Chen[1] and J. L. Kuo[1]

[1]*Feng Chia Univ., Materials Science and Eng., Taiwan*

E-mail of Corresponding Author: gschen@fcu.edu.tw

Sodalime sheet glass is commonly used in industry and architecture. Its coating with a TiO_2 thin film yields photocatalysis, acting for various applications such as anti-fogging and self-cleaning. However, upon thermal annealing, sodium from glass is readily to diffuse into the TiO_2 films, and acts as (a) a recombination center that eliminates the photon-generated electron-hole pairs or (b) a retarding force that inhibits the formation of the catalysis-favoring anatase phase. To prevent the uptake of sodium from sodalime sheet glass poisoning photoactivity, sodalime sheet glass is commonly pre-coated with an SiO_2 barrier layer to block the sodium diffusion into the TiO_2 films during thermal annealing.

The vast majority of studies use hydrothermal synthesis, dip coating, or microemulsion to couple tungsten species into TiO_2 particles or films. The coupled tungsten species could play a role to stabilize anatase, enhance surface acidity, or modify the band structure, all markedly increasing photoactivity. However, the interplay between the coupled WO_3 and the glass's sodium in altering the film's microstructures is rarely examined. Herein, TiO_2 thin films with various amounts of WO_3 additions were deposited on sodalime sheet glass by magnetron co-sputtering of Ti and W targets using Ar/O_2 glow discharge. Change of microstructures after annealing was examined, compared with a reference using identical films coated on sodium-free sheet glass. Rutherford backscattering spectroscopy and depth-profiling XPS analysis revealed that the amount of the incorporated WO_3, along with sodium in glass, is critical to alter surface morphologies and microstructures of the films after annealing. In contrast to what is generally though that sodium contaminates TiO_2, sodium from within glass draws out the incorporated WO_3 and retards grain growth of TiO_2, ultimately forming an anatase-based film with a porous structure and enhanced photoactivity.

Nanostructured Growth

PA037

Preparation, Magnetic and Transport Properties of Co-Cu Microwires

Valentina Zhukova[1], M Ilyn[2], J. J. del Val[1], A. Granovsky[3], A. Zhukov[1,4]

[1]*University of the Basque Country, Materials Physics, 20018, San Sebastian, Spain,*
[2]*Center of Physics of Materials, CSIC-UPV/EHU, 20018, San Sebastian, Spain,*
[3]*Moscow State University, Faculty of Physics, Moscow, 119991, Russian Federation,*
[4]*IKERBASQU, Basque Foundation for Science, 48011 Bilbao, Spain*

E-mail of Corresponding Author: valentina.zhukova@ehu.es

Studies of nanomaterials containing small nano-sized magnetic particles, grains or magnetic impurities in non-magnetic matrix attracted great attention owing to a number of interesting properties, such as giant magnetoresistance (GMR) effect or Kondo effect [1-2]. GMR effect in granular materials has been attributed to spin-dependent scattering of conduction electrons within the magnetic granules as well as at the interfaces between magnetic and nonmagnetic regions [1]. If the size magnetic grains is small the scattering of conduction electrons in a metal due to magnetic impurities give rise to a Kondo effect related to the resonant scattering of conductive electrons by quantum local centers [2].

Studies of glass-coated ferromagnetic microwires exhibiting excellent soft magnetic properties such as magnetic bistability, excellent magnetic softness and giant magneto-impedance, GMI, effect attracted considerable attention [3]. Such microwires are produced by so-called Taylor- Ulitovski technique [3] allowing fabrication of glass-coated metallic microwires (typical metallic nucleus diameters 1 - 30 mkm, the thickness of the glass coating 0,5 - 20 mkm).

Main advantages of this technique are high quenching rate, homogeneous geometry of metallic nucleus and glass coating and almost continuous process allowing fabrication of km long wires. Consequently preparation of microwires with amorphous, nanocrystalline, microcrystalline or granular structure of metallic nucleus is reported [3].

We report on magnetic, transport and structural properties of Co_x-Cu_{100-x} ($5 \le x \le 30$) glass-coated microwires. For x=5 we observed the resistivity minimum at 40 K associated with the Kondo effect. For $x \geq 10$ we observed considerable magnetoresistance effect. Temperature dependence of susceptibility show considerable difference for $x>10$ and $x \le 10$ attributed to the presence of small Co grains embedded in the Cu matrix for $x \geq 10$. By X-ray diffraction we found, that the structure of Co_x-Cu_{100-x} microwires $x \geq 10$ is granular consisting of two phases: fcc Cu appearing in all the samples and fcc α-Co presented only in microwires with higher Co content.

[1] A.E. Berkowitz, J.R. Mitchell, M.J. Carey, A.P. Young, S. Zhang, F.E. Spada, F.T. Parker, A. Hutten, G. Thomas, Phys.Rev.Lett, 68 (1992) 3745-3748.
[2] A. Kawabata, J. Phys. Soc. Jpn. 43 (1977) 1491-1496.
[3] A. Zhukov and V. Zhukova, ""Magnetic properties and applications of ferromagnetic microwires with amorphous and nanocrystalline structure"", Nova Science Publishers, Inc. 400 Oser Avenue, Suite 1600 Hauppauge, NY 11788, 162 p. 2009, ISBN: 978-1-60741-770-

Nanostructured Growth

PA038

Synthesis and Optical Properties Nanostructure of Sn Doped Zinc Oxide Thin Films

H. Aydın[1], C. Aydın[2] and F. Yakuphanoglu[1]

[1]*Physics Department, Faculty of Science, Firat University, Elazig,*
[2]*Department of Metallurgy and Materials Engineering, Faculty of Technology, Firat University, Elazig, Turkey*

Email of corresponding author: cihataydin_26@hotmail.com

Thin films of ZnO at different Sn doping concentration have been synthesized by a new facile sol-gel route using the spin coating method. The sol was synthesized from Zincacetate dihydrate and Tin (II) chloride dihydrate dissolved in 2-metoxyethanol. The structure of thin films were investigated by means of X-ray diffraction (X-ray), atomic force microscopy (AFM) and UV-VIS-NIR spectrophotometer. The X-ray results reveal that all films are polycrystalline with a hexagonal wurtzite structure with a preferential orientation according to the direction (002) plan. The thickness and surface morphology of thin films were investigated by atomic force microscopy (AFM). Atomic force microscopy results indicate that the Sn doped ZnO films have the nanostructure. The influence of the Sn doping on the film growth is resulted in a change of grain size. The optical energy gap changed range from 3.218 to 3.272 eV with an increase in the concentration of Sn - doping. The obtained results indicate that these new simple low-cost approach should promise us a future large-scale growth of metal oxides nanostructures for potential applications in optoelectronics.

Keywords: Sn doped ZnO nanoparticles, sol-gel, thin films, microstructure, optical properties

Nanostructured Growth

PA039

Synthesis and characterization of crack-free large-area 2D of transition metal oxides inverse opal film by a dynamic hard-template strategy on flexible and hard substrates

Yahia Djaoued[1] and Hua Li[1]

[1]*Laboratoire de recherche en matériaux et Micro-spectroscopies Raman et FTIR, Université de Moncton – Campus de Shippagan, 218, boul. J.-D. Gauthier, Shippagan, NB, Canada, E8S 1P6.*

E-mail of Corresponding Author: yahia.djaoued@umoncton.ca

Whereas considerable interest exists in self-assembly of well-ordered, porous inverse opal (IO) 2D transition metal oxides (TMOs) films for optical, electronic and biochemical applications, uncontrolled defect formation has limited the scale-up and practicality of such approaches. Until now, several kinds of 2D IO films have been synthesized by the self-assembled synthetic opal template strategy. Unfortunately, the perfect crack-free IO film still remains one of the holy grails, as the cracks mainly arise after the infiltration step. Over the past few years, several infiltration techniques have been used for IO formation, and most of them used a two-step strategy known as 'static hard-template' infiltration. Firstly, a 2D photonic crystal (PC) monolayer (PS spheres) is deposited on a substrate to form a 'hard template'. Secondly, an inorganic precursor is infiltrated into the PC monolayer. Due to the interaction between the substrate and PS 2D opal, as well as the high surface tension of the inorganic precursor aqueous solution, the films were always found to present large cracks. Herein, we report a new route, which we call 'dynamic hard-template' infiltration strategy for the formation of crack-free large area morphology-controlled 2D IO films of TMOs such as TiO_2, WO_3, etc. on flexible and hard substrates. Once the 2D PS opal film is self-assembled by floating route, it floats onto the surface of water. Subsequently, a TMO alcohol/aqueous solution is slowly injected under the floating PS PCs film. Driven by the dispersion of the alcohol, the TMO will penetrate into the interstitial spaces between the PS spheres from the bottom. As the PS spheres are loosely connected with each other and are floating on top of the solution with more freedom to move than that of the conventional "hard-templating" deposited on a substrate, it is easy for the TMO to penetrate the interstitial spaces between the PS spheres. This infiltration strategy is different from that of an opal already deposited on a substrate, forming a 'static hard-template', rendering difficult any movement to adjust their position to accommodate guest materials. Also this 'dynamic hard-template' strategy is not limited by the particle size of the guest material as with the hard template strategy where the guest material's particle size is required to be smaller than the interstitial space between the PS spheres. Once a substrate is placed under the PS/TMO opal composite monolayer, the solution was sucked out, which deposited the monolayer onto the substrate. After the removal of the PS spheres TMO IO films were obtained. We show that the dynamic hard-template strategy is available for a range organometallic sol-gel and polymer matrix precursors, and represents a simple, scalable method for generating high-quality crack-free large area 2D TMO IO films for a variety of applications.

Nanostructured Growth

PA040

Effect of Correlated Mixed Disorder on Miniband Structure and Resonance Energy of $GaAs/Al_xGa_{1-x}As$ Superlattices

Djelti Radouan[1], Besbes Anissa[1], Bentata Samir[1] and Aziz Zoubir[1]

[1]*Abdelhamid Ibn Badis Mostaganem, Sciences and technology, Algeria*

E-mail of Corresponding Author: djeltired@yahoo.fr

Theoretical analysis of correlated mixed disorder effects on electronic properties in $GaAs/Al_xGa_{1-x}As$ superlattices has been carried out with an applied bias. The Airy functions model based on the transfer-matrix technique and the envelope-function approximation is applied to Schrodinger's equation for a rectangular asymmetric potential. This model is more accurate because the effective mass and band coupling are included. We have shown that by the introduction of the mixed disorders, the transmissions spectra reveal the appearance of a miniband structure with a concomitant disappearance of the localized states.

The miniband structure varies with the applied bias value. For structures without bias extended states exist, the conduction is ohmic and the electron tunneling through. Above a critical value of V_a the second resonance peak disappears to the structure of miniband, because the transmission tunnel between the energy levels of two consecutive wells is greatly restricted when states permitted wells are not in the same energy. This can be explained by the fact that the electron in this polarized structure (SL under an applied bias voltage) sees the following wells deeper than the first and a greater barrier height. In other words the second Eigenstate is not confined inside the well and is therefore not shown here. The possibility of the creation of resonant states, with a good control of the energy differences is pointed out. Also the high bias voltage led to the emergence of a phase transition from the metallic state to the insulating. We see the decrease of the miniband width until the complete disappearance for high values of V_a.

Optical, Optoelectronic and Dielectric Coatings

PA041

Low-Temperature Single-Source Precursors for Tin-Rich Indium Tin Oxides and Their Application for Thin-Film Transistors

Yilmaz Aksu[1], Kerim Samedov[2] and Matthias Driess[2]

[1] *Akdeniz Üniversitesi, Materials Science and Engineering, Turkey*
[2] *Technische Universität Berlin, Institute of Chemistry, Metalorganics and Inorganic Materials, Sekr. C2, Strasse des 17 Juni 135, D-10623 Berlin, Germany*

E-mail of Corresponding Author: yilmazaksu@akdeniz.edu.tr

Nanosized metal oxide particles deposited on substrate surfaces at low temperatures are of significant interest for applicatıons in material science. The siıngle source approach offers several advantages over ather methods of controllable production of nanoparticles. We present the design, syntheses and structural characterisation of dimeric (cyclohexoxy) alkalistannates(II) $[Sn(OC_yHe_x)_2]$ (1), its corresponding (cyclohexoxy)alkalistannates(II) $[\{M(OC_yHe_x)_3Sn\}_2]$ (M=Li (2), Na (3), K (4)) and of the first heteroleptic heterotermetallic Li/In/Sn-halo-alkoxide clusters $[X_2In\text{-}\{LiSn_2(OC_yHe_x)_6\}]$ (X=Br (5), Cl (6)) are reported. Compounds 5 and 6 were successfully probed as suitable SSPs for facile low-temperature access to new amorphous tin-rich ITO materials with drastically reduced amounts of expensive indium, while maintaining or improving the performance of classical ITO (In2O3:Sn doped with 5–15 mol% Sn) as TCOs with respect to electronic applications. The obtained materials were characterised by a number of analytical techniques that proved partial incorporation of tin atoms into the In_2O_3 lattice, homogeneous distribution of both elements as well as and a tin/indium molar ratio close to 2:1 in the final materials. Moreover, compound 5 was suitable for the fabrication of thinfilm FET applications on silicon wafers. Remarkably, the asprepared FET gave an excellent performance, as shown by a field-effect mobility of 6.36×10^{-1} cm^2/Vs and an Ion/off current ratio of 10^6. The new tin-rich ITO materials are promising for other optoelectronic applications (e.g., electroluminescence lamps) and electrocatalysis (e.g., support materials for fuel cells). These investigations are in progress.

Optical, Optoelectronic and Dielectric Coatings

PA042

Design and Fabrication of Single and Double Layer Anti-Reflection Coating on Glass and Silicon by a-SiO_x:H and a-SiN_x:H Deposition in PECVD

Oldouz Tofigh Kouzehkonani[1] and Akın Bacıoğlu[1]

[1]*Hacettepe university, New and Clean Energy, turkey*

E-mail of Corresponding Author: ouldoz.tofigh@gmail.com

We have designed and fabricated single layer anti reflection coating (SLARC) by using a-SiO_x:H and double layer anti reflection coating (DLARC) by using a-SiO_x:H and a-SiN_x:H thin films. The layers of different refractive indices were deposited on polished side of single crystalline Si wafer and corning 1737F glass. Each layer of ARCs was grown in plasma enhanced chemical vapor deposition (PECVD) system by using 13.56 MHz RF-plasma of a gas mixture of either CO_2+SiH_4 or N_2+SiH_4. To calculate the optical parameters including refractive index, we have scanned the growth parameters, such as pumping speed, chamber pressure, substrate temperature, radio frequency (RF) power and mostly gas flow ratios: f[CO_2]/fTotal and f[N_2]/fTotal. With the SLARC design by a-SiOx:H layers, we have achieved to reduce the reflectivity of bare glass and silicon surfaces down to 0.087 centered at the wavelength of 512 nm and to 0.0024 at 560 nm, respectively. With the DLARC design by successive a-SiO_x:H and a-SiN_x:H layers, the reflectivity was reduced to 0.035 at 528 nm on glass and to 0.0084 at 548 nm on silicon.

Keywords: Anti-reflecting coting, ARC, DLARC, PECVD.

Optical, Optoelectronic and Dielectric Coatings

PA043

The Influence of Preparation Parameters on Structural and Optical Properties of n-Type Porous Silicon

Alper Çetinel[1], Nurcan Artunç[1], Enver Tarhan[2] and Gündoğdu Şahin[2]

[1]Department of Physics, Ege University, nartunc@gmail.com
[2]Department of Physics, Izmir Institute of Technology, envertarhan@iyte.edu.tr

E-mail of Corresponding Author: alpercetinel@gmail.com

Raman spectra, photoluminescence properties, and surface morphologies of porous silicon (PSi) were investigated by controlling of applied current densities and HF concentration. PSi samples were formed on (100) n-type silicon single crystal wafers (1-10 ohm.cm resistivity). The galvanostatic etch (anodization) was carried out in a Teflon cell by using a two-electrode configuration under illumination. A platinum rod, as cathode, was placed perpendicular to the Si wafer surface (as anode) at a distance of 1 cm. The advantage of such equipment is its simplicity and ability to anodise silicon-on-insulator structures. The porous silicon structure is formed by electrochemical etching of Si wafers in ethanolic HF. The electrolytes used in our experiment, were made by mixing HF (40%) and ethanol (99%) with different volume ratios. The anodization current density was varied in the range of 10–100 mA/cm2 with constant etching time (30 min). The structural properties of all samples were studied by the field-emission scanning electron microscopy (FE-SEM). The photoluminescence and Raman spectra of the samples were measured by Raman Spectrometers at the room temperature, and the excitation wavelength was 488 nm. High resolution FE-SEM images of porous silicon indicated that the pore size of porous silicon increased as the etching current increased. FE-SEM results also show that pore diameter of PS samples decreased with increasing HF concentration. The cross-sectional views of PSi samples treated in different current density were also analyzed and the images revealed that vertically aligned pores in the PS layer perpendicular to the initial Si surface and distinct interface between porous and original silicon layers. The macropore arrays were generally nice with pore walls straight and rather smooth. The thickness and the porosity of PSi samples were calculated by gravimetric method. Direct thickness measurements of PS layers were approved by FESEM, as well. We observed that the porosity and the corresponding thickness of the PS layer increase when the current density is raised with a constant etching time. The Raman analysis showed that the peak intensities sharply decrease with increasing current density and Raman spectra of the PS samples shifted to lower frequencies due to the presence of nanocrystalline silicon in PS whose diameter was around 9 nm. Photoluminescence of porous silicon was investigated by controlling of applied current densities and HF concentration. Photoluminescence efficiency of porous silicon increased as the current densities increased. It was indicated that the visible luminescence might come from quantum-sized silicon crystallites in the PS. The results obtained from Raman analysis were in good agreement with our optical measurements.

Optical, Optoelectronic and Dielectric Coatings

PA044

Dependence of Structural and Optical Properties of Sol–Gel Derived ZnO Thin Films on Sol Concentration

Toubane Mahdia[2], A. Iratni[1], F. Bencuisi[1,2], A.AZIZI[3], R.Talaighil[1] and A. slimani[1,2]

[1]*UR-MPE, SI F, M'hamed bougara university, Boumerdès , Algéria*
[2]*physics département, SF, M'hamed bougara university , Boumerdès ,Algéria*
[3]*physics département, constantine 1 university, constantine, Algéria*

E-mail of Corresponding Author: toubane_mahdia2005@yahoo.fr

Zinc oxide (ZnO) is a binary semiconductor material with direct band gap (3, 37 eV) because of their good optoelectronics properties, ZnO films find several applications such as: solar cells, gas sensors, piezoelectric sensors, waves guides... etc. ZnO thin films can be prepared by several techniques, such as: spray, thermal evaporation, reactive sputtering, sol gel, laser ablation... etc. In this work, ZnO thin films were prepared by sol–gel method and the dependence of structural and optical properties of these films on sol concentrations was deeply investigated. The DRX analyses indicated that undoped ZnO films deposited at different conditions have polycrystalline nature and hexagonal wurtzite structure with (002) preferential orientation of concentration low then 0, 3 mol/l, for 0,4 mol/l the preferential orientation (100). The particle size increased with an increased initial Zn^{2+} concentration. All prepared ZnO thin films showed a high transparency of over 88% in the visible region. The optical band gap energy decreased with increased of Zn^{2+} concentrations.

Keywords: ZnO thin film, Dip-coating, Sol–gel, sol concentration, structural properties, optical properties.

Optical, Optoelectronic and Dielectric Coatings

PA045

STRUCTURAL AND OPTICAL STUDY OF Co DOPED ZnO THIN FILMS

A.R. KHANTOUL[1], B. RAHAL[2], M. SEBAIS[1], B. BOUDINE[1], O. HALIMI[1], M. MEDJALDI[2]

Univ of Constantine[1], Physics, Algeria

Email of corresponding author: reda_khantoul@yahoo.fr

ZnO is a n-type II-VI semiconductor with a wurtzite structure, a wide direct band gap of 3.37eV, and a large exciton binding energy of 60meV. It occupies a particular place among wide bandgap semiconductors (GaN, ZnS…), which have been actively studied because of their exceptional electrical and optical properties. There are different ways to synthesize ZnO nanostructures which improve these properties. The present study deals with to the fabrication and characterizations of ZnO thin films and Co doped ZnO with different concentrations. The samples preparation was carried out by Colloidal method and films were deposited onto glass substrates by dip-coating technique. Zinc acetate dehydrate, cobalt acetate, methanol and ethanolamine were used as starting materials. The obtained films were characterized by different techniques such as X-ray diffraction and Scanning Electron Microscopy (SEM) from which we deduce the orientation along (002) plan of ZnO crystals and their nanoscale size (R = 48 nm). The UV-Visible absorption of Co doped ZnO thin films shows a shoulder at 366 nm and a blueshift of the band gap Eg = 1,01 eV, which confirms the confinement induced by the nanometric size of ZnO crystallites.

Optical, Optoelectronic and Dielectric Coatings

PA046

Plasmonic waves of random metal-dielectric thin films

Afshin Moradi[1]

[1]*Kermanshah University of Technology, Egineering Physics, Iran*

Email of corresponding author: a.moradi@kut.ac.ir

In the present work, following our previous papers [1,2], we study the dispersion curves of the plasmonic waves of a semicontinuous metal thin film that contains randomly distributed dielectric nanoparticles. We use the Maxwell-Garnet approximation to treat the random media as uniform effective media. Four branches of p-polarized surface plasmon-polariton modes are found to exist. We also illustrate the attenuated total reflection spectra of the system for the case of p-polarization.

[1] A. Moradi, “Plasmonic waves of a semi-infinite random nanocomposite,” Phys. Plasmas 20, 104507 (2013).
[2] A. Moradi, ”Plasmonic modes and extinction properties of a random nanocomposite cylinder,” Phys. Plasmas 21, 042112 (2014).

Optical, Optoelectronic and Dielectric Coatings

PA047

Properties of thin films of titanium dioxide deposited by plasma processes (RF magnetron sputtering)

S. Nezar[1]*, N. Saoula[1], N. Madaoui[1], R. Tadjine[1], M.M. Alim[1], S. Belhousse[2] and S. Sali[2]

[1]*Division des Milieux Ionisés et Lasers, Centre de Développement des Technologies Avancées,BP 17 Baba Hassen , Alger, Algérie,*
[2]*Commissaire à l'Energie Atomique, Algérie. 02 , Boulevard Frantz Fanon, BP 399, Alger-gare*

Email of corresponding author: nsaoula@cdta.dz

Sputtering magnetron allows the creation of coatings or thin films using a plasma process, we find their applications in diverse areas, optics, electronics, chemical and aerospace industries, etc.. The magnetron sputtering is a technique of thin film deposition. A reactive gas, oxygen for oxides, is added to the argon which is the carrier gas.

Titanium dioxide (TiO_2) is a semiconductor having a large band gap. It is transparent in the visible light; it is thus widely used as an optical coating material [1,2]. TiO_2 can exist in amorphous form and also in three crystalline phases of brookite, anatase and rutile. The rutile structure is very compact and thermodynamically most stable phase at all temperatures.

The optical properties of samples have been studied and the optical band gaps were calculated using Tauc plot formula for TiO_2 indirect transitions gap. The results are presented and discussed in function of the structural and physic-chemical features of the thin films.

Optical, Optoelectronic and Dielectric Coatings

PA048

Physical Properties of Sprayed Bi_2S_3 Nanocrystalline Thin Films

Khadraoui Mohammed[1], N. BENRAMDANE[2], R. MILOUA[2], M.MEDELES[2], A. BOUZIDI[2] and K. SAHRAOUI[2]

[1]*University of Sidi bel Abbès, Electronic, Algeria*
[2]*Laboratoire d'Elaboration et de Caractérisation des Matériaux, département d'électronique, Université Djillali Liabes, BP89, Sidi Bel Abbés 22000. Algeria*

Email of corresponding author: khadraoui_hm@yahoo.fr

Bismuth Sulfide (Bi_2S_3) thin film was prepared by spray pyrolysis on glass substrate at 270 °C, by using bismuth chloride ($BiCl_3$) and Thiourea ($CS(NH2)_2$). The optical constants and thickness were extracted using the pattern search optimization technique. The optical constants confirm that the Bi_2S_3 film has a direct gap of 1.56 eV. The dispersion of refractive index in Bi_2S_3 was analyzed using the concept of the single oscillator model. The dielectric constants represented by the lattice dielectric, the dispersion parameters E_0 and E_d, and the rth moments, M-1 and M-3 were determined. It is interesting to note that Bi_2S_3 appears to fall into the covalent class. The values ratio of the carrier concentration to effective masse and plasma frequency were also evaluated.

Keywords: Thin film, Optical Constants, Single oscillator model, Bi_2S_3

Optical, Optoelectronic and Dielectric Coatings

PA049

OPTICAL PROPERTIES AND MORPHOLOGY OF MULTILAYER COATINGS FROM OXIDES AND SULFIDES

N. Ariko1, A.A.Rogachev[1], V.E.Agabekov[2], N.N. Fedosenko[1] and N.G. Ariko[2]

[1]GSU named F. Skaryne , Sovetskaya St. 104, 246019 Gomel, Belarus
[2]Institute of New Materials Chemistry of National Academy of Sciences of Belarus
F. Skaryny St. 36, 220141 Minsk, Belarus;

Email of corresponding author: ariko2002@yandex.ru

The morphology and the optical properties of nanosized multilayer coating deposited on a substrate surface (glass, polymer, quartz, silicon) from the active gas phase formed by electron beam evaporation of the metal oxides (ZrO_2, Al_2O_3, Nb_2O_5, TiO_2,), silicon oxide (SiO_2) and zinc sulfide (ZnS) in vacuum have been investigated.
It has been established that the surface topology of the coating depends on the conditions of electron beam dispersion of an initial substance and its deposition on solid support surface. Regimes designed to ensure the formation of coatings with high homogeneous of the deposited layers , as evidenced by their topological characteristics and AFM data . It has been established that the refractive index (n) and absorption coefficient (k) of obtained structures derived from metal oxides and sulfide are dependent on the wavelength of the incident electromagnetic radiation , number and thickness of the deposited layers as well as the nature of substrate. For example, for TiO_2: n = 3,0 (250 nm) and 1.97 (850 nm), k = 0,9 (250 nm) 0.001 (450 nm); for ZnS n = 2,8 (250 nm) and 2.3 (850 nm), k = 0,1 (250 nm) 0.001 (550 nm). The cover SiO_2 has n = 1,50 (250 nm) and 1.44 (850 nm), k = 0 (250-850 nm).
The 35 layers coatings with the periodicity and thickness of layers: (ZrO_2) (SiO_2) (ZrO_2) [(SiO_2) (ZrO_2) (TiO_2) (ZrO_2)]$_8$; 70 nm - TiO_2, 145 nm - SiO_2, 90 nm - ZrO_2 were priduced. Analysis of reflection and transmission spectra obtained in polarized light showed that the formed structure has the properties of the light beam splitter on the p- and s- polarized rays . It is established that the relationship transmittances Tp / Ts , is dependent on the wavelength of light and nature of the substrate surface.

Optical, Optoelectronic and Dielectric Coatings

PA050

USE OF QUANTUM DOTS "SEQUESTERED" IN SOL-GEL MATRIX FOR FIBRE OPTIC BIOSENSING

Semanu K. TSEI1, Jong Il RHEE2, Galo J. A. A. SOLER-ILLIA3 and Pun To YUNG4

1Photonics Research Group, University of Johannesburg, Republic of South Africa
2Research Centre for Biophotonics, Chonnam National University, Republic of Korea
3Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina
4The Chinese University of Hong Kong, Republic of China

Email of corresponding author: sitsotsei@gmail.com

There is an urgent demand to develop biochemical fibre optic sensors with advanced recognition capabilities to detect selectively, rapidly, reliably, and reproducibly to target [biological] analytes. Organic reagents typically employed to develop optical fibre (bio) sensors often suffer from some intrinsic limitations, including rapid photobleaching and low sensitivity to the target analytes. Conversely, semiconductor photoluminescent nanocrystals, known as quantum dots (QDs),exhibit unique optoelectronic properties including high photoluminescent quantum yields, tuneable emission by particle size control, high photostability, and relatively long emissions lifetimes. Additionally, the nanoparticles size of QDs provides a large interfacial area which enables bioconjugation (i.e. combination of the nanoparticles with enzymes) allowing such properties to be integrated in biological systems. Recent progress in QDs of II/VI materials as sensing elements while immobilised in a sol-gel matrix, which can be combined with optical fibre sensing technology is reported [1]. Particular focus is given to characterization of three sol-gel matrices for urea detection; QD-encapsulated sol- gel matrix, urease-immobilised sol-gel matrix, and double layer consisting of QD-sequestered sol-gel matrix and urease- immobilised sol-gel matrix [2]. Additionally, characterisation of biocompatible and water-soluble , D,L-mercaptosuccinic acid (MSA)-capped CdSe/ZnS QDs and silica-coated CdSe/ZnS QDs for urea detection are highlighted. Advanced recognition capabilities of hydrophilic CdSe/ZnS core-shell QDs conjugated with glucose oxidase (GOD) and horseradish peroxidase (HRP) as bio-probes for glucose detection, based on fluorescence resonance energy transfer (FRET) between the QDs (donor) and the enzymes, GOD and HRP (acceptor molecules) are described [3].

REFERENCES
[1] Tsei S.K, Moreno-Bondi M.C. and Rhee J.I., "Immobilisation of quantum dots in a sol-gel matrix for fibre optic chemical sensing", 3rd International Conference on Materials and Applications for Sensors and Transducers, IC-MATS, Prague, Czech Republic, September 13-17,2013.
[2] Duong H.D., Rhee J.I., "Use of CdSe/ZnS luminescent quantum dots incorporated within sol-gel matrix for urea detection", Analytica chimica acta, Vol. 626, (2008), pp 53-61.
[3] Duong H.D., Rhee J.I., "Use of CdSe/ZnS core-shell quantum dots as energy transfer donors in sensing Glucose", Talanta, Vol. 73, (2007), pp 899-905.

Optical, Optoelectronic and Dielectric Coatings

PA051

The Effect of Al_2O_3 Gate Dielectric Layer on the Performance of Organic Thin Film Transistor

Çağlar Özer, Ehsan Nasirpour and Erdal Çelik

Dokuz Eylul University, Department of Nanoscience and Nanoengineering

Email of corresponding author: omermermer@gmail.com

In recent years, organic thin film transistors (OTFTs) have been extensively investigated for organic flexible electronics because of low cost and large area applications. Since pentacene as an organic layer is a promising material, several researches have been reported high performance pentacene TFT more recently. In order to demonstrate the high performance OTFTs, selection of gate dielectric materials is also very important [1,2,3].

In this study, thin film transistor (TFT) was fabricated by using Al_2O_3 dielectric layer and pentacene as organic layer at room temperature. Al_2O_3 dielectric layer were deposited by RF magnetron sputtering system. Dielectric layer was firstly covered on the glass substrates by playing of different deposition parameters (sputtering power, pressure, time) for optimizing the procedure. The pentacene organic layer of different thicknesses was thermally evaporated on the dielectric layer. The thickness of the Al_2O_3 and organic layer were determined by Ambios XP-2 Surface Profilometer. The source and drain electrodes were finally evaporated of Ag layer through a shadow mask structure with different channel length/width ratios. Electrical measurements are conducted by Keithley 2636B SMU(Source Measurement Unit) system. Hall Effect Measurement system (HMS-2000) is also used to measure mobility, surface resistance of pentacene layer.

[1] Okur, S., Yakuphanoglu, F. and Stathatos, E., 2010, High-mobility pentacene phototransistor with nanostructured SiO2 gate dielectric synthesized by sol–gel method, Microelectronic Engineering, 87:635-640p.
[2] Koo, J., B., Lim, J., W., Kim, S., H., Yun, S., J., Ku, C., H., Lim, S., C., and Lee, J., H., 2007, Pentacene thin-film transistors and inverters with plasma-enhanced atomic-layer-deposited Al2O3 gate dielectric, Thin Solid Films, 515:3132-3137p.

[3] Ding, X., Zhang, J., Li, J., Shi, W., Zhang, H., Jiang, X. and Zhang, Z., 2014, The Al2O3 gate insulator modified by SiO2 film to improve the performance of IGZO TFTs, Superlattices and Microstructures, 69:204-211p.

Organic Thin Films

PA052

Dependence of Optical and Mechanical Properties on Wettabilities and Surface Free Energies of the Polymers

Elbruz Murat Baba[1], Elif Ozen Cansoy[2], Esra Ozkan Zayim[1,3]

1Nanoscience & Nanotechnology Program, Istanbul Technical University, Maslak, Istanbul, Turkey
2Piri Reis University, Faculty of Science and Letters, 34940, Istanbul, Turkey
3Istanbul Technical University Faculty of Science and Letters, Physics Department, Istanbul 34469, Turkey

Email of corresponding author: elbruzmurat@gmail.com

In many industrial applications, it is important to control the wettabilities of the surfaces. For solid surfaces, liquid drop equilibrium, advancing and receding contact angle measurements can be done to characterize the wettabilities of the surfaces [1-4]. Measurement of contact angles on solids yields data that reflect the thermodynamics of a liquid/solid interaction. For this purpose, a series of liquid drops contact angles can be measured on solid surfaces and the characteristics of the solid surface and its wettability can be quantified by the calculations based on these measurements. Surface free energy of a material is the work that should be supplied to bring the molecules from the interior bulk phase to its surface to create a new surface having a unit area [1]. Surface free energy is the key parameter of the surface which dictates the most important properties of the material such as wettability, corrosion and hardness. High dependence of the properties attracts much interest over modification of the surface morphology and chemistry.

In this work, we used polymers with varying surface free energies, such as PVAc, PVP, PMMA, PS, PP and PE, to prepare flat films from their solutions by dipping method. To increase the adhesion of polymers onto glass slides, we also applied an epoxy layer as a primer coating. Wettabilities of the polymer surfaces were characterized by water drop contact angle measurements. To calculate surface free energies of the polymers, contact angle measurements of methylene iodide, ethylene glycol, formamide and α-bromonaphthalene were done. Contact angle values of these liquids were used in surface free energy calculations by using Fowkes, Owens-Wendt and van Oss-Good methods. Optical, morphological and mechanical characterizations of the polymer surfaces were examined in details and dependence of optical and mechanical properties on surface free energies and wettabilities of the polymers were also investigated.

The transmittance and reflectance values of the deposited films were measured by spectrophotometer analyses over the spectral range of 280-1000 nm. The values of refractive index (n) and extinction coefficient (k) have been calculated. Using the transmittance and reflectance data, the extinction coefficient k were evaluated by the spectrophotometer software. Later, the absorption coefficients were calculated by using Tauc method for determining the band gap values.

[1] Erbil, H. Y., Surface Chemistry of Solid and Liquid Interfaces, Blackwell Publishing, Oxford, UK, 2006.

[2] P.G. de Gennes, F. Brochard-Wyart, D. Quéré, Capillarity and WettingPhenomena, Springer, Berlin, 2003.

[3] E. Bormashenko, Wetting of real solid surfaces: new glance on well-knownproblems, Colloid Polym. Sci. 291 (2013) 339–342.

[4] C.N.C. Lam, N. Kim, D. Hui, D.Y. Kwok, M.L. Hair, A.W. Neumann, The effect of liquid properties to contact angle hysteresis, Colloids. Surf. A Physicochem. Eng.Aspects 189 (2001) 265–278."

Organic Thin Films

PA053

Electrical Characterization of p-Aminobenzoic Acid Langmuir-BLodgett Films Containing ZnS Nanoparticles

Gonul Yildirim[1], Gonul Yildirim, Tayfun Uzunoğlu, Rıfat Çapan, Necmi Serin, Tülay Serin, Hüseyin Sari and Şirin Uzun

[1]*Balikesir University, Physics, TURKEY*

E-mail of Corresponding Author: tuzunoglu@balikesir.edu.tr

In the last decay, group II-VI semiconductor nanoparticles have been widely studied for optoelectronic applications. Among them is zinc sulphide (ZnS) nanoparticles which have special importance for optoelectronic applications. ZnS can be easily formed within organic multilayer thin film using Langmuir-Blodgett (LB) technique. In this work electrical properties of ZnS nanoparticles formed in LB films is reported. p-aminobenzoic acid molecule incorporating zinc ions were prepared to transfer as LB thin film layer on aluminium coated glass substrate in different thicknesses. Then the nanoparticles were created by exposing the LB thin films to H_2S gas. Monolayer growth of 5, 7, 9 and 11 monolayer thick LB film samples on the substrate was verified using UV-vis absorption spectra. I-V measurements were carried out for the films grown in a metal/LB film/metal sandwich structure both for the films containing ZnS and without nanoparticles to compare the effect of the nanoparticles. I-V analysis indicates that conduction in these films obeys the Schottky conduction mechanism. Using this result the metal-organic film barrier heights were calculated for the films. Based on our experimental results it was concluded that the presence of ZnS nanoparticles influences the barrier height resulting in change in electrical properties of LB films.

Organic Thin Films

PA054

Chemical Vapor Deposition of Epoxy and Amine Containing Thin Films for Transparent Adhesive Bonding of Thin Polymer Sheets

Mustafa Karaman[1] and Mehmet Gürsoy[1]

[1]*Department of Chemical Engineering, Selçuk University*

E-mail of Corresponding Author: karamanm@selcuk.edu.tr

In this study, a two-part nano-adhesive was synthesized by initiated chemical vapor deposition (iCVD) on poly viny chloride (PVC) substrates. iCVD is a one-step deposition technique involving the thermal decomposition of an initiator over heated filaments to form a film on a cooled substrate. The process is dry and does not require high temperatures or plasma, therefore fragile substrates including polymers can be coated without surface damages. Very thin (~20 nm) Poly(glycidyl methacrylate) (PGMA) and poly(dimethyl aminomethyl methacrylate) (PDMAEMA) films were deposited separately by initiated chemical vapor deposition (iCVD) on the substrate surfaces. FTIR analyses of the as-deposited films showed strong retention of chemical functional groups for both polymers. The deposition rates for PGMA and PDMAEMA were found as 30 and 20 nm/min, respectively. Contacting both surfaces by curing at 80 °C resulted in a strong adhesion between the polymers, due to the reactions between epoxide and amine functional groups. The resulting adhesive layer is essentially transparent, as determined from UV visible spectroscopy analysis. The adhesion strengths of the polymer/polymer interfaces between two PVC sheets were determined by the measurement of the T-peel adhesion strength on an tensile tester (Instron). All measurements were performed at a crosshead speed of 1 mm/min. The results indicated significant adhesion improvement compared to the conventional solution phase adhesives.

Organic Thin Films

PA055

Fabrication, Characterization and Gas Sensing Properties of Gold Nanoparticle and Calixarene Multilayers

İnci Çapan[1], Aseel K. Hassan[2] and Rajaa Abbass[3]

[1]*Balikesir University, Department of Physics, Turkey*
[2]*Faculty of Arts, Computing, Engineering and Sciences, Sheffield Hallam University, Cantor Building, 153 Arundel Street, Sheffield S1 2NU, United Kingdom*
[3]*Department of Physiology and Medical Physics, College of Medicine, Kufa University, Kufa, Najaf, Iraq*

E-mail of Corresponding Author: inci.capan@gmail.com

Calixarenes are a group of materials which are widely used for gas sensing studies because of their simple synthesis, conformational flexibility, binding group tunability, variability in their cavity sizes and improved selectivity to different gas molecules. In recent years it has been shown that the incorporation of gold nanoparticles (AuNps) into organic layers further enhances their gas sensing performance.

The present study reports on the fabrication of the thin films of calixarene and gold nanoparticles using Langmuir-Blodgett (LB) and Langmuir Schiff methods respectively. The gas sensing properties of the produced films are investigated on exposure to saturated vapors of Volatile Organic Compounds (VOCs) using surface plasmon resonance as an optical detection technique. Multilayers comprising films of AuNps and calixarene have been investigated to evaluate the effect of AuNPs on the films sensing performances. It has been demonstrated that the mixed layers exhibited improved sensing performance in terms of the degree of their response.

Organic Thin Films

PA056

Calix[4]arene Langmuir-Blodgett Thin Film for Chloroform Detection

Rifat Çapan[1], S. Şen[1], M.E. Özel[1], Z. Özbek[1] and H. Göktaş[1]

[1]*Balıkesir University, Physics, Turkey*

E-mail of Corresponding Author: rcapan@balikesir.edu.tr

Calix[4]arene molecule was deposited as an LB film by the method of Langmuir-Blodgett (LB) technique onto the suitable substrates. UV-visible spectroscopy was employed for the characterization of these LB films. A high quality and uniform LB film monolayer from the water surface can be transferred onto a glass or quartz crystal substrates with a transfer ratio of over 95 %. Thickness of our sample was measured using Surface Plasmon Resonance with a value of 2.5 nm for two layers. For the sensing application against chloroform, this LB film yields a fast and almost fully reversible response to chloroform in few seconds.

Organic Thin Films

PA057

Electric and Magnetic Field Assisted Effects on Molecular Orientation and Surface Morphology of the films of nonplanar phthalocyanines

Tamara Basova[1] and Aseel Hassan[2]

[1]*Nikolaev Institute of Inorganic Chemistry, Department of chemistry of coordination, cluster and supramolecular compounds, Russia*
[2]*Materials and Engineering Research Institute, Sheffield Hallam University, Sheffield S1 1WB, UK*

Email of corresponding author: basova@niic.nsc.ru

The phthalocyanine thin films can be fabricated by a variety of techniques including vacuum evaporation, solvent casting, spin coating, and Langmuir–Blodgett methods, etc. In order to optimise their potential utility for optical or electronic device applications, it is necessary to obtain uniform films of these compounds with easily controllable architecture and ordering. Recent investigations on -conjugted organic molecules like phthalocyanines and hexabenzocoronene derivatives reported that an electric or magnetic field can modify the molecular arrangement.

In this study, we present electric field assisted effects on the molecular orientation and the surface morphology of thin metal phthalocyanine films. The ability of electric fields to affect the thin film structure of polar molecules is demonstrated using titanyl(IV)phthalocyanine and chloroaluminium phthalocyanine (PcAlCl) as model compounds exhibiting both a permanent and an induced electric dipole moment. Thin films of both phthalocyanines prepared by organic molecular beam deposition in the absence and in the presence of an electric field during the thin film growth are characterized using polarization dependent Raman spectroscopy and atomic force microscopy.

It was shown by analyzing polarized Raman spectra that different preferential orientations of the molecules relative to the substrate surface have been observed in the films deposited under applied electric field or without electric field. Regions where an electric field was applied during thin film growth reveal molecules tilted with respect to the substrate plane of about 90o, whereas in regions where the electric field was absent the molecules adopt preferentially a more lying configuration.

The influence of post deposition annealing without and under applied magnetic field on the chemical transformation of PcAlCl to $[PcAl]_2O$ on the substrate surface was also studied using complementary methods such as optical spectroscopies, X-ray diffraction and atomic force microscopy. Combination of these methods with polarized Raman spectroscopy technique allowed to conclude that the presence of a magnetic field parallel to the substrate surface during annealing of the film improves the azimuthal order of crystalline domains with the phthalocyanine molecules oriented perpendicular to the substrate surface and are turned so that their dipole moments oppose the magnetic field direction.

It was demonstrated that applying an electric field during the growth or magnetic field during post deposition annealing of polar organic molecules may provide a promising opportunity to control the morphology and/or molecular orientation in thin organic films.

Organic Thin Films

PA058

Fabrication and characterization of mixed matrix cation exchange membranes modified by simultaneous using Ilmenite-co-iron oxide nanoparticles

Sayed Mohsen Hosseini[1], A. R. Hamidi[1], A. R. Moghadassi[1], S. S. Madaeni[2]

[1]*Arak University, Chemical Engineering, Iran*
[2]*Razi University*

E-mail of Corresponding Author: S-Hosseini@Araku.ac.ir

In this research mixed matrix heterogeneous cation exchange membranes were prepared by solution casting technique. Ilmenite-co-iron oxide nanoparticle was employed as inorganic filler additive in membrane fabrication. The effect of used additives on membranes properties was studied. Membrane potential, transport number and selectivity were improved by use of $FeTiO_3/Fe_3O_4$ nanoparticles in membrane matrix. Utilizing $FeTiO_3$-co-Fe_3O_4 nanoparticles in the casting solution also led to increase in ionic flux obviously. The modified membranes containing $FeTiO_3$-co-Fe_3O_4 nanoparticles showed higher transport number, selectivity and ionic flux compared to modified membrane containing ilmenite. Results showed that membrane areal electrical resistance was also declined sharply by use of $FeTiO_3$-co-Fe_3O_4 nanoparticles in membranes matrix. Moreover, modified membrane containing ilmenite showed lower electrical resistance compared to others. Results showed that oxidative stability of membranes was decreased slightly by use of $FeTiO_3/Fe_3O_4$ nanoparticles in membrane matrix. The results revealed that modified membranes in this study are comparable with that of other commercial ones.

Organic Thin Films

PA059

Polyvinyl alcohol films modified by organic dyes and zinc oxide nanoparticles

H. A. Almodarresiyeh[1], L.N. Filippovich[1], S. N. Shahab[1], N. G. Ariko[1] and V. E. Agabekov[2]

[1]*Institute of Physical Organic Chemistry of NASB, 220072, Minsk, St. Surganova 13,*
[2]*Institute of Chemistry of New Materials of NASB, 220141, Minsk, St. F. Skorina 36*

Email of corresponding author: luda1977@list.ru

Based on polyvinyl alcohol (PVA) modified by dichroic organic dyes effective polarizers for the visible (400-700 nm) and near IR (830-850 nm) spectral regions were obtained.
A novel dye - derivative of quinoline at λmax = 705, 845 nm was modeled and synthesized; the compositions for creating of dyed PVA films (wt.%: PVA - 9,0-10,0; ethyl alcohol - 6.0; dimethylformamide - 4.0-4.5; glycerin - 2.8-3.0; H_3BO_3 - 0.05; dyes - 0.02-0.04, water - the rest) and their conditions of uniaxial orientation were developed.
It was shown that the maximum value of the polarizing ability (PA = 96%) of the films is achieved at concentrations (C) of the dye from 0.2 to 0.4 wt.% and degree of stretching Rs = 4-4,5. One of the major factors affecting to PA of the polarizing film is the degree of orientation (S) of the dye molecules in the polymer matrix was found. PA of the film increases with increasing the S parameter and at its value 0.7 reaches 96%.
Modification of dyed PVA films by ZnO nanoparticles led to improvement of light resistance of them. Thus the light transmittance and polarizing ability of the sample when it is irradiated with UV light from a mercury lamp DRSh-1000 for 6 hours practically unchanged.

Organic Thin Films

PA060

Study on Doped TiO_2 Thin Films Prepared by Sol-Gel Process

Mohamed Mahtali, Khalida Benzouai, Afifa Derrouiche, Zahia Daas and Abderahmane Boutelala,

Laboratoire Couches Minces et Interfaces, université Constantine I, Physics, Algeria

Email of corresponding author: msmahtali@yahoo.fr

TiO_2 has many outstanding optical, electrical and chimical properties which make it suitable for variety of thin films application. Though studies have attempted to understand how dopants impact on the béhaviorisme of thaïs component. Rare informations are available in the literature regarding the effects of dopants on the phase formation, microstructural évolution, and thus optical properties of the TiO_2 thin films. In thaïs word, magnesium (Mg) doped titanium dioxide (TiO_2) thin films have been successfully elaborated by using sol-gel process on glass substrate. Anatase is à l'os temperature stable phase. In addition, amorphous TiO_2 films are often observed when the substrate temperature during deposition is low.

Science of Thin Films and Quantum Effects

PA061

Structural Analysis of Silicon Nanostructures Obtained from Thermal Annealing of a-Si/SiO_2 Superlattices

Lucie Prušáková[1], Pavol Šutta[1], Ing. Veronika Vavruňková[1] and Ing. Marie Netrvalová[1]

[1]*New Technologies Research Centre, University of West Bohemia, Materials and Technologies, Czech Republic*

E-mail of Corresponding Author: lprusak@ntc.zcu.cz

We report the synthesis and characterization of silicon quantum dots (QD´s) obtained by thermal annealing of silicon/silicon dioxide (a-Si/SiO_2) supper-lattices deposited by magnetron sputtering in Argon and Oxygen atmosphere. The main motivation to study silicon comes from its success and dominance in modern technology, especially in microelectronics. Light sources, modulators, waveguides, logical gates are a few examples of microelectronic materials applications in the various photonic devices which have been developed based on silicon nanocrystals.

a-Si/SiO_2 super-lattices were fabricated by 13,56 MHz radio-frequency magnetron sputtering on glass and silicon substrates using the BOC Edwards TF 600 coating system. The films were sputtered in Argon and mixture of Argon and Oxygen atmosphere from a silicon target of 99,999% purity. The as-deposited supper-lattices and the crystallized films were investigated using in-situ XRD, HR-TEM, FTIR, Raman, UV-Vis spectrophotometry and spectroscopic ellipsometry.

Multilayers composed of alternating stacks of a-Si and SiO_2 layers have been crystallized by thermal annealing in vacuum. The different stages from nucleation until full crystallization have been investigated by in situ X-ray diffractometry. Onset of crystallization and phase separation is observed to occur at different annealing temperature depending on the thickness of the super-lattice a-Si sub-layer. XRD in agreement with Raman spectroscopy confirmed presence of silicon crystalline fraction in annealed super-lattices. It is calculated that there is 19% of crystalline volume fraction in the multilayers after annealing procedure with density of particles of 4. 10 18cm^{-3}. Obtained crystalline fraction consists of nanoparticles, which average size is 3.5 – 4nm.

Science of Thin Films and Quantum Effects

PA062

Probing Lanthanum-Boron Double Film by Carbon Monoxide Adsorption

Tamerlan Magkoev[1], I.V. Tvauri[1], S.A. Khubezhov[1], A.G. Kaloeva[1], G.S. Grigorkina[1], A.P. Bliev[1], V.A. Sozaev[2], O.G. Ashkhotov[3],

[1]*North-Ossetian State University, Physics, Russia*
[2]*North-Caucasus Mining-Metallurgical Institute,*
[3]*Kabardin-Balkarian State University,*

E-mail of Corresponding Author: t_magkoev@mail.ru

Recently there is renewed interest in lanthanum and other rare-earth hexaborides (REHB) due to their new perspectives as high-efficient thermionic emitters with excellent stability. Despite of the extensive recent research, it is not yet clear whether the low work function and high stability of REHB is due to the unique electronic state of bulk crystal or to the double metal-boron dipolar layer formed on the surface. Recently it has been shown that the latter is the preferred viewpoint [1], which requires, however, further studies relating mainly to the electronic state of rare-earth metal and boron atoms coexisting in double surface layer. In relation to this, the aim of the present work was to study how the state of La and B atoms change in double La-B layer compared to the state of corresponding atoms in respective bulk materials. Intramolecular vibration of adsorbed carbon monoxide molecule has been chosen as a high-sensitive probe to test the state of the La-B layer. Lanthanum and boron layers were deposited on Mo(110) crystal in ultra-high vacuum chamber and studied by means of AES, XPS, RAIRS and CPD [1-3]. The state of the double La-B layer dramatically depends on the La and B deposition sequence. When La is deposited on top of the B film preliminary formed on Mo (110), the work function value reaches 2,3 eV, whereas for the reverse deposition order the work functions takes value of 5.8 eV. Comparing the IR intramolecular vibrational bands of CO adsorbed on rather thick (10 nm) La and B films separately and on equilibrated double La-B film, one can notice a blue shift of 8 cm-1 of IR wavenumber for CO bound to La atom in double layer compared to separate La film, whereas almost no shift is detected for CO bound to boron atom in case of CO-La-B- Mo(110) compared to CO-B-Mo(110). This implies that the electronic state of La atom in double La-B layer is somewhat different from that of separate La film, whilst the state of boron atom undergoes less transformation. The observed rather low value of wavenumber shift of about 8 cm^{-1} cannot be viewed as a consequence of strong chemical interaction between La and B, but as a result of La to B charge polarization. In favor of this assumption is an observed fact of high mobility of boron atoms through the La film even at room temperature. In addition, no reliable shift of Auger and core level energies was observed. Thus, it may be concluded that the low work function of LaB6, and presumably other REHB, is due to formation of dipolar La-B surface layer without formation of strong chemical bonds between them.

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[1] T.T. Magkoev et al, Surf. Sci. 602 (2008) 1705.
[2] T.T. Magkoev et al, J. Phys.: Condens. Matter 20 (2008) 485007.
[3] I.V. Tvauri et al, Vacuum 88 (2013) 8.

Science of Thin Films and Quantum Effects

PA063

The Effect of Annealing Temperature on the Microstructure and Electrical Property of La-Sr-Mn-O Thin Films Grown on Si(100) Substrates

Gang Wang[1] and Shaoqun Jiang[1]

[1]*College of Mechanics and Materials, Hohai University, China*

E-mail of Corresponding Author: sqjiang@hhu.edu.cn

The La-Sr-Mn-O thin films were deposited on Si(100) by DC magnetron sputtering and followed by annealing at different temperature (873K, 973K and 1073K) for 1h in air atmosphere. The effects of annealing temperature on microstructure and electrical property of the films were studied. The results indicate that the films restructure during the annealing process, which results in the obvious changes of phase structure, morphology, Mn-O bond length and electrical property with the change of annealing temperature. The films annealed at 873K and 973K show the (100) preferred orientation, however, the (100) peak disappears for the film annealed at 1073K. The grains monotonously increase with the increasing of annealing temperature. All the annealed La-Sr-Mn-O films display metal-insulator transition and the metal-insulator transition temperature (TMI) shifts toward high temperature when annealing temperature increases. Double-peak resistivity transport behavior is observed in the film annealed at 873K, which can be explained by the interplay of bulk phase and surface phase resistivity transport mechanisms and double-phase structure coexistence.

Science of Thin Films and Quantum Effects

PA064

Optical Emission Spectroscopy of Sputtered Titanium and Nickel in RF Magnetron Discharge

Bouaouina Boudjemaa1, S.E Abaidia1 and M.Salhi[1]

[1]*University of Boumerdes, Physic, Algeria*

E-mail of Corresponding Author: b.bouaouina@gmail.com

Sputtering of the titanium and nickel target using argon plasma was investigated by optical emission spectroscopy in home-made sputtering system on Si substrate. The optical emission spectra supply information about the chemical species present in the plasma. The electronic temperature (Te) was determined from that, for different plasma parameters: gas pressure and power density, lines studied in the discharge are I 696.5 for Argon, Titanium I 519.3 nm and 352.4 nm for nickel. An increase of the pressure and power density induces an electronic temperature increase. To determine structure and chemical composition of the film, XRD and EDX techniques are used.

Science of Thin Films and Quantum Effects

PA065

The Electronic and Magnetic Properties of $La_{0.85}Zr_{0.15}MnO_3$ Deposited on $SrTiO_3$ and MgO Substrates

N. G. Deshpande[1], C. H. Weng[1], Y. F. Wang[1], Y. C. Shao[1], C. Q. Cheng[1], D. C. Ling[1], H. C. Hsueh[1], C. H. Du[1] and W. F. Pong[1]

[1]*Department of Physics, Tamkang University, Tamsui 251, Taiwan*

E-mail of Corresponding Author: wfpong@mail.tku.edu.tw

The electronic and magnetic properties of tetravalent-ion-doped $La_{0.85}Zr_{0.15}MnO_3$ (LZMO) thin films that were epitaxially grown on $SrTiO_3$ (STO) and MgO substrates were studied using temperature-dependent x-ray diffraction (XRD), x-ray absorption near-edge structure (XANES), x-ray linear dichroism (XLD) and x-ray magnetic circular dichroism (XMCD) at the Mn L3,2- and K-edge. XRD studies reveal that the LZMO thin films have compressive and tensile strains (along the c-axis) on the STO and MgO substrates, respectively. As the temperature is reduced from room temperature to below magnetic transition temperature, the preferentially occupied Mn majority-spin eg orbital changes from the in-plane dx2-y2 to the out-of-plane d3z2-r2 orbital for LZMO/STO, and vice versa for LZMO/MgO. Experimental results suggest that the new hopping path that is mediated by the Mn^{2+} ions triggers a stronger d3z2-r2 orbital ordering of Mn^{3+} ions and enhances the ferromagnetic coupling between the Mn spin moments of t2g electrons in LZMO/STO, whereas the strong tensile strain stabilizes the dx2-y2 orbital by inducing lattice distortions of the MnO6 octahedra in LZMO/MgO.

Science of Thin Films and Quantum Effects

PA066

On the Current-Density Electric Field Characteristics in Carbon Nanotubes

Ghassem Ansaripour

Sahebe Gholamrezaei Department of Physics, Yazd University, P.O. Box 89195-741 Yazd, Iran

Email of corresponding author: gansaripour@yazduni.ac.ir

Both scientifically and technologically carbon nanotubes (NTs) since their discovery have attracted more attention to the researchers worldwide, because of their inevitably extraordinary and outstanding transport properties such as of their dual metallic semiconducting behavior, the capability of having high electrical and thermal power, having mechanical stability and carrying large current densities at room temperature. The latter property in carbon nanotube field effect transistors, particularly has made the high speed nano electronics devices owe to them[1-7].

In this article the effect of dc (Fdc) and quasi-static ac (Fac) electric fields on the carrier transport properties of carbon nanotubes is studied. Using the Boltzmann's transport equation a theoretical model is implemented to extract the current-density electric field characteristics. Calculating the current density and using Matlab it is shown that at low electric fields the current density verses dc electric field shows a linear dependence that is the so called the region of ohmic conductivity. Then by increasing the electric field when the dc electric field reaches the vicinity at which becomes equal to the amplitude of the ac electric field (i.e.in the quasi-static approximation case when $\omega\tau<<1$) the current density decreases and negative differential conductivity (NDC) is observed and the increase of the Fac electric field results a decrease in the current density peak. This effect is similar to that of [8] studied in a semiconductor superlattice. The demonstrated NDC effect could be significant in the context of future generation of terahertz radiation.

References

[1] S. Iijima, Nature (London) 354, 56 (1991).
[2] R. Saito, G. Dresselhaus, and M. Dresselhaus, "Physical Properties of Carbon Nanotubes," imperial College Press, London, (1998).
[3] J. W. Mintmire, B. I. Dunlap, and C. T. White, Phys. Rev. Lett. 68, 631 (1992).
[4] Saito, M. Fujita, G. Dresselhaus, and M. S. Dresselhaus, Appl. Phys. Lett. 60, 2204 (1992).
[5] S. J. Tans, M. H. Devoret, H. Dai, A. Thess, R. E. Smalley, L. J. Geerligs, and C. Dekker, Nature (London) 386, 474 (1997).
[6] R. Martel, T. Schmidt, H. R. Shea, T. Hertel, and Ph.Avouris, Appl. Phys. Lett. 73, 2447 (1998).
[7] Ghassem Ansaripour, Acta Physica Polonica, 120, 1043 (2011).
[8] S. Y. Mensah, J. Phys. Condense Matter, 41, (1992).

Science of Thin Films and Quantum Effects

PA067

Quantum-Size Oscillations of Thermoelectric Characteristics in IV-VI Semiconductor Nanostructures

Dmytro Freik[1], Rasit Ahiska[2] Igor Yurchyshyn[3] Lyubov Mezhylovska[3]

[1]*Vasyl Stefanyk Precarpathian National University Physical-Technical, Ukraine*
[2]*Gazi University, Ankara, Turkey, ahiska@gazi.edu.tr;*
[3]*Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine*

Email of corresponding author: freik@pu.if.ua

The use of nanostructured materials can significantly increase the thermoelectric figure of merit. Reducing dimension creates conditions for the emergence of quantum-size effect, which leads to increase in the density of states near the Fermi energy (EF). This preserves the high electrical conductivity, and the asymmetry of filled and unfilled states provides a high Seebeck coefficient S.
In this paper, the results of calculations and analysis of the size dependence of the Seebeck coefficient, specific electrical conductivity, and thermoelectric power given in the approximation of the variable Fermi energy.
Calculations are performed for the model of quantum well (QW) with high wall. The QW's width was considered equal to thickness of condensate in the experimental dependences of corresponding parameters. The calculation was carried out in the approximation of constant both the concentration and carrier mobility throughout the interval of QW width. The values of such width were taken with corresponding experimental measurements. The dependence of the thermoelectric coefficients due of QW width of lead chalkogenides was characterized by non-monotonic oscillation behavior. Such behavior is due to the quantization of energy carriers by restricting their movement in the potential well. An increase of QW in the value of one-half of Fermi energy leads to new filled sub-bands below the Fermi level. The jump is observed in density states in the filling of new zone, and leads to oscillation behavior.
It is shown, that both experimentally and theoretically obtained dependence of the Seebeck coefficient due QW width with infinitely high walls for structures based on IV-VI semiconductor compounds characterized the fractures with certain period.
For all structures with a small values of the width of the QW (less than 20 nm) revealed the high values of Seebeck coefficient and reduced values of electrical conductivity. An increase of the width of QW leads to decrease of Seebeck coefficient and to increase the value of electrical conductivity. Thus all these dependences are saturate. This pattern of theoretical curves changes completely to experimental data.
It was established that the period of oscillations is inversely proportional to the Fermi energy. The flowing nature of the Fermi energy indicates that the increase in the width of the QW takes place growth of d-period oscillations dependencies of the TE-parameters.
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Science of Thin Films and Quantum Effects

PA068

1D and 2D Photonic Crystal on the Left-Handed Metamaterial Base: Band Structure and Optics

Filiz Karaomerlioglu

Mersin University Department of Electrical and Electronics Engineering, Turkey

Email of corresponding author: filizkrm@gmail.com

The possibility of applications of left-handed metamaterial based one and two dimensional photonic nanostructures in functional optoelectronic devices containing both inorganic and organic components have been studied in present paper. In this study, metamaterial based photonic crystal array containing one and two dimensional photonic crystal on a narrow-band semiconductor base infiltrated with organic compound was analyzed. In order to study the photonic band gap and optical properties of the structures, their electromagnetic properties were investigated by using the finite-difference time-domain method. Band structure, transmittance, density of photonic states and equi-frequency contours of nanostructures were calculated for both TE and TM modes. In particular, two dimensional photonic crystals with a sufficiently high value of refractive mismatch between the constituent phases possess a full photonic band gap, where light of specific wavelength range is inhibited from propagating in all directions. Structure with a periodic spatial modulation in the refractive index obtained from organic compounds possess an intrinsically low value of refractive index mismatch originating from the relatively low refractive index of organic compounds, and as a result these materials do not possess a full band gap. In present work, possibilities a left-handed metamaterial photonic crystals operating at optical frequencies had also been analyzed for solar cell and super-lens applications.

Science of Thin Films and Quantum Effects

PA069

Synthesis and Characterization of Sol-Gel Synthesized CdZnO Nanocomposites

Sinem Aydemir[1] and Şeref Kalem[2]

[1]*Eskisehir Osmangazi University Physics, Turkey*
[2]*Tubitak- Uekae National Research Institute of Electronics and Cryptology Gebze 41470 Kocaeli, Turkey*

Email of corresponding author: saydemir@ogu.edu.tr

The sol-gel route has been applied to obtain CdZnO nanocomposite films. CdZnO films with different ratio of CdO and ZnO (1:1, 2:1 and 1:2) were grown on glass substrates. The crystalline structure of the CdZnO films depend on the amount of ZnO and CdO in the films. A combination of cubic (CdO) and hexagonal wurtzite (ZnO) phase was observed for the film deposited film 0.3 M precursor concentration of zinc and cadmium salts. From scanning electron micrograph (SEM) uniform distribution of spherical shaped nanograins was observed. Films having higher amount of CdO shows the presence of grains along with the self-assembled network texture of ZnO. AFM analaysis reveals the average grain size is in the range of 8-50 nm. PL spectra show emissions corresponding to the near band edge (NBE) ultra violet emission and deep level emission in the visible region.

Science of Thin Films and Quantum Effects

PA070

RADAR ABSORBING MATERIALS (RAM) BASED ON THIN OXIDE FILMS

Rafael De La Vega de Mendonça[1] and Viviane Lilian Soethe[1]

[1]*Universidade Federal de Santa Catarina, Centro de Engenharia da Mobilidade, Brazil*

E-mail of Corresponding Author: rafaelmendonca5@hotmail.com

This study presents a survey which aims to study the properties of electromagnetic absorption in the frequency range of microwave thin oxide films deposited on polymer substrates. Basically, it seeks to obtain a material that is capable of attenuating radiation in the frequency range of interest, with concomitantly low density and high efficiency. Often, it is necessary to use the Radiation Absorbing Materials (RAM) to minimize interference problems and electromagnetic compatibility in equipment's used in civil and military industry, for example, cellular phones, wireless transmission, pacemakers and others. In this study, thin oxide films were produced in an equipment of the type Magnetron Sputtering (MS).

The thin films were evaluated for their ability to absorb radiation in the frequency range of microwaves (8-12GHz) using a waveguide device. The result obtained from this study reveals that the films are presented as efficient absorbers of electromagnetic radiation in certain frequency bands.

Science of Thin Films and Quantum Effects

PA071

Chemical composition and structure of thin $La_xHf_{1-x}Oy$ films on Si

T.P.Smirnova[1], L.V.Yakovkina[1], V.O.Borisov[1] and V.N.Kichay[1]

[1]*Nikolaev Institute of Inorganic Chemistry SB, Russian Federation, Novosibirsk, 630090, Russia*

E-mail of Corresponding Author: yakovk@niic.nsc.ru

At present HfO_2 and double oxides on its base (HfO_2-Ln_2O_3, Ln=RE) are widely investigated as materials for developing new technologies. Of primary interest are thin films based on these compounds, as they refer to high-k materials used in making gate dielectrics for micro-and nanoelectronic devices of a new generation. It is known the film functional properties are closely related to film structures. The results of crystal structure, phase's transformation investigation within $La_xHf_{1-x}Oy$ films and their permittivity will be discussed in the report. La-doped HfO_2 films(50-80nm) were obtained by MO CVD. 2,2,6,6 tetramethyl-3,5 hafnium heptandionate ($Hf(thd)_4$) and 2,2,6,6 trimethyl-3,5 lanthanum heptandionate ($La(thd)_3$) were used as precursors. To characterize films, a set of methods was used including XPS, EDS, AFM, X-ray diffraction using greasing incidence angle of synchrotron radiation and HRTEM. With increasing La concentration, the reflections in the X_ray diffraction patterns of the films shift to smaller 2θ angles, indicating the formation of solid solutions. At 18 at % La, we observed a transition from a fluorite-like structure to the pyrochlore structure ($La_2Hf_2O_7$). The film containing 30 at % La consisted of a mixture of cubic La_2O_3 and $La_2Hf_2O_7$. The surface roughness of the films was shown to increase with increasing La concentration. Capacitance–voltage (C–V) measurements were used to assess the relative dielectric permittivity (k) of the films as a function of La
concentration. The minimum k value was obtained at the La concentration corresponding to the transition from the fluorite structure to an ordered pyrochlore structure (second_order phase transition).

Science of Thin Films and Quantum Effects

PA072

Temperature Dependence of Raman Scattering in (211)B CdTe/GaAs Grown by Molecular Beam Epitaxy

Selin ÖZDEN[1], Sinem DUMAN[1] and Yusuf SELAMET[1]

[1]İzmir Institute of Technology, Department of Physics

Mercury Cadmium Telluride (HgCdTe) is widely used material for infrared detection. GaAs substrates are generally used as a substrate for the growth of HgCdTe because (211)B surface of GaAs suppress twin defect formation, gives best surface morphology and higher Hg sticking coefficients. In addition, epitaxial growth surface can be easily obtained after low temperature thermal removal of protective oxide layer. Although the direct growth of HgCdTe can be performed on GaAs substrates, diffusion of gallium and arsenic atoms into the growing layers and dislocations due to large lattice mismatch degrades the device performance build on these films. To decrease impurity atom migration and reduce the number of dislocations per unit area, CdTe can be used as a buffer layer. CdTe and HgCdTe have closely matching lattice parameters. Large number of dislocations occur at CdTe film and GaAs substrate interface due to 14.6% lattice mismatch. In addition, due to excess Te during growth, Te precipitates can be formed on CdTe buffer layer.

This study focuses on a Raman study of defects on (211)B CdTe buffer layers grown on (211)B oriented GaAs substrates by Molecular Beam Epitaxy (MBE). In order to investigate Te precipitates and the quality of CdTe (211)B epitaxial films on epiready 625□25 µm thick GaAs(211)B wafers, temperature dependent Raman scattering experiments in the range of 300 K to 80 K were performed by using emission of an Ar+ laser at 488 nm. The TO and LO phonon modes of CdTe observed approximately at 140 and 175 cm-1, respectively. Additional modes near 92, 103 and 120 cm-1 are phonons with E and A1 symmetry modes of tellurium which are the indications of Te precipitates in CdTe [1, 2]. It has been reported that as the density of Te precipitates increases, the Raman intensity of A1 and E symmetry modes of Te would also increase [3].

In addition; to examine the quality of CdTe layers, the intensity ratio of second order (2LO) and first order (LO) longitudinal phonon modes was calculated at measured temperatures. It was observed that the intensity ratios change with measurement temperature and, Te-specific A1 and E symmetry modes and transverse optical phonon mode of CdTe form a broad peak as the measurement temperature decreases for some CdTe samples. In order to examine the character of topologically different areas as observed by optical and electron microscopy, the variations in Te specific E and A1 symmetry mode intensities on the sample surface were recorded by two-dimensional Raman mapping.

REFERENCES

1.Amirtharaj, P. and F.H. Pollak, Raman scattering study of the properties and removal of excess Te on CdTe surfaces. Applied Physics Letters, 1984. 45(7): p. 789-791.
2.Zitter, R., Raman detection of tellurium layers on surfaces of CdTe. Surface Science, 1971. 28(1): p. 335-338.
3.Levy, M., et al., Characterization of CdTe substrates and MOCVD Cd< sub> 1− x</sub> Zn< sub> x</sub> Te epilayers. Journal of crystal growth, 1999. 197(3): p. 626-629.

PA073

Quenching of Pyrene and Tris(2,2'-bipyridine)ruthenium Dyes in Their Thin Film Forms by Nitric Oxide Radical

Ozlem Oter[1], Akif Cihan Aydın[2], Kadriye Ertekin[3] and Erdal Celik[4]

[1]*University of Dokuz Eylul Department of Chemistry, Turkey*
[2]*The Graduate School of Natural and Applied Sciences, Dokuz Eylul University, Kaynaklar Campus, 35160 Buca, Izmir, Turkey*
[3]*Department of Chemistry, Faculty of Science, Dokuz Eylul University, Kaynaklar Campus, 35160 Buca, Izmir, Turkey*
[4]*Center for Fabrication and Application of Electronic Materials (EMUM), University of Dokuz Eylul, 35160 Buca, Tinaztepe, Izmir, Turkey*

Email of corresponding author: ozlem.oter@deu.edu.tr

In this work, we have constructed thin films of plasticized polymers of polymethyl metharcylate, polyviniyl chloride (PVC) /or sol-gel matrices with oxygen sensitive fluorescent dyes for the sensing of reactive oxygen radical of nitric oxide. Like other free radicals nitric oxide contributes to the development of several human diseases. Besides it takes place in many biological mechanisms occurring in human body. Nitric oxide is also a very toxic environmental waste of industrial processes or exhaust gases. Thus, the accurate measurement of nitric oxide is of great importance. The employed fluorescent dyes were pyrene and tris(2,2'-bipyridine)ruthenium ([Ru(bpy)3]2+) which are well known with their sensitivities for oxygen molecule and for reactive oxygen species in solution phase. However, this is the first study that these dyes are tested for nitric oxide sensitivity in their solid thin film forms which is suitable for further optical sensor designs. Both, time-resolved and steady state fluorescence measurements were performed for the two dyes in their thin film forms of different polymers and the results were compared in terms of sensitivity. The films were tested for nitric oxide in phosphate buffer solution of pH 7.4. We have found that the nitric oxide can actively quench the two probes in thin film forms. Our data correspond to the classical Stern–Volmer equation. The pyrene dye in PVC thin films is more efficient than the ([Ru(bpy)3]2+) dye for the sensing of nitric oxide. In conclusion, our method allows for detecting ppm levels of nitric oxide at intracellular pH. Our data suggest that the method can be used for the quantification of nitric oxide based on not only the quenching of fluorescence intensity but also the quenching of fluorescence lifetime of the employed probes.

Optical, Optoelectronic and Dielectric Coatings

PA074

Fabrication of High-T_c Superconducting Multilayer Structure with $YBa_2Cu_3O_{7-x}$ Thin Films Separated by $SrTiO_3$ Interlayers

Yigitcan Uzun[1] and Ilbeyi Avci[1]

[1]*Ege University, Faculty of Science, Physics Department, Bornova, Turkey*

E-mail of Corresponding Author: uzunyigitcan@gmail.com

Multilayer thin film structures are attractive for superconducting microelectronics, but they are difficult to achieve on high Tc superconductors such as $YBa_2Cu_3O_{7-x}$ (YBCO) thin films. The conventional process has been based on fabricating the YBCO thin films on multiple buffer layers resulting in a single superconducting upper layer on a multilayer-type structure, here we present a full fabrication process for the growth of a multilayer superconducting thin film structure that contains multiple superconducting YBCO thin film layers separated by $SrTiO_3$ (STO) interlayers in sandwich-type configuration. The deposition process was optimized for dc and rf magnetron sputtering techniques for the deposition of YBCO and STO thin films respectively. An YBCO/STO/YBCO/STO/YBCO type configuration was fabricated on a commercial single crystal (100) STO substrate by precisely tuning the deposition process parameters. Superconducting properties of YBCO layers were tested by ac magnetic susceptibility and resistances versus temperature measurements after the deposition of each additional layer. In order to demonstrate potential device application, a microbridge pattern was fabricated onto the top YBCO layer and current – voltage analysis was performed.

Superconducting Thin Films

PA075

Fabrication of NdFeB Thin Films for Applications in Superconductor and Ferromagnetic Systems and Characterization by Using Low Temperature Scanning Hall Probe Microscopy

Sunusi Suleiman Usman

Meliksah University, Electrical and Computer Engineering, Turkey

Email of corresponding author: suleiman.sunusi@yahoo.co.uk

A literature review and experimental investigation were realized in this study. The literature review includes the magnetic material of a permanent magnet, the fabrication techniques as well as the image processing techniques.
In this experimental study, samples were prepared by DC sputtering from the hand-made NdFeB target and a target of Mg was used to keep oxygen onto a silicon substrate at room temperature condition. CuTEM with 1500 square mesh was used as a shadow mask to pattern the film surface by the use of Al_2O_3 coated. Films were capped by a nanometer thick tantalum layer against diffusion and oxidation. The liquid nitrogen cold finger was added periodically during the sputtering process to ensure trapping the impurities in the system. The films were thermally annealed at 550℃ for 30 minutes. X-ray diffraction pattern was performed for both as deposited and annealed temperature as grown sample and formation of $Nd_2Fe_{14}B$ phase was realized during an x-ray diffraction investigation with good lattice orientation. We have imaged the sample surface with the aid of low temperature SHPM system to be used for determining the scanning image of the sample surface at various temperatures.This allows the experimental investigation to acquire topography image a long with the magnetic field distribution was achieved. The image results then show that the scanning image with SHPM give a better smooth image and is well complimented .The film which was studied can be used for applications in superconductor and ferromagnetic of hybrid structures.

Superconducting Thin Films

PA076

Analysis of Interface Charge Densities for ZrO_2 Based MOS Devices

N. P. Maity[1], Reshmi Maity[1], R. K. Thapa[1] and S. Baishya[2]

[1]*Mizoram University (A Central University), Electronics & Communication Engineering, India*
[2]*National Institute of Technology Silchar*

E-mail of Corresponding Author: maity_niladri@rediffmail.com

In this letter a thickness-dependent interfacial distribution of oxide charges for thin metal oxide semiconductor (MOS) structures using high-k material ZrO_2 has been methodically investigated. The interface charge densities are designed using capacitance-voltage (C-V) method and also conductance (G-V) method. It indicates that by reducing the effective oxide thickness (EOT) at 3.54 nm, 2.65 nm and 1.77 nm, the Dit increases linearly. For the same EOT, Dit has been found for the materials to be the order of 10^{11} $cm^{-2}eV^{-1}$ and it is originated to be in good agreement with published fabrication results at p-type doping level of 1×10^{17} cm^{-3}. Numerical calculations and solutions are performed by MATLAB and device simulation is done by ATLAS.

Theory of Structure, Surface and Interface

PA077

Effects of Withdrawal Speed on the Microstructural and Optical Properties of Sol-gel Prepared ZnO:Al Thin Films

Sinem Aydemir

Eskisehir Osmangazi University Physics, Turkey

Email of corresponding author: saydemir@ogu.edu.tr

The growth of Al doped ZnO (AZO) thin films via sol–gel process were investigated. Wurtzite nanostructure AZO films were successfully deposited onto corning glass substrates by sol-gel method using dip coating technique. The effect of withdrawal speed on the crystalline structure, morphology and optical properties of the ZnO thin films were investigated using X-ray diffraction (XRD), atomic force microscopy (AFM), field emission scanning electron microscope (FESEM) and optical transmittance data. The WS significantly affected the crystalline structure, morphology and optical properties of the films. All AZO films were observed to grow along the c-axis preferential orientation of (100) and (101). The lower WS of the substrate in the AZO thin films the more highly preferred orientation along (100) and (101) planes. The optical transmittance of the thin films within the visible and near infrared region was about 80%. The surface roughness mean square (RMS) of the films estimated from AFM measurements rise from 10 nm to 29 nm, when the withdrawal speed increased from 20 to 80 mm/min, respectively. The optical transmittance of the thin films within the visible and near infrared region was about 80%. The absorption edge varied from 3.20 to 3.27 eV with increasing withdrawal speed. Room temperature photoluminescence was observed for pure and Al doped ZnO thin films and the origin of the emissions was discussed.

Science of Thin Films and Quantum Effects

PA078

Preferred Orientation of $NaCl_xBr_{(1-x)}$ Polycrystalline in Different Atomic Planes

H. Sadeghi , A.Zolanvari, Z. Shahedi and F. Es'hagi

Department of Physics, Faculty of Science, Arak University, Arak 38156-8-8349, Iran

Email of corresponding author: h-sadeghi@araku.ac.ir

NaClxBr(1-x) polycrystalline has been grown by, pulling from the melt, Czochralski method. The texture and preferred orientation of $NaCl_xBr_{(1-x)}$ in different planes (111), (200) and (400) has been studied. As the figures show the highest intensity has been obtained for <001> direction in (200) plane where indicates the grains directions are normal to the surface of substrate. The direction of other planes such as <110>, <203> and <301> were formed that indicated the twinning effect. Inverse pole figure and orientation distribution function of the sample also has been studied.

Theory of Structure, Surface and Interface

PA079

Study of Intermediate Bands of Amorphous Oxygen-deficient and Hydrogen-Doped Molybdenum and Tungsten Oxide Films and Application in Multicolor Organic Light Emitting Diodes

Maria Vasilopoulou[1], Nikos A. Stathopoulos[2], Stelios A. Savaidis[2] and Dimitris Davazoglou[3]

[1]*National Centre for Scientific Research "Demokritos" Institute of Nanoscience and Nanotechnology, Greece*
[2]*Department of Electronics, Technological Educational Institute (TEI) of Piraeus, Greece*
[3]*Institute of Nanoscience and Nanotechnology (INN), National Centre for Scientific Research "Demokritos", Greece*

Email of corresponding author: mariva@imel.demokritos.gr

Semiconductors exhibiting intermediate bands (IB) are a subject of intense research during last twenty years mainly because theoretical calculations have shown that single-junction solar cells build on them have a detailed balance efficiency of 62.3% compared with the 40.7% for an ordinary solar cell. Also, in recent years IB semiconductors were successfully used to modify electrodes in hybrid organic-inorganic electronic devices such as light emitting diodes and solar cells to inject and extract carriers through the IBs in the organic semiconductor. To be useful an IB semiconductor must fulfill a few conditions. For instance, for use in solar cells the electronic transitions between valence, conduction (VB and CB, respectively) and IBs must be allowed and strong, the corresponding absorption spectra must not overlap, must fit with the spectrum of the light to be absorbed and the non-radiative recombination of IB electrons with VB holes must be low. Moreover for electrode modification applications, the IB must not act as trap for free electrons and holes within the CB and VB respectively and the IB must be several kT away from CB and VB to avoid thermal escape of IB carriers towards them thus destroying the alignment of the various levels.

This work deals with the IBs in amorphous molybdenum and tungsten oxide films with various degrees of oxygen stoichiometry and hydrogenation. When these oxides are reduced by losing oxygen and/or by introducing hydrogen within the Metal-Oxygen lattice, energy states appear within their forbidden gaps, which above a certain concentration become bands while the oxides retain their semiconducting character. Optical properties, such as Fourrier transform infrared (FTIR) spectroscopy, spectroscopic ellipsometry (SE) and photoluminescence (PL) spectroscopy are used to probe the composition and the electronic structure of deposited samples near and within the energy band gap and schematic energy diagrams are proposed for both oxides.

Acknowledgments

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Theory of Structure, Surface and Interface

PA080

Surface Finishing Processing for Biocompatibility of the Multipurposes Medical Transmission Tubes

Ozlem Salman[1] and Kadir Çeviker[2]

[1]*Suleyman Demirel University CAD/CAM research and application center TR*
[2]*Süleyman Demirel University Medical Faculty, Cardiovascular Surgery*

Email of corresponding author: ozlemsalman@sdu.edu.tr

A commonly used definition of biocompatibility is ability of a material to perform with an appropriate host response in a specific application. Since materials interact with environment through their interfaces, both the kind and the strength of such interactions are largely dependent on the surface properties of the materials. The contact of blood with foreign surfaces induces several cascade reactions and activation phenomena. These reactions potentially create clinically significant side effects in the application of medical devices (cardiovascular implants, extracorporeal circulation, catheters) and interfere with the success of the medical treatments. In certain cases even the formation of thromboemboli or systemic inflammatory reactions were reported to occur as a consequence of the activation of coagulation enzymes, thrombocytes, and/or the activation of the complement system and leukocytes at the biointerfaces of the applied materials. Protein adsorption on the material surface is believed to be the initial event when a material comes into contact with a biological environment. Therefore, understanding the interaction between proteins and material surfaces is critical, and control of protein–surface interactions continues to be an important factor for consideration in the design of biocompatible surfaces. Recently, a number of excellent reviews have been made in the understanding of protein interaction with all biocompatible materials. While a material is in contact with a biological environment, the surface chemistry and topography of the material are important parameters that may influence protein adsorption, cell interaction, host response and ultimately the mechanical damage to shaped blood cells. Nowadays, studies have been focused on biocompatibility of the inner surface of the medical tubing sets that may be one of the reasons of shaped blood cell damage, the activation of coagulation enzymes, thrombocytes, and/or the activation of the complement system and leukocytes at biological environment.

The nano-level surface finishing requirements on the medical components made of materials with extraordinary properties, miniature surface features on tubular geometries etc. are highly demanded in today's medical and manufacturing area. These are not feasible to achieve by any traditional methods of finishing. Such objectives can be achieved only through the advanced finishing processes because the traditional abrasive finishing processes generally employ a rigid tool that subjects the component to substantial normal stresses which causes microcracks on surface or subsurface resulting in reduced strength and reliability of the component. Owing to this, the precise control of finishing forces is an important consideration for fine finishing of components with close tolerances and without damaging surface topography. This had led to the development of many advanced surface finishing technologies. These include magnetic abrasive.

Theory of Structure, Surface and Interface

PA081

Semi-empirical Method to Extract Minority Carrier Bulk Lifetime and Surface Recombination Velocity in P-type Multicristallines Silicon Wafers from QSSPC Measurements

BOUHAFS Djoudi[1], N. Khelifati[1] Abdelghani Boucheham[1], B. Palahouane[1],

[1]*CRTSE, Division de Développement de Dispositifs de Conversion à Semiconducteurs*

E-mail of Corresponding Author: bouhafsdjoudi@crtse.dz

We have investigated the effect of extended phosphorus diffusion gettering (EPDG) on effective minority carrier lifetime (teff) in P-type multicristalline silicon (mc-Si). Quasi-steady state photoconductance (QSSPC) technique are used to measure teff before and after each EPDG run. The silicon surface is pasivated with Iodine Ethanol (IE) solution before each measurement. teff values have been increased from 9 µsec to 36 µsec after EPDG gettering. We have used the theoretical model which lie the apparent lifetime using Hornbeck-Haynes model and the fit of measured effective lifetime teff to determine the bulk lifetime tb, surface recombination velocity (SRV), the recombination center (Nr)and traps density (Nt). Surface recombination velocity value around 240 $cm.s^{-1}$ relative to the IE passivation is deduced and the obtained bulk lifetime (tb) values vary from 11 to 77 µsec depending on gettering efficiency. tb =77 µsec are obtained at the second temperature stage TL=600 °C. Using the teff fit curves the recombination center density Nr and traps density Nt are $5.3x10^{11}$ cm^{-3} and $1.0x10^{14}$ cm^{-3} respectively, proving a neutralization of the recombination electrical activity and the reduction of traps density.

Keywords: Multicristalline Silicon, Gettering, Carrier Lifetime, Recombination, traps.

NB. in teff and tb: (t) is in symbol character.
$5.3x10^{11}$ cm^{-3} : 11 and -3 are in exponential."

Theory of Structure, Surface and Interface

PA082

Analysis of FGM vibrating rectangular nanoplates in thermal environment

Korosh Khorshidi[1] and Ali Bakhsheshy[1]

[1]*Arak University, Mechanical Engineering*

E-mail of Corresponding Author: k_khorshidi@iust.ac.ir

In the present study the free vibration analysis of functionally graded rectangular nanoplates in thermal environment is investigated. The modified coupled stress theory based on the first order shear deformation theory has been used to obtain the natural frequencies of the nanoplate. Modified coupled stress theory is a non-classical theory. In this theory material length scale parameter is applied to capture the size effect of the microstructures which the earlier classical plate theories were not able to explain these effects. The functionally graded material properties are varied continuously and smoothly along the thickness. The Poisson's ratio of the FGM plate is assumed to be constant in the whole plate. In order to validate the present method, the natural frequencies of the both functionally graded rectangular plate and rectangular nanoplates are compared with those are reported in the literature, separately. Finally, the effect of various parameters such as; the power law index, the thickness to length scale parameter ratio, aspect ratio, thickness ratio on the natural frequencies of plates in thermal environments with different temperatures are presented and discussed in detail.

Theory of Structure, Surface and Interface

PA083

Structural and Optical Properties of Composite Thin Films Deposited by PLD Method

Mesure Mutlu Sanli[1], Elif Kacar[1], Mesadet Asuman Sinmaz[1], Belgin Genc Oztoprak[1] and Arif Demir[1]

[1]*Kocaeli University, Physics, Turkey*

E-mail of Corresponding Author: mesuremutlu@gmail.com

In this work the structural and optical properties of TiO_2:Al_2O_3 and Ti:Al_2O_3/SiO_2 thin films were investigated with different compositions. The weight ratios of TiO_2/Al_2O_3 compositions are 1:20, 1:10, 1:5, 1:2, 1:1, 2:1, 5:1 and 10:1. Also the weight ratio of Ti:Al_2O_3 and Ti:SiO_2 compositions are 1:20, 1:10 and 7:20 respectively. The composite thin films prepared by Pulsed Laser Deposition method at room temperature and annealed at 200oC. The effects of weight ratio of TiO_2/Al_2O_3 and Ti:Al_2O_3/SiO_2 on transmission spectrum and band gap energy values were analysed. The elemental compositions of thin films were analysed using laser induced breakdown spectroscopy (LIBS). LIBS analysis were carried out using a 4,4 ns pulsed Nd:YAG laser runing at 20 Hz repetation rate and radiation emitted from thin films were recorded by BAKİ spectrometer. The structure and the optical characteristics were investigated using XRD, SEM, UV/Vis spectrophotometer.

Thin Film Growth & Epitaxy

PA084

Plasma-Assisted Approach for Developing Janus Nanofibers that Improve Cell Proliferation and Extracellular Matrix Production

Mehmet Mutlu[1], Gizem Kaleli[1], Gözde Kabay[1], Zahida Sultanova[1], Özge Dincel[1], Bong Sup Shim[2]

[1]TOBB University of Economics and Technology, Plasma Aided Biomedical Research Group (pabmed), Ankara, Turkey
[2]Inha Unversity , Chemical Engineering Division, Incheon, Koreagkabay@ etu.edu.tr

Email of corresponding author: gozdekabay@gmail.com

Tissue engineering is an interdisciplinary field used for overcoming the deficiency of tissues and organs, and for restoring, maintaining, or improving their functions. One of the most common techniques is the seeding, culturing, and modulating of cells on three-dimensional biodegradable scaffolds followed by implantation in vivo. Thus, the three major tissue engineering tools are cells, extracellular matrix, and biochemical factors. Among them, the extracellular matrix should be continuously developed to meet the property and production requirements of tuning their physical scaffolding properties, biochemical and biomechanical cues for tissue morphogenesis, differentiation and homeostasis as well as standardized processes of guarantying quality of the ECM products. We focus on developing clean plasma assisted production processes for multiphase nanostructured extracellular matrix which has ideally natural level of material compositions, topographical structures, and biophysical functional properties, particularly suggesting for treating injuries of nervous system. To mimic 3D structure of cell environment, production of conductive nanofiber will be developed by using multiphase electrospinning process. Further polymerization step will be achieved by low pressure clean plasma process, instead of conventional electrochemical or wet chemical methods which may leave toxic residues in the implantable ECM. Mouse brain/neuroectodermal NE-4C neural stem cells (NSCs) will be cultured on the Janus type multifunctional nanofiber matrixes. Their proliferation will be accelerated by electrical stimulation through electrically conductive phase of the nanofibers. Furthermore, cell modulating drugs such as ascorbate will be stored on the biodegradable portions of the fibers to enhance extracellular matrix production conformable to the shape of NSCs as well as their neural networks. The main objective of the research is to develop a clean plasma assisted process for producing conductive nanofibers that improve cell proliferation and ECM production. We aim to develop multiphase nanofibers composed of biodegradable polycaprolactone (PCL) or poly(vinyl alcohol) (PVA) and electrically conductive Polypyrrole (PPy) or Poly(3,4-ethylenedioxythiophene) (PEDOT).

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PA085

Production and Development OF Yttrium Tantalate Niobate ($YTa_{0.85}Nb_{0.15}O_4$) Thin Film X-ray Phosphor via Sol-Gel Technique

Serdar YILDIRIM[1], Selim Demirci[2], Omer Mermer[3], Mustafa Toparlı[2], L. Zumre Alıcan Alıcıkus[2], Fadime Akman[2] and Erdal Celik[2],

[1]*Dokuz Eylül University, Center for Production and Applications of Electronic Materials (EMUM),TURKEY*
[2]*Dokuz Eylül University*
[3]*Ege University*

Email of corresponding author: serdar.yildirim@deu.edu.tr

Monoclinic yttrium tantalate (M`-$YTaO_4$), yttrium niobate ($YNbO_4$) and yttrium tantalate niobate ($YTa_xNb_{1-x}O_4$) are efficient X-ray phosphors used in X-ray medical imaging, in which these phosphors are used in films/screen cassettes, and also in electronic detector systems such as computed radiography, computed tomography and fluoroscopy. Performances of these phosphors are related to composition, crystalline structure, surface properties and luminescence properties of films. In this study, yttrium tantalate niobate ($YTa_{0.85}Nb_{0.15}O_4$) films were synthesized by five steps sol-gel spin coating route on single crystal silicon substrate. And then these films were dried at 120 ^oC and were sintered at 1200 ^oC for 4 hours and slowly cooled to room temperature. The obtained films were characterized by means of X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), atomic force microscopy (AFM), differential thermal analysis (DTA) and nanoindentation (with berkovich indenter). After sintering, monoclinic $YTa_{0.85}Nb_{0.15}O_4$ phase was obtained.

Thin Film Growth & Epitaxy

PA086

The Effect of the Crystalline Order on Magnetic Properties of Mn Implanted TiO_2

O.Yildirim[1;2], S. Cornelius[1;2], M. Butterling[3], W. Anwand[3], A. Wagner[3], A. Smekhova[4], C. Baehtz[1;5], K. Potzger[1]

[1] *Institute of Ion Beam Physics and Materials Research*
[2] *Technische Universität Dresden, D-01062 Dresden, Germany*
[3] *Institute of Radiation Physics, Helmholtz-Zentrum Dresden-Rossendorf e.V. , D-01328 Dresden, Germany*
[4] *Lomonosov Moscow State University (MSU), Faculty of Physics, Moscow, Russia*
[5] *Rossendorf Beamline, European Synchrotron Radiation Facility, F-38043 Grenoble*

E-mail of Corresponding Author: o.yildirim@hzdr.de

As one of the most promising candidates for a diluted magnetic oxide material for spintronic and magneto optic applications, transition metal (TM) doped titanium dioxide (TiO_2) has been extensively studied for last two decades. Up to date room temperature ferromagnetism (RTFM) has been reported for different types of TM dopants and also different types of preparation methods, such as ion implantation [1] or magnetron sputtering [2]. There is an ongoing debate on the origin of the observed ferromagnetic properties of TiO_2, whether RTFM arises from unwanted clustering of the TM atoms, magnetic contamination from sample handling or the desired substitution of Ti by the TM dopants.
We have investigated Mn implanted TiO_2 films with respect to the effect of the crystalline structure of the pristine film on the magnetic properties of the doped films. The films were prepared by DC magnetron sputtering using a high purity oxygen deficient ceramic TiO_{2-x} target in Ar/O_2 atmosphere. $SrTiO_3$ (100) single crystals were used as substrates. In order to achieve different structures of TiO_2, namely amorphous, polycrystalline anatase and epitaxial anatase, different substrate temperatures and post-growth annealing were applied. The as-prepared TiO_2 samples have been implanted with Mn ions of 30 keV to 190 keV kinetic energy and variable fluence resulting in a homogenous Mn concentration of 5 at.% within a 150 nm thin layer below the film surface.

The structural changes upon implantation were followed by means of X-ray diffraction (XRD) measurements. Comparison of the diffraction patterns indicates ion-induced damage in the epitaxial film and the formation of Mn containing secondary phases in the polycrystalline material. Depth resolved defect concentration profiles of as-grown and Mn implanted films were determined by means positron annihilation spectroscopy (PAS) measurements based on Doppler broadening spectroscopy. Magnetometry measurements of Mn implanted films reveal ferromagnetism for amorphous and polycrystalline films whereas paramagnetism is observed for epitaxial films. The local environments of implanted Mn ions in different TiO2 structures were probed by X-ray absorption spectroscopy (XAS) in fluorescence mode. In summary, we have found a significant influence of the as-grown film structure on the magnetic properties of Mn:TiO_2. During the presentation the PAS and XAS data will be discussed with respect to the presence of defects and secondary phases in the Mn doped TiO_2 films.

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[1] V. Shutthanandan et al. Appl. Phys. Lett. 84, 22 (2004)
[2] F.M. Liu et al. Nuc. Ins. and Met. in Phys. Res. B 267, 3104-3108 (2009)

Thin Film Growth & Epitaxy

PA087

A Study of TiAlN Thin Films Deposited by Rf Magnetron Sputtering

Amina Zouina AIT DJAFER[1], Nadia Saoula[2], Daniel Wamwangi[3] and Abdellatif Zerizer[1]

[1]*Laboratory of minerals and composites, UMBBoumerdes, Boumerdes, Algeria.*
[2]*centre de developpement des technologies avancées, Alger, Algérie*
[3]*University of witwaterstrand, Johannesburg, South Africa*

E-mail of Corresponding Author: zouina amina az.aitdjafer@gmail.com

Thin films based on nitrides of transitional metal produced by physical vapour deposition (PVD) techniques are extensively used for cutting and forming tools and wear applications, such as TiN. Recently, ternary nitride TiAlN is used to provide better properties to TiN. In fact, the addition of Al to TiN increases hardness, improves the oxidation resistance and decreases coefficient of friction.

In this study, we present the effect of plasma deposition parameters on the characteristics of TiAlN thin films. The elaboration of our films has been carried out by RF-Magnetron Sputtering (13.56 MHz) under argon and nitrogen atmosphere at low pressure and target of titanium aluminum. These films were deposited onto silicon, glass and steel substrates. We have studied the influence of different plasma deposition parameters on the properties of TiAlN thin films.

Thin Film Growth & Epitaxy

PA088

Influence of Substrate Temperature and Pulse Rate on the Structural and Luminescence Properties of $(Y\text{-}Gd)_3Al_5O_{12}:Ce^{3+}$ Phosphor Thin Films Grown by Pulsed Laser Deposition.

Ali Wako[1], Fancis B. Dejene[1] and Hendrik C. Swart[1]

[1]*University of the Free State, Physics Department, South Africa*

E-mail of Corresponding Author: wakoah@qwa.ufs.ac.za

Pulsed laser deposition (PLD) technique was used to grow thin films of commercial $(Y\text{-}Gd)_3Al_5O_{12}:Ce^{3+}$ (YGAG:Ce) phosphor on Si(100) substrates with a 266nm Nd-YAG laser. The effect of substrate temperature vis a vis laser pulse repetition rate on the structure, morphology and photoluminescent (PL) properties of (YGAG:Ce) thin films were investigated. In vacuum, the XRD profiles reveal no great change at 100 ^{0}C with varying pulse rates but shows that the material becomes amorphous at 200 ^{0}C and crystallizes at 300 ^{0}C substrate temperatures for 18000 pulses respectively favoring growth in the (420) direction. The PL intensities were found to increase with increasing substrate temperatures for films deposited in vacuum at 6000 pulse rate. However as the pulse rate was raised, the PL intensity dropped at 300 ^{0}C substrate temperature for 18000 pulse rate.

Thin Film Growth & Epitaxy

PA089

Modeling of Nanosecond Pulsed Electron Beam Ablation: Heating and Sublimation of a Graphite Target.

Muddassir Ali[1] and Redhouane Henda[1]

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[1]*Bharti School of Engineering, Laurentian University, 935 Ramsey Lake Road, Sudbury, ON P3E 2C6, Canada*

E-mail of Corresponding Author: rhenda@laurentian.ca

Electron beam ablation is a complex process, which comprises heating, phase change, and removal of a fine fraction from the target surface. A two stage, one-dimensional heat conduction model is presented to describe the heating and sublimation of a graphite target upon interaction with a polyenergetic electron beam. The influence of the Knudsen layer just above the target surface during ablation is taken into account. In this work, the beam delivers intense electron pulses of 100 ns with energies up to 15 keV and an electric current of 400 A. The effect of the distance between the electron beam tube output and target surface on ablation is assessed. The fraction of beam electrons that are effectively used during ablation is accounted for through the efficiency factor. The temperature distribution, surface receding velocity, ablation depth, and ablation rate for the graphite target are numerically simulated by the finite element method. For an efficiency factor of 0.6, the simulation results indicate that the target surface can reach up to 7500 K at the end of the pulse duration. The surface begins to vaporize within 30 ns from the pulse start. Under the same process conditions, the surface ablation rate is about 4 μg/mm^2. The results obtained by the model are compared with available experimental data in the literature. The estimated ablation rate is in good agreement with experimental data at lower efficiency factors.

Thin Film Growth & Epitaxy

PA090

Red Emitting Eu-doped YVO_4 Thin Film Phosphors Prepared by PLD

Foka Kewele[1], B.F Dejene[1] and H.C Swart[1]

[1]*University of the Free State, Physics, South Africa*

E-mail of Corresponding Author: fokake@gmail.com

The oxide thin film phosphors are highly attractive in use of the FED devices because of its advantages such as mechanical stability and better thermal. YVO_4 has attracted great interested as an excellent laser medium and a host material of the rare earth ions for the phosphors. YVO_4:Eu^{3+} is one of the leading red phosphor materials for LEDs. Eu–doped YVO_4 phosphors have been deposited on silicon substrate using pulse laser deposition (PLD) technique. In this report the films were grown at the various substrate temperatures and oxygen pressure. The substrate temperatures were changed from 100 to 300 ^{o}C. The structural characterization and the surface morphology of the YVO_4:Eu^{3+} thin films were investigated using the X-ray diffraction (XRD), scanning electron microscopy (SEM) and atomic force microscope (AFM). The results of XRD results of XRD showed that the films were preferentially oriented at (200). AFM revealed the consisted of homogeneous grains. The photoluminescence spectra were measured using Cary Eclipse Fluorescence spectrophotometer. YVO^4:Eu^{3+} has the strong red emission peak at 619 nm corresponding to ^5D_o-$^7F_2$ transition, by the energy transfer to Eu^{3+} ion following absorption of UV light in the $VO4^{3-.}$ The crystallinity, surface morphology and photoluminescence spectra of the thin-films were observed to depend on the deposition conditions.

Thin Film Growth & Epitaxy

PA091

Measurement and simulation of point defects and trapping centers in lightly B-doped silicon for photovoltaic application

A. Dussan[1], F. Mesa[2] and B. A. Paez-Sierra[3]

[1]*Dpto. Física, Grupo de Materiales Nanoestructurados, Universidad Nacional de Colombia, Bogotá, Colombia*
[2]*Unidad de Estudios Universitarios, Universidad del Rosario, Cra. 24. No. 63c-69 Bogotá, Colombia*
[3]*Thin films and Nanophotonics Group, Pontificia Universidad Javeriana, Bogotá Colombia*

Email of corresponding author: adussanc@unal.edu.co

In this work, conductivity measurements were performed in a wide temperature range (120 < T < 420 K) to microcrystalline silicon thin films boron compensated. It was observed that all curves are determined by two slopes that characterize the regions of high (T > 300 K) and low temperatures (T < 300K). It was established that the linear behavior for the region of T < 300 K is related to intrinsic defects in the material, while low-temperature region is mainly due to extrinsic vacancies in the material. From the ratio of Arrhenius activation energies were ob-tained from each of the samples. It was observed, that the transport for the high temperature region has a thermally activated behavior with single activation energy. We present a simulation of the variation of conductivity considering the presence of inherent defects in material and those introduced from impurities. The trap parameters and trapping centers have been determined by various methods of analysis, and they agree well with each other. There was a good fit between the curves of simulated and experimentally obtained conductivity for all samples of Si.

Optical, Optoelectronic and Dielectric Coatings

PA092

Characterization of VO_2 Films by X-Ray Photoelectron Spectroscopy (XPS)

A. Cantas[1], H.Yuce[1], M. Ozdemir[1], G. Aygun[1] and L. Ozyuzer[1]

[1]*Department of Physics, İzmir Institute of Technology, Urla, 35430, İzmir, TURKEY*

E-mail of Corresponding Author: aytencantas@iyte.edu.tr

Vanadium oxide (VO_2) is the superior material with its property of metal-insulator transition (MIT) at about 68 ºC accompanied by a structural phase transition from low-temperature monoclinic to high-temperature tetragonal rutile (R) phase [1]. In addition, MIT characteristics induced by electric field (E-MIT) is attracting considerable attention to VO_2 for applications to ultrafast switching, thermal relay device, and optical storage elements.

Owing to these applicabilities, in this study, VO_2 films were grown on sapphire (Al_2O_3) by radio frequency reactive magnetron sputtering technique. The crystalline structure of VO_2 samples were analyzed by X-ray diffraction (XRD). The chemical composition and atomic concentration were examined in detail with X-Ray Photoelectron Spectroscopy (XPS). The characteristic peaks belong to VO_2 were searched with Raman Scattering technique. The detailed results were under investigation.

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[1] W.W. Li, J.J. Zhu, J.R. Liang, Z.G. Hu, J. Liu, H.D. Chen, and J.H. Chu, J. Phys. Chem. C, 115, 23558–23563 (2011).

Thin Film Growth & Epitaxy

PA093

Growth and Characterisation of Electrodeposited ZnO Thin Films

N. Ait Ahmed[1, 2], H. Hammache[1], S. Sam[2], L. Makhloufi[1], N. Gabouze[*2].

[1]*Laboratoire d'Électrochimie, Corrosion et de Valorisation Énergétique (LECVE), Université A. Mira. Bejaia*
[2] *Centre de Recherche en Technologie des Semiconducteurs pour l'Energétique (CRTSE),*

E-mail of Corresponding Author: aitahmed.nadia97@gmail.com

The electrochemical method has been used to deposit zinc oxide (ZnO) thin films from aqueous zinc nitrate solution at 70 °C onto indium thin oxide (ITO) coated glass substrates. ZnO thin films were grown between − 0.500 and − 1.5 V vs SCE as established by voltammogram. The as-prepared nanostructured ZnO was characterized by X ray diffraction (XRD), scanning electron microscope (SEM) and for its structure and surface morphology. XRD results showed (002) oriented ZnO seed layer growth. Surface morphology study revealed the cluster of ZnO nanocrystals with hexagonal shape. The ZnO nanostructures prepared under the optimized growth conditions showed an intense UV emission as confirmed by photoluminescence spectroscopy, thus demonstrating the formation of defect free structure.

Keywords: Electrodeposition; ZnO; X-ray diffraction; Photoluminescence; Morphology.

Thin Film Growth & Epitaxy

PA094

Structural and Magnetic Properties $La_{0.7}Sr_{0.3}MnO_3/LaNiO_3$ Superlattices Prepared by RF Sputtering

Hsin-Yi Lee[1] and Heng-Jui Liu[2]

[1]*National Synchrotron Radiation Research Center, Scientific Research Division, Taiwan*
[2]*Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu 300, Taiwan*

E-mail of Corresponding Author: hylee@nsrrc.org.tw

Magnetic oxide superlattice films have caused much intensive research for their technological use in magnetic recording media and sensors. In tis work, we have grown the symmetry $La_{0.7}Sr_{0.3}MnO_3/LaNiO_3$ (LSMO/LNO) superlattices on (001) $SrTiO_3$ substrate by rf sputtering. X-ray diffraction measurements show the superlattice films deposited at a higher temperature have a more greatly strained state and better crystalline quality than for the films deposited at a lower temperature. However, the superlattice would produce the self-organized grains when the deposition temperature reach as high as 750℃. From magnetic hysteresis loops, the coercive field (Hc) and magnetocrystalline anisotropy can be seen as strain dominated due to lattice distortion, except for the superlattice films deposited at 750℃. The self-organized grains exhibit unique magnetic properties from others such as higher saturation magnetization and more square like the shape of hysteresis loops.

Thin Film Growth & Epitaxy

PA095

Effect of Hydrogen on the Properties of Hydrogenated Amorphous Silicon Carbide (a-SiC:H) Thin Films, Studied by FTIR and Spectroscopic Ellipsometry.

Amer BRIGHET[1] and Mohamed Kechouane[1]

[1]*USTHB University, Physics of materials, Algeria*

E-mail of Corresponding Author: amer_brighet240@yahoo.fr

In this work, we have deposited the hydrogenated amorphous silicon carbide (a-SiC:H), by DC magnetron sputtering, to investigates the effect of the hydrogen content on the optical and stochiometric properties. In this purpose, a serie of samples was deposited at a constant optimum temperature, at 300°C, with varying hydrogen flow during the growth of layers. The samples have been extensively investigated by different technique such as Fourier Transform Infrared (FTIR) absorption, spectroscopic ellipsometry and electrical measurements. The concentration of hydrogen was determined from FTIR spectra, whereas spectroscopic ellipsometry has been proven to be an important tool for the determination of several parameters of a-SiC:H films, so we used the Tauc-Lorentz model to the interpretation of the results of ellipsometry, where they correspond to those of the optical transmission and they have a correlation with the results of corresponding FTIR spectra, we noticed that the optical bandwidth (Eg) of the film increases from 1.6 eV to 2.3 eV with the increasing in hydrogen content, even the hydrogen content has influenced the electrical behavior of the material.

Thin Film Growth & Epitaxy

PA096

Structural, Morphological and Optoelectrical Characterization of Bi_2S_3 Thin Films Grown by Co-Evaporation

F. Mesa[1], C.A. Arredondo[2] and W. Vallejo[3]

[1]*Unidad de Estudios Universitarios, Universidad del Rosario, Cra. 24 Nº 63C-69, Bogotá, Colombia E-mail: fredy.mesa@urosario.edu.co*
[2]*Facultad de Ingeniería, Universidad de Medellín, 87 N° 30 - 65, Medellín, Colombia*
[3]*Grupo de fotoquímica y fotobiología, programa de Química, Facultad de Ciencias Básicas, Universidad del Atlántico, Barranquilla, Colombia*

E-mail of Corresponding Author: fgmesar@unal.edu.co

This work presents results about of synthesis and characterization of polycrystalline n-type Bi_2S_3 thin films. The films were grown by a chemical reaction from co-evaporation of their precursor elements on a soda-lime glass substrate. The effect of the experimental conditions on the optical, morphological structural properties, the growth rate and the electrical conductivity was studied through spectral transmittance, X-ray diffraction (XRD), atomic force microscopy (AFM) and versus T measurements, respectively. The results showed that, the films grow only in the orthorhombic Bi_2S_3 bismuthinite phase. It was also found that the Bi_2S_3 films present an energy band gap (Eg) of about 1.38 eV, regardless of the thickness of the samples. In addition to these results, the electrical conductivity of the Bi_2S_3 films was affected by both the transport of free carriers in extended states of the conduction band and for variable range hopping transport mechanisms, each one predominating in a different temperature range.

Thin Films in Photovoltaic Cells and Energy

PA097

Conversion treatment of thin chromium layers deposited on high carbon steel substrates

Younes BENARIOUA[1]

[1]*M'sila University, Mechanical engineering, Algeria*

Email of corresponding author: benariouayounes@yahoo.fr

The use of transition metal carbides as material coatings to improve the mechanical and chemical properties of mechanical parts has shown a large and extensive development. Among these metal compounds, chromium carbides film which has a better chemicals and mechanicals properties can be used as candidate for this purpose. Coatings of chromium carbide films deposited by different deposition techniques including chemical and physical vapour deposition present a low adhesion to their substrates which is considered as disadvantage.

The aim of the present paper is to obtain chromium carbide thin film having a better mechanical behaviour by annealing treatment of chromium films deposited on high carbon steel substrates. In the first step of this study, high carbon steel substrate is covered with a pure chromium thin layer deposited by electrolytic method. In the next step, samples (layer / substrate) were exposed to annealing at different temperatures ranging from 400°C to 1200°C in steep of 100°C. The structure and morphology of the layers were investigated respectively by X-ray diffraction and scanning electronic microscopy. The adhesion and hardness of films were measured by means of a scratch tester and microhardness tester.

It was observed that the film was totally, partially or not transformed into chromium carbide, depending on heat treatment temperature. The transformation of chromium layer in chromium carbide takes place firstly at the interface between the film and the substrate, then it expands through the whole film thickness, toward the outer surface, by diffusion of carbon coming from the substrate. As a result, complete transformation of the chromium film in chromium carbide is obtained when an annealing temperature of 1200°C is used. A higher adhesion and hardness, is found for this coating if compared to the one obtained on samples treated at lower temperatures and to other literature data on coatings having similar thickness and composition.

Thin Film Growth & Epitaxy

PA098

Plasma Chemical Deposition of Nancomposite Polymer-based Coatings with Controlled Release of Biocide Agents

Alexander Rogachev[1], V.E. Agabekov[2], A.V. Rahachou[3], M.A. Yarmolenka[3] and D.V. Tapalski[4],

[1]*Francisk Scorina Gomel State University, Physics, Belarus*
[2]*Institute of Chemistry of New Materials, National Academy of Sciences of Belarus, Minsk, Belarus*
[3]*Francisk Scorina Gomel State University, 104 Sovetskaya str., Gomel, Belarus 246019*
[4]*Gomel State Medical University, 5 Lange str., Gomel, Belarus 246000*

E-mail of Corresponding Author: rogachev78@mail.ru

The composite blends and layered polymer-biocides coatings were deposited from active gas phase formed by electron beam dispersion of polymer and biocide agent in vacuum. Antimicrobial substances (ciprofloxacin) and silver nanoparticles were used as biocide agents. Polyurethane (PU) and poly(L-lactic acid) (PLLA) were used as matrix material of coatings.
The morphology, molecular structure, biocompatible and antibacterial properties of synthesized coatings have been studied. The ciprofloxacin and silver release experiments were performed on the titanium substrate by washing them in phosphate buffered saline for a period of 6 days. Influence of substrate plasma pretreatment, thickness and kind of polymer matrix onto drug release rates were evaluated to predict and understand formation of thin delivery systems with prolonged effect."

Thin Films in Biology

PA099

Horseradish peroxidase enzyme immobilization on modified porous silicon for hydrogen peroxide detection

Amel Lounas[1], Yannick Coffinier[2], Nourerdine Gabouze[1], Sabrina Sam[1], Khadidja Khaldi[1], Rabah Boukherroub[2]

[1]Centre de Recherche en Technologie des Semi-conducteurs pour l'Energétique (CRTSE), 02 Bd Frantz Fanon B.P. 140 Alger 7 Merveilles, Alger, Algérie
[2] Institut de Recherche Interdisciplinaire (IRI, USR 3078), Université de Lille1, Parc de la Haute Borne, 50 Avenue de Halley, BP 70478, 59658 Villeneuve d'Ascq, France

Email of corresponding author: lounasamel@yahoo.fr

The accurate determination of hydrogen peroxide (H2O2) plays an important role in many fields including industry, clinical control and environmental protection. In this work, one kind of surface modification method on porous silicon wafer was proposed by chemical silanization using 3-aminopropyltriethoxysilane (APTES) to immobilize horseradish peroxidase (HRP). The silanization was carried out by the formation of Si-O-Si covalent bond via the reaction of the Si-OH surface with silane groups. The resulting surface is covered by amino groups that could react with terminal acid groups on the enzyme after their transformation to succinimidyl ester termination. This reaction, called activation, is achieved using N-hydroxysuccinimide (NHS) in the presence of the water soluble N-ethyl-N'-(3-dimethylaminopropyl)-carbodiimide (EDC). The enzymatic activity of immobilized HRP was determined by a colorimetric test based on the HRP-catalyzed oxidation of 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid (ABTS) in the presence of hydrogen peroxide (H_2O_2).

References
[1] A. Heilmann, N. Teuscher, A. Kiesow, D. Janasek, U. Spohn, Journal of Nanoscience and Nanotechnology 2003, 3, 1-5.
[2] Qi. Wang, A. Kromka, J. Houdkova, O. Babchenko, B. Rezek, M. Li, R. Boukherroub, S. Szunerits, Langmuir 2012, 28, 587-592.
[3] A. Kermad, S. Sam, N. Ghellai, K. Khaldi, N. Gabouze, Materials Science and Engineering B 2013, 178, 1159-1164.

Thin Films in Biology

PA100

Study of immobilized-acetylcholınesterase on modified porous silicon surface

KHALDI Khadidja[1], Sabrina SAM[1], Amel LOUNAS[1], Nacera GHELLAI[2] and Noure-Eddine GABOUZE[1]

[1] CRTSE, 2 bd Frantz Fanon, BP 399, Alger-Gare, Algiers, Algeria
[2] URMER Université Abou Bekr BELKAÏD TELMCEN ALGERIA

Email of corresponding author: khadidjaphy@yahoo.fr

The reliability of the biochips device strongly depends on the control of the immobilization of biological probes on the solid surface. From this viewpoint, covalent immobilization of the probes has been recognized as an attractive strategy , since it offers the best performance in terms of stability and can be made reproducible with a high yield. Many aspects of covalent probe immobilization procedures are common to all of the above-mentioned biochipes. In this work, it was reported the functionalization of porous silicon for Acetylcholinesterase immobilization. Porous silicon surfaces were first hydroxylated with hydrofluoric/nitric acid (HF/HNO_3), followed by silanization with APTES, the AChE enzymes were dissolved in PBS x1 then mixed with EDC (1-ethyl- 3-[3-dimethylaminopropyl]carbodiimide hydrochloride) and NHS (N-hydroxysulfosuccinimide) solution to activate the terminal acid groups on the enzym and finally incubated with silanized surfaces.the morphologie of elaborated porous silicon were characterized by scanning electron microscopy. The infrared spectroscopy (FTIR) and contact angle measurements were used to investigate the different steps of functionalization. The enzymatic activity of immobilized AChE were determined with a colorimetric test based on the AChE catalyzed the substrate acetylthiocholine, the thiolate produced will then be reacted with 5,5'-dithiobis(2-nitrobenzoic acid) to produce a colored product.

Thin Films in Biology

PA101

Synthesis of $(CH_3NH_3)PbI_3$ Organic/inorganic Hybrid Perov-skite on TiO_2 Nano-structure Layer for Solar Cell Application

Hamid-Reza Bahari[1], A.A. Umar[2], M.M. Salleh[2] and R. Turan[1]

[1]*Center for Solar Energy Research and Applications (GÜNAM) and Department of Physics, Middle East Technical University (METU), 06800 Ankara, Turkey*
[2]*Institute of Microengineering and Nanoelectronics (IMEN), Level 4, Research Complex, National University of Malaysia (UKM), 43600 Bangi, Selangor, Malaysia*

Email of corresponding author: hr.bahari.59@gmail.com

Recently discovered perovskite solar cells, using methylamine lead iodide provskite material as the heart of the solar cell, shows a great potential for next generation of cheap and efficient photovoltaic cells (Heo et al.; 2013). In the suggested solar cells, the perovskite material normally combined with mesoporous TiO_2 as cathode material contacted to a conductive glass such as FTO or ITO coated glass. Although, in some interesting reports Al_2O_3 (as electron blocker) (Lee et al.;2012) or ZnO (Liu and Kelly, 2013) are used in mesoporous form or thin dense film; but, still fabrication of these kind of solar cells by using of mesoporous TiO_2 layers absorbs interest of many research groups. In this regard, fabrication of mp-TiO_2/peroveskite layers such that the incorporation material with highest effective contact is of great interest. In this report we investigate two-step deposition technique for fabrication of mp-TiO_2/$CH_3NH_3PbI_3$ on ITO coated glass. The mp-TiO_2 is provided by liquid phase deposition (LPD) method for synthesis of TiO_2 nanograss. The perovskite is synthesized by deposition of 1 molar PbI_2/DMF solution on TiO_2 nanograss layer and dipping into different $CH_3NH_3I_2$ solutions. In this research, morphology, crystallization and optical properties of the layers were investigated. Hexagon sheets or polyhedron structures of provskites with different crystallization and different light harvesting capability were found. In summary, we found that perovskite material synthesized by using of methylamine iodide diluted by ethanol shows quite better nanoscopic in-corporation with TiO_2 nanograss layer (Figure 1). In addition, photoluminescence (PL) spectra show lower emission intensity for sample dipped in ethanol-diluted methylamine iodide solution that is related to better electron transfer to TiO_2 nanograss after exiting the lowest exciton energy of 3D perovskite material.

Keywords: Organic/inorganic provskite materials, TiO_2 nangrass meso/nanoporous layer, Solar cell application, Surface morphology, Optical properties.

<Fig.1> Fig1: FESEM image illustrating perfect incorpo-ration of $CH_3NH_3PbI_3$ perovskite material (prepared by ethanol diluted solution in room temperature) with TiO_2 nanograss (the bar bellow the figure is shows a 100 nm). White needle like materials are TiO_2 nanograss, while the grey covering is related to provskite (Arrows are drown to guide the eye). Merging of two materials in nanometric level can be seen in this figure.

References:
Heo, et al., (2013), Nature Photonics 7, 486-491
Lee, et al., (2012), Science 338, 643–647.
Liu, et al., (2013), Nature Photonics 8, 133–138

Thin Films in Photovoltaic Cells and Energy

PA102

Growth and Characterization and (NaOH)aq Treatment of Ga Doped ZnO Thin Films

Gundogdu Sahin[1], Enver Tarhan[1] and A. Halis Guzelaydın[2]

[1]*Izmir Institute Of Technology, Physics, Turkey*
[2]*Izmir Institute of Technology Deparment of Material Science and Engineering*

E-mail of Corresponding Author: gundogdusahin@iyte.edu.tr

Zinc oxide (ZnO) is a II-VI semiconductor with a direct band gap of 3.37 eV at room temperature. It has diverse fields of application owing to its electronic band structure and crystal structure, which results in interesting electrical, optical, and structural properties. In this work, we investigated the effect of gallium doping on the electrical and optical properties of high purity (99.99%) ZnO thin films. ZnO thin films with varying Ga concentrations were grown on glass substrates via RF magnetron sputtering. They were then treated in %10 (NaOH)aq solution at different temperatures and during varying time intervals in order to enhance their electrical conductivity, optical transmission, and structural stability. FTIR, Raman, and UV-VIS-NIR spectroscopies were used for optical characterization, 4-point probe and Hall mobility were employed for eletrical studies, and XRD, AFM, and SEM were used for structural characterization. After some initial analyses, optimum values of Ga dopant amount, the temperature and duration of (NaOH)aq treatment were assessed by systematically changing the growth parameters for repetitive growths. This work was primarily conducted to produce a TCO (transparent conducting oxide) material that is relatively cheap and having the most desirable optical, electronic and structural properties (mainly; a ‘high optical tranmission’ in the visible range with a ‘good electrical conductivity’ and structural durability for organic photovoltaic cell applications.

Thin Films in Photovoltaic Cells and Energy

PA103

Effect of Annealing Duration onto the Dark Current Transport Mechanism in CdTe/SdS Solar Cells

Sadan OZDEN[1], Adem DONMEZ[1], Cagdas KOCAK[1], Yasemin ALTINAY[1], Habibe BAYHAN[1], Murat BAYHAN[1], Jonathan MAJOR[2] and Ken DUROSE[2]

[1]Mugla Sıtkı Kocman Üniversity, Physics Department, Mugla, Turkey
[2]University of Liverpool, Stephenson Renewable Energy Institute, Liverpool, U.K

E-mail of Corresponding Author: sozden@mu.edu.tr

The current transport mechanisms in thin film CdTe/CdS solar cells have been studied extensively in the literature. Several models have been proposed to explain temperature dependent current – voltage (I-V) characteristics of these cells. In this work, we have investigated the dark forward current transport mechanism in CdTe/CdS solar cells treated with CdCl{2} at different annealing durations. All I-V characteristics have exhibited a clear rollover behavior at voltages approximately greater than 0.6V. This was explained by the blocking effect of the back contact. Recombination at heterojunction interface was found to be the dominating route for the current transport at temperatures above than 200K. However at temperatures lower than this value, a tunneling type mechanism was determined.

Thin Films in Photovoltaic Cells and Energy

PA104

Replacement of Amorphous Silicon Layer with Silicon Sub-oxides in Silicon Heterojunction Solar Cells

Okan YILMAZ[1], O. Pehlivan[2], D. Menda[3], O. Ozdemir[3] and A. O. Kodolbas[4]

[1]*TÜBİTAK, UME, TURKEY*
[2]*TÜBİTAK National Metrology Institute, ozlem.pehlivan@tubitak.gov.tr*
[3]*Yıldız Technical University, Departmant of Physics, denebmenda@gmail.com*
[4]*TÜBİTAK Marmara Research Center, alposman.kodolbas@tubitak.gov.tr*

E-mail of Corresponding Author: okan.yilmaz@tubitak.gov.tr

Potential of silicon sub-oxides (a-SiO_x:H, x<1) for increasing the efficiency and decreasing the optical loses in silicon heterojunction solar cells was investigated by utilizing then as front intrinsic buffer layer and emitter layer. Development of cell characteristics was detected through I-V and QE measurements. The evolutions of the hydrogen content and hydrogen bonding configurations in the films were monitored by attenuated total reflection infrared spectroscopy (FTIR-ATR). Despite the observed QE improvement in cells with sub-oxides, standard cells show higher efficiency at STC. On the other hand, cell with silicon sub-oxides possesses high efficiencies at higher temperatures.

Thin Films in Photovoltaic Cells and Energy

PA105

Effect of Zinc Acetate Precursor Concentration in Structural and Optical Properties of Tin Doped and Undoped Zinc Oxide Thin Layers

Razika TALA[1], B.LARAB[2], S.BACHIR[2], F.BENSOUICI[2], M.TOUBANE[2], A.SLIMANI[2], N.E.H ARABI[2], A. IRATNI[2]

[1]*IGHIL University M'hamed bougara boumerdes, Institute of Electrical & Electronic Engineering, ALGERIA*
[2]*Unité de Recherche des Matériaux, des Procédés et Environnement, University M'hamed Bougara Boumerdes*

E-mail of Corresponding Author: t_razika@hotmail.com

Zinc oxide material is widely used in all photo electronic devices especially photovoltaics, in both organic and non organic solar cells.

The present work focus on the study of the structural and optical properties of tin doped zinc oxide ZnO:Sn and undoped zinc oxide ZnO deposited by spray pyrolysis technique.

A variation in zinc acetate concentration has been made. Two values have been taken 0.4 mol/l and 0.5 mol/l. Doped zinc oxide layers have realized by adding $SnCl_4$ in the sprayed solution.

After that, many characterizations have been carried out like X-ray diffraction method for structural properties and spectrophotometry for optical properties.
For 0.4mol/l zinc acetate precursor concentration, a high cristallinity for tin doped zinc oxide layers compared to undoped ones, while in 0.5 mol/l zinc acetate the inverse occurs between doped and undoped layers.

It has been found that for both zinc acetate concentrations, tin doping shifts energy gap to lower values. While temperature substrate increases energy gap from 3.29 eV at 400°C to 3.10 eV at 500°C.

Thin Films in Photovoltaic Cells and Energy

PA106

Effect of Anodic Polarization on the Free-Floating Parts at Pt/YSZ Catalyst Electrode

Arafat Toghan[1]

[1]*Friedrich-Alexander-Universität Erlangen-Nürnberg Lehrstuhl für Physikalische Chemie II Germany*

E-mail of Corresponding Author: arafat.toghan@yahoo.com

Photoemission electron microscopy (PEEM) was used as spatially resolving method to explore the effect of electrochemical pumping with a positive voltage to porous platinum electrodes interfaced as working electrode to yttrium stabilized zirconia (YSZ). The experiments were conducted under UHV conditions ($p \approx 10^{-9}$ mbar). In PEEM a uniform rapid darkening of the Pt surface was observed during anodic polarization followed by the appearance of a bright spots on a dark background. The bright spots observed in PEEM images are due to zirconia reduction around electrically isolated Pt islands.

Thin Films in Photovoltaic Cells and Energy

PA107

Effects of Silver Doping on Nano Structured CdS Thin Films Sublimated by CSS Technique

Waqar Mahmood[1], Nazar Abbas Shah[1]

[1]*COMSATS IIT, Physics, Islamabad*

E-mail of Corresponding Author: rajawaqarmahmood@comsats.edu.pk

Cadmiium zinc telluride (CZT) thin films of varying thickness 900 nm to 1200 nm have been deposited on to a glass substrate using multilayer method under vacuum. In the first step, cadmium telluride (CdTe) was deposited on to an ultrasonically cleaned glass substrate. And in next step zinc telluride (ZnTe) thin film was evaporated on to a CdTe thin film to make cadmium zinc telluride (CZT). After fabricating CZT of desired thicknesses, selected samples were annealed under vacuum to optimize the annealing temperature for better structural and optical properties. The conditions of growth and annealing played an important role on crystallite size in structural analysis and optical properties e.g. transmission, energy band gap etc.The crystallite size of as deposited CZT thin films were estimated 35 to 50 nm for different thicknesses also after annealing it was upto 60 nm. The value for energy band gap varies from 1.48 eV for as deposited CZT samples. These changes were occurred due to

Thin Films in Photovoltaic Cells and Energy

PA108

Annealing Effect on the Structural and Optical Properties of Pt –Al_2O_3 nanocoatings for high temperature solar-thermal applications

Zebib Yenus Nuru[1], C.J. Arendse[2] and M.Maaza[3,4]

[1]*iThemba LABS, Nationa Research Foundation, Material Science, South Africa*
[2]*Dept. of Physics, University of Western Cape, Private Bag X 17, Bellville, 7535,South Africa,*
[3]*UNESCO-UNISA Africa Chair in Nanosciences/Nanotechnology, College of Graduate Studies, University of South Africa (UNISA), Muckleneuk ridge, POBox 392, Pretoria-South Africa.*
[4]*Nanosciences African Network (NANOAFNET), iThemba LABS-National Research Foundation, Old Faure road,7129, Somerset West, South Africa.*

E-mail of Corresponding Author: zebibnate@yahoo.com

To improve the efficiency of photo-thermal collectors, development of spectrally selective solar absorbers with good performance, durability and reproducibility is of prime importance. Especially at high temperature, thermal stability and microstructure are critical to enhance the operating temperature, and withstand the degradation performance. Spectrally selective Pt-Al_2O_3 cermet nanocoatings were deposited onto Mo coated stainless steel substrate by using planar radio frequency sputtering technique. The microstructure and optical properties of the coatings as deposited were reported in the previous work. In this contribution, the studies were carried out to access the high temperature (above 400^{o}C) thermal stability of Pt-Al_2O_3 selective solar absorber nanocoatings with and without Al_2O_3 antireflection layer. The coatings were annealed at different temperatures for 2 h in vacuum. The samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive x-ray spectroscopy (EDS), Atomic force microscopy (AFM), Raman spectroscopy, UV-vis spectrophotometer and emissometer. The selective Pt-Al_2O_3 cermet solar absorber nanocoatings with Al_2O_3 protective layer were found to be stable up to 800oC, having spectral selectivity of 0.95/0.1. However, the coatings without Al_2O_3 protective layer showed a decrease in solar absorptance from 0.93 to 0.91 and thermal absorptance from 0.17 to 0.16 after heating at 600^{o}C, which is attributed to the oxidation of the surface, and diffusion of the layers.

Thin Films in Photovoltaic Cells and Energy

PA109

Structural and Optical Properties of TCO Thin Films Deposited by Rf Magnetron Sputtering

Petronela Garoi[1]

[1]*National Institute for Laser, Plasma and Radiation Physics Lasers, Romania*

E-mail of Corresponding Author: petronela.garoi01@gmail.com

The most interesting potential applications for TCO (e.g. ITO and SnO_2) include photovoltaic cells on flexible and transparent substrate.

The synthesis of these two oxides was performed using rf magnetron sputtering deposition method on flexible substrate from individual pure targets, that allow for thin films with a good stoichiometry to be obtained.

ITO and SnO_2 thin films were characterized using SEM, XRD, and AFM techniques. Optical and stoichiometric characterization were also realized in order to identify the composition, structure and their quality as transparent and conductive contact electrodes.
Surface topography of the thin films was investigated by atomic force microscopy. Topography analysis indicate a smooth surface and a roughness of the order of nm, for the given samples.

Polycrystalline ITO and SnO_2 samples, deposited at room temperature are transparent with a transmission coefficient ranging between (80-90%) in the VIS and NIR.
Based on transmission spectra, optical parameters (i.e. absorption coefficient - α, extinction coefficient - k, and refractive index - n) were calculated; respectively the optical bandgap width of the TCO samples was computed.

Thin Films in Photovoltaic Cells and Energy

PA110

In_2S_3 Thin Films Buffer Layer Prepared by PVD Tehnique for Thin Film Solar Cells

Ammar Messous[1], Abdesselam Bouloufa[2] and Kamal Djessas[3]

[1]*Setif-1 University, Setif, Algeria*
[2]*Laboratory of Electrochemical and Materials, Ferhat Abbas Sétif-1 University, Algeria*
[3]*Laboratory of PROMES-CNRS, TECNOSUD, Perpignan University, France*

E-mail of Corresponding Author: messous_ammar@yahoo.fr

Thin films of indium selenide (In_2Se_3) used in this work have been prepared by thermal vacuum evaporation from a single source onto soda-lime glass substrates. High purety (99.9995%) In and Se were weighed according to the stoichiometric molar ratio. Layers were obtained at various substrate temperature (ambiente, 100 °C, 200 °C and 300 °C). The layer thickness of In_2Se_3 and evaporation rates were measured in situ by an h.f. quartz monitor and is ajusted about 260 nm for all samples.

The X-ray diffraction (XRD) patterns of In_2Se_3 thin films exhibits strong (301) preferred which correspond to β-In_2Se_3 phase, but at 300 °C a change in phase (α- In_2Se_3) have observed. The morphology of the films has been observed by scanning electron microscopy (Fig.1). The surface and cross section of a film at ambient temerature provide evidence that the films are very homogeneous, have a good adherence to the substrate. The EDS results exhibit that all samples have a quasi-stoichiometry atomic composition.

Electrical parameters of In_2Se_3 films deposited at different various subtrate temperatures were carried out with HMS5300 Hall effect system. All samples were n type. The electron concentration of films is about 6,53.1018 cm^{-3}, aresistivity of $9,73.10^{-2}$ Ω.cm and a mobility of 9,82 $cm^2V^{-1}s^{-1.}$

The energy band gap was estimated by a plot of Tauc assuming a direct permitted transition and fitting the absorption coefficient a on a range about (αhν) 2≈3.1011 $(eV/cm)^2$ (Fig.2). The values of band gap were between 2.10 and 2.53 eV.

Thin Films in Photovoltaic Cells and Energy

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Substrate Temperature Effect on Optical Properties of Sprayed β-In_2S_3 Thick Films

Noureddine Bouguila[1], A. Timoumi[1] and H. Bouzouita[1]

[1]*Faculty of Sciences of Gabes, Physics, Tunisie*
[2]*Photovoltaic and semiconductor materials laboratory, National Engineering School of Tunis, Belvedere PO Box 37, 1002 Tunis, Tunisia*

E-mail of Corresponding Author: nour.bouguila@fsg.rnu.tn

In_2S_3 thick films have been grown on glass substrates using spray pyrolysis technique. The deposition was carried out in a 613-773 K range of substrate temperature. Compressed nitrogen was used as a carrier gas. Optical properties of these films have been studied. These properties are related to the substrate temperature. Optical transmission and reflection measurements were carried out at room temperature in the wavelength range from 350 to 2800 nm. Optical transmission of 80 % has been achieved in the visible spectrum. In_2S_3 band gap energy in the range of 2,33–2,65 eV has been found.

The static refractive index n, the oscillation energy gap E_0 and the dispersion energy Ed were determinated using the Wemple-Didomenico model. The complex dielectric constants of In_2S_3 films have been calculated in the investigated wavelength range. It was found that the refractive index dispersion data obeyed to the single oscillator of the Wemple–Didomenico model, from which the dispersion parameters, the oscillation energy values and the high-frequency dielectric constant were determined. These films can be used as an optical windows in photovoltaic devices.

Thin Films in Photovoltaic Cells and Energy

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High Performance ZnO:Al Films on Flexible and Soda-lime Glass Substrates Prepared by Radio Frequency Reactive Magnetron Sputtering

Abdesselam Bouloufa[1] and Kamal Djessas[2]

[1]*Setif-1 University, Setif, Algeria*
[2]*Laboratoire Procédés Matériaux et Energie Solaire PROMES-CNRS, 66100 Perpignan, France*
E-mail of Corresponding Author: a_bouloufa@yahoo.fr

Highly transparent conducting Al-doped ZnO films with good adherence and low resistivity have been prepared on flexible substrates and soda-lime glass substrates using radio frequency (RF) reactive magnetron sputtering at various O_2:Ar ratio. Stable polycrystalline conducting ZnO:Al films having a highly preferred orientation (002) of the c-axis perpendicular to the substrates were obtained with low resistivities in the range of $1,81.10^{-2}$ ohm.cm to $7,64.10^{-2}$ ohm.cm, carrier densities more than 1021 cm^{-3} and Hall mobilities between 5.3 and 12.2 $cm^2V^{-1}s^{-1}$. The average transmittance exceeded 80% for all films in the visible spectrum. The quality of obtained films depended on sputtering power, O_2 pressures and compositions of used targets during film fabrication.

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Investigation of Si/ZnSnTe Heterojunction Growth and Device Properties

Hasan Huseyin Gullu[1], Arezoo Hosseini[1], Emre Coskun[1], Mehmet Parlak[1], Cigdem Ercelebi[1]

[1]*METU, Department of Physics,*

E-mail of Corresponding Author: hgullu@metu.edu.tr

The material properties of ZnTe, which belongs to the family of II–VI semiconductor compounds has attracted extensive research due to its optoelectronic and photovoltaic applications. In addition to the investigations on light emitting diode, photo-detector, THz emitters and detectors, there have been thin film applications in the field of solar cells. Direct band gap and high absorbance characteristics of this structure result in its thin film and Si based hetero-junction applications. Among these properties, in general ZnTe shows a p-type conductivity with a nature of high electrical resistivity. Therefore, to increase the conductivity values, doping process is required with an element such as In, Sn or Cu.

In this study, ZnSnTe thin film were deposited on n-type Si (111) mono-crystalline wafers having 1-3 Ω.cm resistivity and 600 μm thickness by sequential-sputtering from compound targets of SnTe and ZnTe. During the deposition process, the substrate temperature was kept at about 300°C.

Energy dispersive X-ray spectroscopy, X-ray diffraction, transmission and conductivity measurements were carried out to determine the film properties of the deposited ZnSnTe layer.

To identify the possible conduction mechanism and device parameters of the Ag/n-Si/p-ZnSnTe/In heterojunction diode structure, the temperature dependent current-voltage (I-V) characteristics of the heterojunction were measured and studied in the temperature range of 220–360 K. This p-n junction showed a good diode behavior with rectification ratio of two orders magnitude. The diode series and shunt resistance values were obtained from the dark I-V measurements about 10^3 Ω and 10^5 Ω respectively, depending on the sample temperature. Under this characterization, the ideality factor and the barrier height values of the diode were determined by performing different I-V plots.

Thin Films in Photovoltaic Cells and Energy

PA114

Aluminum Doped Zinc Oxides and Their Application in Dye Sensitized Solar Cells

Sule Erten Ela and Mesut Ekmekci

Ege University Solar Energy Institute 35100 Bornova, Izmir, Turkey

Email of corresponding author: suleerten@yahoo.com

Investigations show that the world will be dependent on fossil fuels for energy generation for at least the next 20 years. A reasonable solution to overcome this need is the use of renewable energy sources, like solar energy, that could in principle, fulfill our energy requirements with clean procedures and low prices [1-3]. The development of photovoltaic devices based on organic materials, suitable to convert solar energy into electricity is a challenging research field for many scientists around the world. In this study, aluminium doped zinc oxide nanostructures were prepared using microwave oven. ZnO nanostructures were synthesized from both zinc acetate and zinc nitrate precursors. All Al doped ZnO nanostructures were characterized by means of XRD and SEM techniques. The aluminium was doped to ZnO nanostructures with different concentrations. Dye sensitized solar cells were fabricated and characterized using aluminium doped ZnO nanostructures.

References

[1] J. L. Delgado, P.A. Bouit, S. Filippone, M. A. Herranza, and N., Martı´n, 2010. Chem. Commun, 46;5082–5084.
[2] S. Erten-Ela, S. Cogal, S. Icli , Inorganica Chimica Acta, 362 (2009) 1855.
32] a) S. Erten-Ela, J. Brendel, M. Thelakkat, Chemical Physics Letters, 510 (2011) 93.
b) S. Erten-Ela, A.C. Cakir, Energy Sources, Part A, 2014 in press.

Thin Films in Photovoltaic Cells and Energy

PA115

Raman and Optical Studies of Spray Pyrolysed Sb_2S_3 Thin Films

MEDLES Mourad[1], N. Benramdane[2], A. Bouzidi[2], K. Sahraoui[2], R. Desfeux[3] and C. Mathieu[3]

[1]*Laboratoire d'élaboration et de caractérisation des matériaux (LECM) electronique Algeria*
[2]*Université Djillali Liabbes, Algeria, nbenramdane@yahoo.fr;*
[3]*Université d'Artois, Faculté Jean Perrin, France, rachel.desfeux@univ-artois.fr;*

E-mail of Corresponding Author: m_medles@yahoo.fr

Thin films of Sb_2S_3 have been prepared by spray pyrolysis technique. Thiourea $(CS(NH_2)_2)$ and Antimony Trichloride ($SbCl_3$) have been used as starting chemicals for the thin films preparation. The film surface morphology has been analyzed using the AFM (Atomic Force Microscope) and revealed that crystallites of average size of 620 nm compose the films of Sb_2S_3. Raman vibration mode assignments confirmed the identification of the Sb_2S_3 phase for the prepared thin films and revealed that their Raman spectra are roughly dominated by stretching vibration modes (Sb-S). The optical constants analysis of the prepared films gave 1.78 eV as a value of the optical band gap and confirmed the ionic character of the Sb_2S_3 material.

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PA116

Influence of Sulphur in the Precursor on Efficiency of Cu_2ZnSnS_4 Solar Cell

Fulya Turkoglu[1,2], Sebnem Yazici[1], Metin Kurt[1], Gulsah K. Akca[1], Gulnur Aygun[1], E. Tarhan[1] and Lutfi Ozyuzer[1]

[1]*Department of Physics, Izmir Institute of Technology, 35430 Urla Izmir, Turkey*
[2]*Department of Material Science and Engineering, Izmir Institute of Technology, 35430 Urla Izmir, Turkey*

E-mail of Corresponding Author: fulyaturkoglu@iyte.edu.tr

Due to the increasing demand for natural source and costs of materials for electricity, it is inevitable transition to renewable energy to satisfy the global energy demand. Nowadays, the photovoltaic cell is the most popular and promising segment of renewable energy. The thin film solar cell technologies receive increasing interest from the photovoltaic industry because of their potential producing low cost electricity compared to wafer based crystalline Si technologies. Cu_2ZnSnS_4 (CZTS) absorber layer attracts so much attention in photovoltaic industry since it contains earth abundant, low cost and non-toxic elements contrary to other chalcogenide based solar cells such as $CuIn(Ga)(S,Se)_2$ (CIGS) and CdTe. According to Shockley–Queisser theoretical calculations, 30-32 % conversion efficiency is expected from CZTS solar cells [1]. Although, CZTS studies have been newly started yet, recently 11.1 % efficiency has been achieved [2]. The main intention of this work is to analyze the influence of sulphur in the precursor on efficiency of solar cell. Therefore, one series of CZTS with precursors that only contained metals (Sn/Zn/Cu precursors) and one series of CZTS with precursors that has an additional content of sulphur (Sn/ZnS/Cu precursors) were performed and compared. It was asserted that sulfur introduction in the precursors using sulfur-containing targets ensures uniform and more dense layers due to less diffusion of sulphur into the film during the sulfurization process. In all RAMAN plots nearly pure kesterite CZTS structure's vibration modes are clearly depicted. We observed more intense peaks for CZTS with Sn/ZnS/Cu precursors for RAMAN spectroscopy graphs. Moreover, optimum growth parameters for CdS, ZnO and ITO layers were determined. For the transmission graph of CdS-ZnO-ITO trilayer, we observed that high percentage of the incoming light can reach the CZTS absorber layer. As a future work, CdS, ZnO and ITO layers will be deposited on CZTS absorber layers with different precursors and the influence of sulphur in the precursor on efficiency of solar cell will be analyzed.

[1] W. Shockley and H.J. Queisser, J. Appl. Phys. 510, 32 (1961).
[2] T. Todorov et al., Adv. Energy Mater 3, 34-38 (2012).

Thin Films in Photovoltaic Cells and Energy

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Solution Processed Polymer-Fullerene Inverted Bulk Heterojunction Solar Cells

Sule Erten Ela

Ege University Solar Energy Institute 35100 Bornova, Izmir, Turkey

Email of corresponding author: suleerten@yahoo.com

Recent problems on energies and environments request a new system for providing an environment friendly and safe energy source instead of fossil fuel. For this reason, organic solar cells have attracted global attention as its promising candidate [1, 2]. Bulk heterojunction solar cells have attracted considerable attention in the past years owing to their inexpensive, lightweight and flexible production [3-4].

Inverted bulk heterojunction solar cells are great of interest in recents years because of their stability and lifetime according to normal type bulk heterojunction solar cells. In this study, solution processed P3HT:C60 blend were prepared in different ratios. Solution processable ZnO cathode layer is used as electron collecting electrode. And bulk heterojunction solar cells were tested in two different ZnO cathode layer. Single and double layered ZnO cathode layers were prepared two methods. One of them, nanoporous single layer ZnO that prepared from Zn^{2+} and HO^{-} solution system. And the other one was double layered ZnO cathode layer that prepared from Zn^{2+} and HO^{-} solution onto ZnO backing layer system. All processes were carried out using spin coating techniques. Bulk heterojunction solar cells were characterized using different blend ratios of P3HT and C60. Nanostructured morphologies of ZnO cathode layers and P3HT:C60 films were investigated by means of Atomic Force Microscopy, which are correlated with device performance. Better device performance is observed in a double-layered ZnO cathode electrode layer/P3HT:C60/Gold device configuration.

Keywords: Inverted bulk heterojunction solar cells, ZnO cathode layer, Energy,
Poly(3- hexylthiophene) , C60

References

[1] Tang CW. Two-Layer Organic Photovoltaic Cell, Appl. Phys. Lett 1986;48:183-85.
[2] N.S. Sariciftci, L. Smilowitz, A.J. Heeger, F. Wudl, Science 258 (5087) (1992) 1474.
[3] B. Kippelen, J.-L. Bredas, Energy Environ. Sci. 2 (2009) 251–261.
[4] a) Sule Erten-Ela, Sadik Cogal, Gulsah Turkmen, Siddik Icli, 'Hybrid Solar Cells Using Nanorod Zinc Oxide Electrodes and Perylene Monoimide-Monoanhydride Dyes', CURRENT APPLIED PHYSICS, Volume 10, Issue 1, pages 187-192, 2010.
b) D. Rana Bekci, Sule Erten-Ela, Nanostructured ZnO Cathode Layer on the Photovoltaic Performance of Inverted Bulk Heterojunction Solar Cells, RENEWABLE ENERGY, Volume 43, pp.378-382 ,2012.

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Structural and Luminescence Properties of Yellow $Y_3Al_5O_{12}:Ce^{3+}$ Thin Film Phosphors Prepared by Pulsed Laser Deposition

FB Dejene[1], KT Roro[2], and LF Koao[1]

[1]*Department of Physics, University of the Free State (Qwaqwa Campus), Private Bag X13, Phuthaditjhaba, 9866, South Africa*
[2]*CSIR-National Laser Centre, P.O. Box 395, Pretoria 0001, South Africa*

E-mail of Corresponding Author: dejenebf@qwa.ufs.ac.za

Recently oxide phosphors have gained much attention because of the variety of materials available and chemical stability as compared to sulfide phosphors. $Y_3Al_5O_{12}:Ce^{3+}$ (YAG) crystal is an excellent host material which is able to compatibly accept divalent and/or trivalent activators from both rare earth and transition metal groups. It is well known that YAG is a highly efficient yellow phosphor. However, these phosphors in the form of thin films have not yet been fully realized due to technical difficulties. We prepared thin film type YAG phosphors on silicon (110) substrate using a pulsed laser deposition technique. The luminescent and structural properties of thin film phosphors were monitored as a function of key processing parameter which is the deposition temperature. The surface morphology of the grown thin films was strongly affected by the growth temperature. Electron diffraction spectroscopy confirms the presence of the Y, Al, O, and Si. Even though we could not obtain homogenous phases, by optimizing processing parameters, thin films with large homogenous areas and a high photoluminescence could be produced. XRD measurements revealed $Y_3Al_5O_{12}$ structure when grown at temperatures from room temperature to 750 °C, however, other phases such as $Y_4Al_2O_9$ and $YAlO_3$ are observed as impurities. The PL results, which are in good agreement with the XRD data, showed that $Y_3Al_5O_{12}$ phase was relatively dominant in the film deposited at 750 ºC, so emission spectra is strong at around 570 nm.

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PA119

Fabrication of Characterization BZCYYb Electrolyte Thin Films for IT-SOFCs by E-Beam Vapor Deposition

Min hwan Lim[1]

[1]*Gachon univ, chemical engineering, Korea*

E-mail of Corresponding Author: hhyoon@gachon.ac.kr

Barium zirconate-cerate co-doped with Y and Yb (BZCYYb) electrolyte thin films for the intermediated temperature SOFC application were fabricated by electron beam vapor deposition method. The influence of annealing temperature, film thickness, and electrolyte composition on the structural and electrical properties of the BZCYYb thin films was examined. The crystal structure of the electrolyte films was analyzed by an XRD. Microstructure of the thin films was observed by a FESEM. The electrochemical properties of the thin films were analyzed using a 2-probe AC impedance method using an impedance analyzer. We obtained uniform and crack-free BZCYYb electrolyte thin films with a thickness of about 1-3µm.

Keywords: SOFC, E-beam deposition, BZCYYb

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Performance Analysis of a Thin-Film Photovoltaic Generator of 3.6 kW Installed in Kahramanmaras

Saban Yılmaz[1], Saban Yılmaz[2], Hasan Rıza Ozcalık[1] and Mustafa Aksu[2],

[1]*Kahramanmaras Sutcu Imam University Department of Electrical and Electronics Engineering*
[2]*Kahramanmaras Sutcu Imam University, Vocational School of Kahramanmaras*

E-mail of Corresponding Author: sabanyilmaz1@hotmail.com

Nowadays, photovoltaic systems have been a new promising solution for energy need increasing every day. Thin film panels use in Turkey, as it is in the world, is increasing with each passing day. The main objective of this study is the modelling, performance and cost analysis of a photovoltaic generator of 3.6 kW working since 2010 in Kahramanmaras where there is relatively high solar radiation in the most part of a year.

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PA121

Tracing Current-voltage Curve of Silicon Solar Panel Based on LabVIEW Arduino Interfacing

Arar Hemza[1], HAOUAM Abdslam[1] and Chenni Rachid[1]

[1]*Université of Constantine, Electronique , Algeria*

E-mail of Corresponding Author: arar.hemza@yahoo.fr

This study describe a low cost system to measure current and power-voltage characteristics of photovoltaic (PV) silicon solar panel under natural conditions based on LabVIEW software. The desired parameters of PV panel including irradiation, temperature, short-circuit current, open-circuit voltage are calculated. The characteristics of the solar panel have been drawn quickly using the MOSFET as an electronic load. The new developments of this work include the Arduino to acquire the values of current and voltage from the solar panel under test and transfer it to a supervisory computer. All details of the electronic circuit are shown in this paper and experimental results obtained are presented.

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PA122

Effect of Hydrogen on the Optical and Structurales Pproperties of Amorphous Silicon Carbide Films

Imene ABDENNEBI[1], Kamel MIROUH[1] and Mohamed KECHOUANE[2]

[1]*University of Constantine-1-, Physics, Algeria*
[2]*Institution/University: University of Science and Thechnology Houari Boumedienne, Algies, Algeria*

E-mail of Corresponding Author: abdennebi_imene@yahoo.com

Recently, hydrogenated amorphous silicon carbide (a-SiC:H) has attracted much attention because of its potential applications in many kinds of optoelectronic devices, such as solar cells, sensors (optical, color), light-emitting diodes. This is due to its wide band gap with excellent properties such as high electron mobility, high thermal conductivity, high melting point. Furthermore, the significance of this material is that its electrical and optical properties can be controlled by the optimization of the deposition condition.

The main idea of the present work was prepared Hydrogenated amorphous SiC films (a-SiC:H) by DC magnetron sputtering technique on p-type Si and corning 9075 substrates to facilitate different characterizations by using of silicon carbide target (6H–SiC) at different temperature. The pressure in sputtering chamber before deposition was 1×10^{-5} mbar, with constant gas flowrates of 10 and 2 sccm for hydrogen (H2) and argon (Ar), respectively, and a plasma power of 130W have been used. The atomic hydrogen is used for its important role in controlling the films network and in turns the physical properties of amorphous semiconductors.

The structural, optical and chemical properties of a-SiC:H films (50 nm thicknesses) have been investigated by X-ray diffractometer (D8 Advance Bruker AXS) using Cu Kα radiation (λ = l.54 Å, 40 kV, 40 mA), infrared spectroscopy (Perkin Elmer), for luminescence measurements (PL) a Perkin Elmer LS 50B was used with a 150W Xenon lamp with an excitation wavelength of 325nm (3.81 eV) and Ellipsometry measurements, to study the influence of deposition temperature on the optical properties.

Using a high-resolution X-ray diffractometer, a XRD pattern of the as-deposited layer indicates the absence of the peaks in the XRD spectrum means that the a-SiC:H films grow with an amorphous structure.

The FTIR spectra reveals the presence of hydrogen at our samples is shown by apparition of bands at 640, 1000 and 2100 cm^{-1}, corresponds to Si–H wagging mode, vibrations rocking and/or wagging of the C–H bonds in CHn radicals, Si–H stretching mode, respectively. The absorption peaks at 660 attributed to Si–Si stretching vibration. The vibration band at 769 cm^{-1} corresponds to Si-C or Si-CH3 wagging mode and is specific of the SiC films in amorphous phase.

Ellipsometry characterization has allowed us to determine the effect of the deposition temperature on the optical gap. the Eg value is depending on Td. Eg increases when increasing deposition temperature Td. This result goes with theoretical studies.

The Photoluminescence of deposited thin films exhibits two bands, a blue band and green band centred at 2.88 eV and 2.39 eV, respectively. The peak centred at 2.88 eV is ascribed probably to the radiative recombination from some direct transitions such as self-trapped excitons in the surface of nanoclusters and that located at 2.39 eV could be attributed to the defects in the film.

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PA123

Controlling Si-H Bonds in i-layer on the Characteristics of a-Si:H p-i-n Solar Cells

Yeu-Long Jiang[1,2], and Tai-Chao Kuo[1,2]

[1]*Graduate Institute of Optoelectronic Engineering and Department of Electrical Engineering*
[2]*National Chung Hsing University, Taichung 40227, Taiwan, Republic of China*

E-mail of Corresponding Author: yljiang@nchu.edu.tw

Silicon-hydrogen (Si-H) bonds in i-layer of hydrogenated amorphous silicon (a-Si:H) thin films and p-i-n solar cells were prepared by a pulse-wave modulated 13.56 MHz plasma chemical vapor deposition system. Under the fixed of SiH_4/H_2 gas ratio, the Si-H bonding configurations of a-Si:H films were precisely controlled by fixed the plasma turn-off time (toff) and altered the plasma turn-on time (ton). Increasing ton dissociates more radicals, resulting in the increasing of the deposition rate of a-Si:H films. High concentration of dihydride (SiH_2) and/or cluster of dihydride $(SiH_2)_n$ Si-H bonds and low concentration of monohydride (Si-H) bonds are formed in the films, which is represented by high microstructure ratio (R). The optical bandgap (Eg) is increased but the absorption coefficient (α), the refractive index (n) and the peak value of dielectric constant (ε) of the films are decreased, which are the results of increasing the R ratio and hydrogen concentration in the films. The a-Si:H solar cells with the i-layer deposited by changing ton from low to high, due to the increasing of Eg and the reducing of α, n, and ε, correspondently, the open-circuit voltage (Voc) is significantly increased, but the short-circuit current density (J_{sc}) is reduced. Because the cell deposited by low ton can obtain high Jsc but low Voc, conversely, deposited by high ton can obtain low J_{sc} but high V_{oc}. In this work, we also demonstrate that combining a buffer layer at p/i interface deposited by high ton and the bulk of i-layer deposited by low ton can increase the Voc and maintain the high value of Jsc. The energy transfer efficiency of a-Si:H p-i-n solar cell could be further improved by simply switch the ton of pulse-wave modulated plasma from high to low for the p/i buffer layer and the bulk i-layer deposition.

Thin Films in Photovoltaic Cells and Energy

PA124

Electrical Properties of CuO/ZnO/ITO Hetrojunction Elaborated by Spray Pyrolysis for Photovoltaic Devices

Lamia Chabane[1], N. Zebbar[1], M. Lamri Zeggar[2], M. S. Aida[2], M. Kechouane[1]

[1]*Dept. Materials & Compounds, Faculty of Physics, USTHB, Algiers, Algeria*
[2]*Faculty of Sciences, MENTOURI university of Constantine, 25000 Algeria*

E-mail of Corresponding Author: lamia007ch@hotmail.com

In this study, we have investigated the electrical and capacitive behavior of CuO/ZnO hetero-junction deposited onto ITO substrate by spray pyrolysis. The samples are elaborated under atmospheric pressure and at 300°C. The non-aqueous solution of zinc acetate (0.1 M) are used to deposit the zinc oxide thin films. The copper oxide layers are deposited from aqueous solution of copper chloride (0.1 M) at different deposition time.

The current-voltage (J-V-T) characteristics indicate that all hetero-junction exhibit rectifying characteristic due to p-n junction formation. Among the samples, the hetero-structure corresponding to the CuO layer thickness 275 nm (40 min), has the lowest ideality factor (~ 3.4) and a threshold voltage equal to 0.8 V. From the capacitance-voltage characteristics (C-V-T), we deduced that the density of carrier concentration in CuO and ZnO layers is in the order of ~ 1015 cm^{-3}. Under illumination (lamp: 100 W), the same hetero-structure, present a photovoltaic effect with open circuit tension Voc = 5 mV.

This type of structure also finds applications in photo-catalysis, such as photodiode sensors or hydrogen gas.

Thin Films in Photovoltaic Cells and Energy

PA125

Effect of Substrate Temperature on the Structural, Morphological and Optical Properties of Sb_2S_3 Thin Films

Fethi Aousgi[1], Wissem Dimassi[2], Brahim Bessais[2] and Kanzari Mounir[3]

[1]*Centre de Recherches et des Technologies de l'Energie (CRTEn), Technopole Borj Cédria, Laboratoire de Photovoltaïque (LPV), Tunisia*
[2]*Centre de Recherches et des Technologies de l'Energie Technopole Borj Cédria*
[3]*Institut Préparatoire aux Etudes d'Ingénieurs de Tunis Montfleury -Université de Tunis*

E-mail of Corresponding Author: aousgifethi@yahoo.fr

Sb_2S_3 thin films have been deposited by single source vacuum thermal evaporation onto glass substrates. The substrate temperature was varied in the range 25-270 °C and seems to be one of the most important parameters affecting the physical properties of the films. The structural investigations performed by means of X-ray diffraction (XRD) technique, atomic force microscopy (AFM) and scanning electron microscopy (SEM) showed that the films deposited at substrate TS < 250 °C have an amorphous structure, while those prepared at TS ≥ 250 °C have a polycrystalline structure. Increase of crystallite size with temperature was proved by XRD and the effect of substrate temperature on roughness and grain size was studied by AFM. The optical constants were obtained from the analysis of the experimental recorded transmission spectral data over the wavelength range 500–1800 nm. It has been found that the refractive index dispersion data obeyed the single oscillator of the Wemple–DiDomenico model. By using this model, the dispersion parameters and the high-frequency dielectric constant were determined. The low value of the extinction coefficient (in the order of 10^{-2}) is a qualitative indication of excellent surface smoothness of the films. The optical band gap energy of the films decreases from 1.98 eV to 1.74 eV as the substrate temperature varies from 25 to 270 °C.

Thin Films in Photovoltaic Cells and Energy

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Synthesis of Silver Paste for Solar Cells Metallization

Yacine Boukennous[1], N. Moudir[1], I. Bozetine[1], R. Sikaddour[1], F. Tiour[1], M. Maoudj[1] and A. Hazmoune[1]

[1]*CRTSE, Solar cells, Algeria*

E-mail of Corresponding Author: boukennous_y@yahoo.fr

The study focuses on the synthesis of silver powders for the preparation of conductive pastes used for solar cells metallization. Carbitol and carbitol acetate have been used as solvents and reducing agents of silver nitrate ($AgNO_3$) as precursor.

XRD characterization revealed silver powders with a cubic Crystal system. MEB showed spherical morphology of the particles. Similar particles distribution was obtained by the two agents.

Using same glass frit and organic vehicle for comparative purposes, two conductive pastes were prepared with the synthesized silver powders for the front-side metallization of multi-crystalline cells. The pastes were fired on a fast-firing IR belt furnace at a peak set point temperature around 720ºC with roughly 3 seconds in the hot zone to achieve a thickness of 12 µm. The pastes provided good print resolution, strong adhesion, and acceptable low contact resistance of 7.3 and 9.1 10-6 Ωcm^{-2} respectively.

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Plasmonic Light-trapping for Silicon Solar Cells Using Au-Ag Nanoclusters

Melih Zafer ONDERLI [1,*], Necmi SERIN[1], Savas SONMEZOGLU[2]

[1]*Department of Physics Engineering, Ankara University, Ankara, Turkey*
[2]*Department of Materials Science and Engineering, Karamanoğlu Mehmetbey University, Karaman, Turkey*

E-mail of Corresponding Author: melihzfronderli@gmail.com

Silicon solar cells have the potential to significantly increase the efficiency of photovoltaics. Light trapping is particularly critical in such crystalline silicon solar cells in order to increase light absorption and hence cell efficiency. In this work, we investigate the suitability of localized surface plasmons on gold-silver nanoclusters for enhancing the absorbance of silicon wafer-based solar cells. Our results show that for front surface application, gold-silver nanoclusters provide maximum overall enhancement in the visible as well as the near-UV for solar cell applications. Particularly, at wavelengths close to the band gap of silicon, we observe a significant enhancement of the absorption for silicon wafer-based structures. Our results suggest that surface plasmons offer a promising way to improve the efficiency of silicon wafer-based solar cell structures, avoiding the problem of increased recombination which occurs when silicon is textured directly.

Keywords: Plasmonics, Silicon solar cells, Au-Ag nanoclusters.

Acknowledgement
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Thin Films in Photovoltaic Cells and Energy

PA128

Aluminum doped zinc oxide Wide bandgap p-type optical window for µc-Si superstrate solar cell

Idris Bouchama[1], F. Khaled[1,2], A. Bouloufa[1] and Kamal Djessas[3]

[1] *Laboratoire d'Electrochimie et Matériaux, Université de Sétif-1, Algeria.*
[2] *Département d'Electronique, Université Mohamed El Bachir El Ibrahimide Bordj Bou Arréridj, Algeria.*
[3] *Laboratoire Procédés Matériaux et Energie Solaire PROMES-CNRS, Rambla de la Thermodynamique, Technosud, 66100 Perpignan,France.*

Email of corresponding author: univfr.ens66@yahoo.fr

This paper presents a new structure of solar cell based on p-type microcrystalline silicon as an absorber and n-type aluminum doped zinc oxide(ZnO:Al) transparent conductive oxide as an optical window [1-5]. The ZnO:Al layer deposited by rf-magnetron sputtering at room temperature yields a low resistivity about 7,64.10-2 Ω.cm and more than 85% mean optical transmittance in the VIS–NIR range, with an optical band gap of 3.3 eV [6-12]. These excellent optical properties of this layer in combination with an optimal contact at the front surface result in a superior light trapping yielding to efficiencies about 20%. In order to improve efficiency, we have used a p+-µc-Si thin layer highly doped as a back surface field which minimizes significantly the impact of rear surface recombination velocity on voltage and current leading to a high efficiency of 24%. Optoelectronic parameters were determined using the current density-voltage (J-V) curve by means of a numerical simulation with Analysis of Microelectronic and Photonic Structures (AMPS-1D) device simulator.

References

[1] M. Steglich, A. Bingel, G. Jia, F. Falk. Sol. Energy Mat. & Sol. Cells, 103, 62 (2012)
[2] P.J. Rostan, U. Rau, V.X. Nguyen, T. Kirchartz, M.B. Schubert, J.H. Werner. Sol. Energy Mat. & Sol. Cells, 90, 1345 (2006)
[3] C. Becker, H. Häberlein, G. Schöpe, J. Hüpkes, B. Rech. Thin Solid Films, 520, 1268 (2011)
[4] JeongChul Lee, VireshDutta, JinsuYoo, Junsin Yi, Jinsoo Song, Kyung Hoon Yoon. Superlat.and Microstructures, 42, 369 (2007)
[5] Byeong-Yun Oh, Jeong-Hwan Kim, Jin-Woo Han, Dae-ShikSeo, Hwan Soo Jang, Ho-Jin Choi, Seong-Ho Baek, Jae Hyun Kim, Gi-SeokHeo, Tae-Won Kim, Kwang-Young Kim. Current Appl. Phys., 12, 273 (2012)
[6] J.D. Santos, S. Fernández, J. Cárabe, J.J. Gandía. Thin Solid Films, 548, 617 (2013)
[7] Ping-Kuan Chang, Fu-Ji Tsai, Chun-Hsiung Lu, Chih-Hung Yeh, Na-Fu Wang, Mau-Phon Houng. Solid-State Electronics, 72, 48 (2012)
[8] Sung JuTark, Min Gu Kang, Sungeun Park, JiHoon Jang, JeongChul Lee, Won Mok Kim, Joon Sung Lee, Donghwan Kim. Current Appl. Phys., 9, 1318 (2009)
[9] N. Ohta, D. Ohba, S. Sato, Z. Tang, H. Shimizu, H. Shirai. Thin Solid Films, 519, 6920 (2011)
[10] Y.Y. Chen, J.R. Yang, S.L. Cheng, M. Shiojiri. Thin Solid Films, 545, 183 (2013)
[11] S. Fernandez, O.deAbril, F.B.Naranjo, J.J.Gandia. Sol. Energy Mat. & Sol. Cells, 95, 2281 (2011)
[12] O. Lupan, S. Shishiyanu, V. Ursaki, H. Khallaf, L. Chow, T. Shishiyanu, V.S ontea, E. Monaico, S. Railean. Sol. Energy Mat. & Sol. Cells, 93, 1417, (2009)

Thin Films in Photovoltaic Cells and Energy

PA129

Effect of paste concentration on morphology and size of pores in titania porous layer

Razieh Adelfar

University of Tehran, Metallurgy & Material Engineering, Iran

Email of corresponding author: r.adelfar@gmail.com

A titania layer containing pores of different sizes was fabricated by using a doctor-blade method. The paste was mainly composed of homemade titania nanoparticles, alpha terpineol as rheological agent, and ethyl cellulose as organic filler. A highly viscous titania (TiO_2) paste was deposited on a glass substrate. Varying the concentration of titania in the paste changed the physical properties of the porous layer, particularly its porosity and surface area. Scanning electron microscopy of titania layers showed that the space between particles increases with decrease in concentration and a hierarchical structure is formed. The XRD pattern shows that the crystalline phase is pure anatase and the diffuse reflectance spectroscopy shows the band gap energy of approximately 3.29 eV.

Thin Films in Photovoltaic Cells and Energy

PA130

Electrical Characterizations of Cu_2ZnSnS_4 Absorber Layer Material for Thin Film Solar Cells

Fatime Gulsah Akca[1,*], Sebnem Yazici[1], Mehmet Ali Olgar[2], Fulya Turkoglu[1], Gulnur Aygun[1], Ekrem Yanmaz[2], Lutfi Ozyuzer[1]

[1] Department of Physics, Izmir Institute of Technology Urla, Izmir 35430, Turkey
[2]Department of Physics, Karadeniz Technical University, Trabzon 61080, Turkey

Email of corresponding author: gulsahakca@iyte.edu.tr

Keywords: Thin film solar cells, Cu_2ZnSnS_4 (CZTS), Sputtering, Electrical characterization

Cu_2ZnSnS_4 (CZTS) is p-type intrinsic semiconductor compound that is stable in kesterite structure. CZTS has high band-gap energy around 1.5 eV, a large absorption coefficient ($\geq 10^4$ cm^{-1}) in the visible range of spectrum [1,2]. CZTS absorber layer attracts so much attention in photovoltaic industry since it contains earth abundant, low cost and non-toxic elements contrary to other chalcopyrite based solar cells such as $CuIn_xGa_{1-x}(S,Se)_2$ and CdTe. According to Shockley–Queisser theoretical calculations, 30-32% conversion efficiency is expected from CZTS solar cells [3]. Although, CZTS studies have been newly started, 12.6 % efficiency has been already achieved [4]. It means that more research is needed to be done with this newly explored material to improve the efficiency. In this work, CZTS absorber thin film layers were grown on soda lime glass substrate by using magnetron sputtering technique, followed by sulfurization process of the metallic precursor (Cu/Sn/Zn layers) that were sputtered in the multi target sputtering system. Rather than structural characterizations through Raman Spectroscopy, X-Ray Diffraction (XRD) and Energy Dispersive X-ray Spectroscopy (EDS) analysis which were done in our previous studies, this study mostly focused on temperature dependence of electrical properties of CZTS semiconductor. Also, CZTS with precursor that have additional content of sulphur (Cu/Sn/ZnS precursors) were performed and compared. We obtained intense and sharp Raman peaks, which corresponds to CZTS kesterite structure A1 vibration mode. For this reason, four point probe and Hall effect measurements by using Van der Pauw technique were carried out to measure the electrical properties such as sheet resistance, resistivity, carrier concentration and mobility of the CZTS structure. Electrical characterization of CZTS demonstrated p-type semiconducting material behaviour and the resistivity of the films were measured between 0.1-1.89 Ω.cm values at room temperature. The mobility value was estimated ~0.5 cm^2/V.s and the hole concentration was obtained approximately 10^{18} cm^{-3} at room temperature. Temperature dependence of resistivity, carrier concentration and mobility will be discussed.

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References:

[1] H. Katagiri, et al., PCC-Nagaoka'97, IEEE, 1003 (1997)
[2] P.A. Fernandes, et al., Phys. Status Solidi C 7, **901**, 3 (2010)
[3] W. Shockley, H.J. Queisser, J Appl Phys, **510**, 32 (1961)
[4] W. Wang, et al., Advanced Energy Materials, Online Published (2013)

PA131

TCO/SILICON HETEROJUNCTION SOLAR CELL: EFFECT OF NANOPARTICLES.

Alla Chebotareva[1], G.G.Untila[1], T.N. Kost[1], S.A. Evlashin[1] and A.S. Stepanov[1]

[1]*Lomonosov Moscow State University, SINP, Russia*

E-mail of Corresponding Author: allachebotareva@rambler.ru

This paper investigates the effect of nanoparticles in silicon heterojunction solar cell structures based on ITO/(nn+)c-Si (ITO - Indium Tin Oxide), AZO/(nn+)c-Si (AZO – Aluminum doped Zinc Oxide) and IFO/(pp+) c-Si (IFO - Indium Fluorine Oxide). Heavily doped silicon nanoparticles (n+ and p+), and metallic nanoparticles (NPs), in particular of silver, were introduced between the silicon substrate and TCO film or inside TCO film. The parameters of silicon and metal NP deposition on the silicon substrate by ultrasonic spray pyrolysis (pyrosol)were studied and optimized. The photoelectric properties of the interface TCO/NP/Si depending on the deposition conditions and heat treatments were studied.

Nanomaterials are used such as: 1) silicon NPs, particularly heavily doped (n+ and p +), and 2) metal NPs, in particular silver. NPs were deposited on different silicon test structures by pyrosol method. Silicon test structures (nn+), (pp+)Cz Si were both textured and polished. NPs were deposited on the samples with polished and textured p or n side simultaneously; the nanoparticles deposited on a polished silicon substrate - for studying the distribution of nanoparticles on the SEM. N+ and p+ layers in Cz-Si were fabricated, consequently, by phosphorus and boron diffusion with parameters similar to those used in solar cells. Deposition temperature (300-500C), carrier gas composition ($Ar+O_2$) and parameters of additional heat treatments were varied. After that TCO films were also deposited by pyrosol method with optimised conditions to form the heterojunctions ITO/(nn+)c-Si, AZO/(nn+)c-Si and IFO/(pp+) c-Si with the best parameters . Suns-Voc measurements were done for TCO/NP/(nn+)Si and TCO/NP/(pp+)Si structures to control the influence of deposition and annealing parameters on photovoltage and Fill Factor of the heterostructures. Also spectral response of the produced nanoheterostructures was measured. All conversion parameters were determined in comparison with test structures without NPs to evaluate the effect of the application of nanomaterials. Solar cells having ITO/NP/(nn+)Si/IFO, AZO/NP/(nn+)Si/IFO and IFO/NP/(pp+)Si/ITO structures with LGCell design (Laminated Grid Cell -wire contacts are attached to the surface of the TCO through low-temperature lamination method) were fabricated and investigated.

To deposit a NP layer (semiconductor and metal) for the first time is proposed to use non-vacuum economical method of ultrasonic spray pyrolysis (pyrosol). NPs were inserted between the silicon and the TCO film or inside TCO film. The photoelectric properties of the interface TCO/NP/Si depending on the deposition conditions and heat treatments were studied. Solar cells based on heterojunction transparent conductive oxide/ silicon with embedded NPs were fabricated and tested.

Thin Films in Photovoltaic Cells and Energy

PA132

Modelling the effect of defects n the performance of an n-CdO/p-Si solar cell

Nouredine Sengouga[1], S. Chala[2] and F. Yakuphanoglu[3]

[1]*Université de Biskra Sciences de la Matière, Algeria*
[2]*Laboratory of Metallic and Semiconducting Materials, Université de Biskra, 07000 Biskra, Algeria*
[3]*Physics Department, Firat University, 23169 Elazig, Turkey*

Email of corresponding author: n.sengouga@univ-biskra.dz

Cadmium oxide (CdO) is a semiconductor with promising electrical and optical properties. Pure CdO is an n-type degenerate semiconductor and is almost entirely transparent in the optical region of the electromagnetic spectrum. Thus, the interest in its study as a possible device for photo detectors and solar cells has increased significantly. However real solar cells, based on an n-CdO/p-Si heterostructures, show poor photovoltaic performance [1]. In this work numerical simulation is used to elucidate this poor performance. The measured photovoltaic performance of an n-CdO/p-Si heterostructures [1] were compared to simulation. We have simulated the same structure by considering two cases. The first is that CdO is a perfect material. The second models CdO as a semiconductor with continuous distribution of states in its band gap similar to an amorphous semiconductor. The density of states model used here is composed of four bands: two tail bands (a donor-like and an acceptor-like) and two Gaussian distribution deep level bands (an acceptor-like and a donor-like).
Evidently the first case gave results far from reality. In the second case, however, and by adjusting the constituents of the band gap states we were able to reproduce, almost ideally, the real behaviour of the solar cell.

[1] F. Yakuphanoglu, Applied Surface Science, 257 1413 (2010).

Thin Films in Photovoltaic Cells and Energy

PA133

X-Ray Photoelectron Spectroscopic (XPS) Depth Profiling Analysis of HfO_2/Hf/Si Multilayer Structure

Ayten CANTAS[1*], Gulnur AYGUN[1] and Lutfi OZYUZER[1]

[1]*Department of Physics, Izmir Institute of Technology, Urla, 35430, Izmir, Turkey*

Email of corresponding author: aytencantas@iyte.edu.tr

Having high dielectric constant (κ =25) [1] and wide bandgap energy (Eg>5 eV) [2], hafnium oxide (HfO2) is one of the best materials to be replaced by common material of microelectronics, namely SiO2 . However, there grows an undesired interfacial layer between HfO2 and Si.

In this study, to understand the formation of undesired interfacial layer, HfO2 thin film was grown on Hf/Si using an rf sputtering system. The final thickness and optical properties of the grown film was obtained by Spectroscopic Ellipsometer (SE) at 632 nm wavelength. The crystalline structure of grown thin HfO2 film was determined with X-Ray Diffraction (XRD), while the chemical states were defined by Fourier Transform Infrared (FTIR) spectroscopy. The chemical composition and quantification analyses of grown film were done by XPS depth profiling feature.

SE results give the final thickness of HfO2 film as 7 nm. From XRD spectra, the film shows m (-221) crystalline structure. Since the grown film is so thin, FTIR spectrum indicates that HfxSiyOz is the dominant mode. XPS depth profiling analysis shows that the tested film is not in homogeneous form. It consists of both Hf silicate (HfxSiyOz) and SiO2 at the top layers and lower amount of Hf silicate through deeper layers which is also supported by FTIR. These results bare that 3 min deposition of HfO2 is not sufficient to grow stoichiometric HfO2 film.

References

[1]A. Cantas, G. Aygun and D.K. Basa, J. Appl. Phys. in press (DOI number: 10.1063/1.4893708).
[2]A. Cantas, G. Aygun and R. Turan, Appl. Surf. Sci., in press (DOI number: 10.1016/j.apsusc.2014.03.077).

POSTER SESSION B

PB001

Heavy Metal Uptake Studies on Mg-Al and Zn-Al Layered Double Hydroxides Thin Films Obtained by Laser Techniques

A. Vlad[1], R. Birjega[1], A. Matei[1], M. Dumitru[1], M.Filipescu[1], C. Luculescu[1], V. Ion[1], M. Dinescu[1], R. Zavoianu[2], O.D. Pavel[2]

[1]*National Institute for Lasers, Plasma and Radiation Physics, 409 Atomistilor Str., 77125 Bucharest- Magurele, Romania*
[2]*University of Bucharest, Faculty of Chemistry, Department of Chemical Technology and Catalysis, 4-12 Regina Elisabeta Bd., Bucharest, Romania"*

E-mail of Corresponding Author: angela.vlad@gmail.com

Pulsed laser deposition (PLD) is commonly used for the deposition of various thin films, most of them being inorganic materials while matrix assisted pulsed laser evaporation (MAPLE) mainly for soft materials (organic/ inorganic) no matter their stoichiometry. In the present study we show a comparative study of the ability of these films obtained by two laser techniques for uptake heavy metals (Ni and Co) from water.

Layered double hydroxides (LDHs) are a class of layered materials consisting of positively charged brucite-like layers and exchangeable interlayer anions, which have received increasing attention in the last years, due to their chemical versatility and to their prospects in a wide range of technological applications such as catalysis, separation, and environmental remediation. The proper condition (wavelength, fluence, repetition rate, duration of the pulse, preparation of frozen targets) for obtaining highly oriented Mg-Al and Zn-Al LDHs films were determined. The ability of our films to detect heavy metals from aqueous solution was also investigated. The LDHs films were characterized using X-Ray Diffraction, EDX, Atomic Force Microscopy and Scanning Electron Microscopy with energy dispersive X-ray analysis.

Advances in Deposition Techniques

PB002

Electropolymerized Metallophthalocyanine Thin Films

Duygu Akyüz[1], Ali Rıza ÖZKAYA[2] and Atıf KOCA[3]

[1]*Marmara University, Chemistry Department, TURKEY*
[2]*Chemistry Department, Faculty of Science, Marmara University,*
[3]*Department of Chemical Engineering, Engineering Faculty, Marmara University, Istanbul Turkey.*

E-mail of Corresponding Author: akoca@marmara.edu.tr

Metallophthalocyanines (MPc) have been used in various electrochemical technologies such as, electrocatalysts, electrosensors, electroluminance, and electrochromism, due to their versatile redox activity, modification flexibility with many metallic and some nonmetallic elements in the Pc ring cavity, easy modification by numerous substituents, and chemical and thermal stability [1, 2]. For practical applications, coating MPcs on a substrate with desired specifications is the main factor to supply expectations of the application fields. Among the numerous film coating methods, electropolymerization is one of the most preferred electrode modification techniques due to its simplicity and controllability to obtain desired futures [3-5]. The ease of coating on the desired surfaces (e.g. electrode) especially with electrochemical polymerization is the main factor for the selection of MPcs as functional materials. Therefore in this study, MPcs bearing and electropolymerizable amino and thiazole moieties were characterized with voltammetric and spectrochronocoulometric methods, electropolymerized on different substrates and used as active electrochromophores. Reversible, diffusion controlled multi-electron redox processes and different colors of the electrogenerated species of the complexes indicated their redox richness and suitability in various electrochemical technologies. For an example application, ITO/MPcs electropolymerized thin films of the complexes were constructed and investigated as electrochromic materials ITO/MPcs electropolymerized thin films represented reversible color changes during oxidation with short response times, high optic contrast and optical and coulombic stabilities. These results illustrated suitability of the complexes in display technologies as anodic coloring materials.

[1] N. Kobayashi, T. Fukuda, Chapter 1 - Recent progress in phthalocyanine chemistry: Synthesis and characterization, in: S.-H. Kim (Ed.) Functional Dyes, Elsevier Science, Amsterdam, 2006, pp. 1-45.
[2] A.B.P.L. C. C. Leznoff, Phthalocyanines, Properties and Applications, 4 ed., Wiley-VCH, 1996
[3] D. Arican, A. Erdogmus, A. Koca, Thin Solid Films, 550 (2014) 669-676.
[4] R.D. Gould, Coordination Chemistry Reviews, 156 (1996) 237-274.
[5] M.L. Rodriguez-Mendez, J.A. de Saja, J Porphyr Phthalocya, 13 (2009) 606-615.

Applications of Electrochemical and Electroless Depositions

PB003

Layer by Layer Growth of Copper Silver Film Using Underpotential Deposition by an Electrochemical Process

Jau-Shiung Fang[1], Y.S. Liu[1] and T.S. Chin[2]

[1]*Department of Materials Science and Engineering, National Formosa University, Huwei, Taiwan*
[2]*Department of Materials Science, Feng Chia University, Taichung, Taiwan*

E-mail of Corresponding Author: jsfang@nfu.edu.tw

This paper describes the formation of Cu and Cu-Ag films using an electrochemical atomic layer deposition. The deposition process was preformed layer by layer by an underpotential deposition. A p-type Si (100) wafer, with 10 nm Ru prepared by sputtering on top of, was as a substrate, and the substrate was cleaned by cyclic voltammetry in 10 mM HCLO4 at a scan rate of 5 mV/s to remove the oxide layer. Cu underpotential deposition was used to deposit the first Cu atomic layer on the Ru/Si substrate. Pb was chosen as a sacrificial layer as it forms atomic layers on the Cu layer via underpotential deposition, and then Cu2+ solution was flushed into the cell at open-circuit potential where the Pb atoms were exchanged for Cu by a redox replacements. Several Cu layers were formed by repeating the above sequences several times, and then deposited Ag layer on the Cu using underpotantial deposition. Cu-Ag alloy film was formed using the sequence by performing 50 periods, each consisting of 4 cycles Cu and 1cycle Ag. The depositions were carried out using 0.1 and -0.05 V for Cu and Ag solution, respectively. The resulting Cu-Ag film was characterized using X-ray diffraction, electrochemical chromatography and four point probe measurement. The average thickness of Cu film per replacement cycle was 0.51 ML. The result indicates that the lowest resistivity 3.3 and 4.7 μΩ.cm for Cu thin film and Cu-Ag thin film, respectively. Structural analysis showed that Cu (111) and Cu (200) peaks shift to lower diffraction angle, indicating that Ag atoms were incorporated into Cu lattice. Because the self-limiting reactions and electrochemical surface limited reaction, the process has the capability of atomic layer deposition to meet the requirement of gap-fill process.

Applications of Electrochemical and Electroless Depositions

PB004

Corrosion and Microhardness Behavior of Electrodeposited Ni–Mo Alloy Coatings in the Presence of Organic Inhibitor

BEN TEMAM Hachemi[1] and E. GUETTAF TEMAM[1]

[1]*Laboratoire de Physique des Couches Minces et Applications, chimie industrielle, Université Mohamed Khider-Biskra, Algérie*

E-mail of Corresponding Author: ha_bentemam@yahoo.fr

Composite coatings of Ni-Mo were prepared by co-deposition of Mo metal with electrolytically deposited nickel from a citrate bath onto pretreated Cu substrates at pH of 6.5-7. The effect of molybdate concentration has been investigated using different values of $[MoO_{4-2}]/Ni_{+2}$ molar ratios. The corrosion results were calculated from polarization Tafel line in both 0.6M NaCl and 0.1M HCl solutions. The microhardness and polarization resistance R_p of the prepared coatings are remarkably lower than those of pure nickel coatings. The addition of organic inhibitor in the electroplating bath shows a positive influence on the microhardness and polarization resistance R_p.

Keywords: Nickel; Molybdate; Polarization resistance; Ni-Mo coatings; Co-deposition.

Applications of Electrochemical and Electroless Depositions

PB005

Influence of Heat Treatment on the Structural Characteristics of Electroless Ni–B Film

Ulaş Matik[1], Handan Turan Matik[2] and Ramazan Çıtak[3]

[1]*Karabük University, Vocational School, Department of Machine and Metal Technologies, Karabük, TURKEY*
[2]*Karabük University, Graduate School of Natural and Applied Sciences, Department of Manufacturing Engineering, Karabük, TURKEY*
[3]*Gazi University, Technical Education Faculty, Department of Metallurgy, Ankara, Turkey*

Email of corresponding author: matik@karabuk.edu.tr

Electroless nickel–boron (Ni–B) was synthesized from the bath using a sodium borohydride as a reducing agent. Heat treatments were performed at 300°, 400° and 500 °C for 1 h, respectively. The crystallisation process in the electroless Ni–B film during continuous heating is investigated using the differential scanning calorimetry (DSC). The resulting surfaces were examined and characterized by scanning electron microscopy (SEM) and X-ray diffraction (XRD). XRD analysis was performed to investigate structural modifications. XRD patterns reveal that electroless Ni–B coatings are amorphous in as-plated condition and undergo phase transformation to crystalline nickel and nickel borides upon heat-treatment.

Keywords: Electroless plating; Nickel-boron; Phase transitions; Heat treatment

Applications of Electrochemical and Electroless Depositions

PB006

Polyaniline on Porous Silicon for as Sensing

Maha AYAT[1], Luca Boarino[2], Noureddine Gabouze[1], Mohamed Kechouane[3] and Nawel Chiboub[4].

[1]*Centre de Recherche en Technologie des Semi-conducteurs pour l'Energétique-CRTSE-Thin films, surfaces and interfaces Algeria*
[2]*Nanofacility, Istituto Nazionale di Ricerca Metrologica*
[3]*Université des Sciences et de la Technologie Houari Boumediene,*
[4]*Université Saad Dahlab de Blida*

Email of corresponding author: ayat.maha@yahoo.fr

Conducting polymers are recognized as highly promising multifunctional materials suitable for fabricating a spectrum of flexible, lightweight and large area electronic devices. Polyaniline (PANI) has been the subject of considerable recent interest because of their unique electrical behavior, good environmental stability in doped and neutral states, ease of synthesis and wide applications in different fields. In the present work, the PANI films were electrochemically deposited on porous silicon (PS) substrate because of its prominent properties. The results has shown that the PANI films were covalently grafted on PS structures and we demonstrate that such structures are sensitive towards organic vapors (ethanol) and gases (NO_2, NH_3).

Applications of Electrochemical and Electroless Depositions

PB007

Preparation and Tribological Properties of Nano-MoS2-containing Composite Coating by Plasma Electrolytic Oxidation on Ti6Al4V Alloy

Yongkun Qin[1], Dangsheng Xiong[1] and Jianliang Li[1]

[1]*Nanjing University of Science and Technology, School of Materials Science and Engineering, China*

Email of corresponding author: qyk1121@163.com

Self-lubricating composite coating containing nano-MoS_2 as solid lubricant was deposited on the titanium alloy surface by plasma electrolytic oxidation with MoS_2 nanoparticles in aluminate-phosphate mixed electrolyte. The friction and wear behavior of the coating was examined by carrying out tests on a ball-on-disk friction tester at a load of 2N and a sliding velocity of 0.1m/s. The results showed that the phases of MoS_2 and hard α-Al2O3 appear in the composite coating in addition to the main phase of Al_2TiO_5. The doping of nano-MoS_2 leads to a more compact surface morphology compared to the rough and porous PEO coating. The ball-on-disk friction tests indicated that the nano-MoS2-containing composite coating presented a lower friction coefficient of 0.67 than that of the one without MoS_2 (about 0.9), and the wear resistance was also markedly improved. The influence of the amounts of nano-MoS_2 in electrolyte on the tribological properties was also discussed.

Applications of Electrochemical and Electroless Depositions

PB008

Electrocrystallization of Copper Indium Diselenide Semiconductor for Solar Cell Applications

Serkan Gürbüz [1], Sema Memiş[2], A. Sezai Saraç[1] and Melek Erol[2]

[1]*Istanbul Technical University, Department of Chemistry*
[2]*TUBITAK Marmara Research Center, Materials Institute*

Email of corresponding author: melek.erol@tubitak.gov.tr

Electrocrystallization of copper indium diselenide (CIS) on commercial molybdenum substrates was investigated. An x-Ray diffraction (XRD) based approach was used with several parameter optimizations such as salt concentration, deposition potential and acidity of the solution. As-deposited samples were characterized with XRD, SEM and EDS techniques. A crystallite size growth up to 17.42 nm was achieved by increasing the acidity of the deposition solution. In addition to common tetragonal phase of CIS, a new phase for electrodeposition of CIS, wurtzite, was obtained, which was believed to compete with the tetragonal phase during electrodeposition.

Applications of Electrochemical and Electroless Depositions

PB009

THE EFFECT OF BIAS VOLTAGE ON THE ELECTROCHEMICAL CORROSION BEHAVIORS OF TIO2 COATING DEPOSITED ON STAINLESS STEEL BY RF MAGNETRON SPUTTERING

Noureddine MADAOUI[1], N. Saoula[1], K. Kheyar[1], S. Belhousse[1] and C. Yaddaden[1]

[1]Centre de Développement des Technologies Avancées CDTA Cité du 20 août 1956, Baba Hassen, BP n°17, Alger Division des Milieux Ionisés Algérie

E-mail of Corresponding Author: n.madaoui@hotmail.fr

Anticorrosion TiO_2 coatings were deposited by reactive r.f magnetron sputtering method, on stainless steel substrates. The effect of bias voltage on the electrochemical corrosion behaviors was investigated. The microstructure and phase composition of titanium dioxide coating were analyzed by optical microscope (OM), scanning electron microscope (SEM), energy dispersive spectrometer (EDS) and X-ray powder diffraction (XRD). Electrochemical corrosion behavior of the coating was mainly investigated by potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) in simulated marine environment aqueous NaCl solution at room temperature. The results indicated that the free corrosion potential of TiO_2 coatings increased and the free corrosion current density decreased, which corresponded to a decreased corrosion rate. Results showed that TiO_2 coatings effectively improve the corrosion resistance in 3.5 % NaCl of the stainless steel surface.

Applications of Electrochemical and Electroless Depositions

PB010

Pulse-controlled surface roughness, microstructure and magnetisation reversal in electrodeposited nanocrystalline nickel films

Farzad Nasirpouri[1], Mohammad Reza Sanaeian[1], Alexander S Samardak[2] , E.V. Sukovatitsina[2], Alexey V. Ognev[2] , L.A. Chebotkevich[2]

[1]*Faculty of Materials Engineering, Sahand University of Technology, Tabriz, Iran*
[2]*Far Eastern Federal University, 8 Sukhanova St., Vladivostok 690950, Russia*

Email of corresponding author: nasirpouri@sut.ac.ir

Nanocrystalline nickel has attracted much attention due to its improved surface properties such as hardness, corrosion and wear resistances, and also functional characteristics like magnetic and magentotransport properties. Electrodeposition is a common, convenient and flexible method for the production of metal films like nickel. Electrodeposition current modes include direct current (DC), pulsed current (PC) and pulse reverse current (PRC) having considerable effects on the mechanism and morphology of electrodeposits.
In this work, nanocrystalline nickel films with different surface morphologies were electrodeposited from Watts bath using direct (DC), pulsed (PC), and pulsed reverse (PRC) current techniques. The effect of electrodeposition conditions including pulse mode, current density, and duty cycle has been studied on the evolution of microstructure, cathodic efficiency, crystallographic micro-texture, micro-hardness, magnetic and corrosion properties of nickel films were investigated. Ni films electrodeposited by PC method revealed the highest cathodic efficiency due to minimum amount of hydrogen evolution. All films electrodeposited by PC and PRC methods making the films nanocrystalline (NC) exhibited greater hardness values and smaller crystallite size compared to those deposited by DC method. A preferential crystallographic orientation or texture was found in Ni films depending upon the electrodeposition pulse shape, as the microstructure is polycrystalline in the DC electrodeposited films, while exhibits <111> and <100> crystallographic growth directions for PC and PRC methods, respectively [1]. Magnetic properties of the nanocrystalline Ni films indicate the existence of strong magnetocrystalline anisotropy depending on the microstructure of the films. In term of magnetic properties all the fabricated films are isotropic. We define magnetization reversal occurring through the non-coherent magnetization rotation where the average grain size is comparable to the width of Bloch domain walls (DW). For those films with a greater grain size, the remagnetization processes take place due to the non-coherent magnetization vectors rotation and DW displacement in the grains [2]. Corrosion evaluation results showed that the PC electrodeposited NC-Ni films are more corrosion resistive in the 2 mol/liter NaOH solution, compared to film those electrodeposited by PRC and DC methods. In contrast, in the 0.5 mol/liter H_2SO_4 solution, corrosion resistance of the films is in descending order from PC to PRC and DC.

Refs.:
1-F. Nasirpouri et al, Applied Surface Science 292 (2014) 795– 805
2-E.V. Sukovatitsina et al, Solid State Phenomena Vol. 215 (2014) pp 139-143

Applications of Electrochemical and Electroless Depositions

PB011

Optical Measurement of Mechanical Stress in Al_2O_3 Thin Films

Miloslav Ohlidal[1], Ivan Ohlidal[2], Pavel Nadasky[1] and Jakub Klus[1]

[1]Brno University of Technology, Institute of Physical Engineering, Czech Republic
[2]Masaryk University Brno

E-mail of Corresponding Author: ohlidal@fme.vutbr.cz

The contribution describes an optical method for measuring mechanical stress inside thin films. The method is based on measurement of substrate deformation caused by the film stress using the optical profilometer. The method is applied to studies of stress dependences of Al_2O_3 thin films deposited onto glass substrates on technological conditions of their preparation.

Characterization and Instrumentation

PB012

Determination of Optical Parameters of Thin Films Non-Uniform in Thickness

Ivan Ohlidal[1], David Necas[1], Vladimir Cudek[1] and Miloslav Ohlidal[2]

[1] *Masaryk University, Department of Physical Electronics , Czech Republic*
[2] *Brno University of Technology*

E-mail of Corresponding Author: ohlidal@physics.muni.cz

A multi-pixel modification of the data fitting procedure for imaging spectroscopic reflectometry is used for the optical characterization of thin films non-uniform in thickness. It is shown that this procedure allows a more precise and reliable determination of the optical parameters, i.e. refractive index, extinction coefficient and distribution of local thickness, compared to the standard application of the imaging spectroscopic reflectometry. This modification is applied to SiOxCyHz and carbon nitride thin films.The optical constants, i.e. refractive index and extinction coefficient, of these films obtained using this modified imaging spectroscopic reflectometry are verified by standard variable-angle spectroscopic ellipsometery. Very good agreement between the spectral dependencies of the refractive index and extinction coefficient of the thin films characterized is presented. Moreover, it is shown that the multiple-pixel modification of the imaging spectroscopic reflectometry represents useful optical method completing the methods of standard spectroscopic ellipsometry and spectrophotometry.

Characterization and Instrumentation

PB013

Characterization of Turkey-gordes Zeolite Minerals and Utilization Areas

Öykü Bilgin[1]

[1]*Sirnak University, Mining Engineering, Turkey*

E-mail of Corresponding Author: ykbilgin@yahoo.com

Turkey has an important potential of zeolite reserves, 1.5 billion ton of those are proven reserves. Clinoptilolite is the most commonly used natural zeolite group. Utilization areas of zeolites can be classified under four basic heads, which are pollution control, energy sector, agriculture and stockbreeding. In this study, zeolite samples used are taken as representatives from active zeolite fields that belong to Manisa-Gordes region in Turkey. Analyses and experiments concluded on the samples which are the basic of this study have been detailed. Assessment towards the contamination and minerals within the structures of the Gordes Zeolites used as zeolite sample was carried out on the basis of the images defined in binocular microscope and electron microscope (SEM) in the research. It is detected by X-Ray and chemical analysis experiments that 85% of the samples used in the experimental studies represent clinoptilolite-heulandite based zeolite raw material. Gordes zeolites have high.

Characterization and Instrumentation

PB014

60W Nanosecond Pulsed All-Fiber Laser Amplifier for Bulk and Thin Film Material Modification

Yigit Ozan Aydin[1,2] and Alpan Bek[2,3]

[1]*FiberLAST Inc, ODTU Teknokent Galyum Z3, 06800, Ankara Turkey*
[2]*Middle East Technical University, Micro and Nanotechnology Program, 06800, Ankara, Turkey*
[3]*Middle East Technical University, Department of Physics, 06800, Ankara, Turkey*

Email of corresponding author: yigitozan@gmail.com

Fiber lasers have the advantage of high beam quality,high efficiency,small size and air cooling.Therefore much interest in the development of high power fiber laser systems has recently arisen in the world.Almost all commercially developed fiber lasers with nanosecond pulse duration that are being used for material processing,are Q-switched systems.Vital parameters in the material processing,such as repetition rate,pulse energy and pulse duration,are correlated with each other and hence cannot be adjusted independently in the Q-switch mechanism.For high beam quality pulse energy better be 0.5-1.0 mJ and as the repetition rate determines the processing speed, aiming for high average power leads to best results. As a result, development of all-fiber laser systems with diffraction limited beam quality,high energy, high repetition rate at high average power, and independently adjustable parameters are highly desired.In this study, ytterbium doped all-fiber laser amplifier with 60 W average power and more than 20 kW peak power at 1 μm wavelength was developed.This master-oscillator power-amplifier (MOPA) architecture system is composed of pulses, produced by electronically pumped diode, and amplified by a series of fiber amplifiers. Apart from Q-switch lasers,MOPA architecture allows us to adjust pulse duration, repetition rate and power independently. Beam quality is nearly diffraction limited, and typically the value is M2<1.3.Produced by 1064 nm wavelength laser diode, the pulses with the approximate duration of 200 ns or longer are amplified to 3 W average power by a middle amplifier and then to 60W average power by an amplifier stage.The maximum pulse energy achieved 0.6 mJ at 100 kHz repetition rate and minimum pulse duration is 29 ns at this energy level. System is all-fiber and the amplified laser output is delivered from the collimated isolator following the 2 m long beam delivery fiber.Due to multi-stage architecture and special precautions, the system works without ASE (<1%) and shows an optical efficiency of 64% Because of Raman scattering, peak power value is limited to 20 kW for the current beam delivery fiber lengths.This value can be increased if the beam delivery fiber length will be shorter or in the applications where transfer of more energy to stokes wavelengths won't be a problem.Additionally,due to MOPA architecture,the fluctuations (energy changes between pulses and the energy changes during a single pulse) are fewer than the systems which are using Q-switch.In material processing,high stability and high beam quality leads to high consistency.Reduced diameters of active and passive fiber cores and specially optimized fiber splices, which are used in the system architecture,results with higher beam quality thus the focusing is better than commercial lasers.As the thing which determines the interaction with materials is the power delivered to target area,with this system the material processed effectively with less power.

Characterization and Instrumentation

PB015

Simulation for GaAs MESFET Devices Using Mobility Models

Chahrazed Kaddour and Cherifa Azizi

Larbi Ben M'hidi University Material Sciences, Algeria

Email of corresponding author: kaddourchahra@yahoo.fr

The Electron mobility in GaAs is an important parameter for device design and analysis. Accurate mobility models are necessary for predictive simulation due to the direct dependence of the current on mobility .For this, we present in this communication the characteristics id (Vd,Vg) and two models of the electron mobility for GaAs MESFET . This study takes account: the electric field E, the saturation velocity Vs, the parameter β of Gaughy Thomas and the doping profile Nd . The theoretical results obtained were compared with those of the experiment.

Characterization and Instrumentation

PB016

Prussian Blue Thin Films Produced by Chemical Bath Deposition

Sani DEMİRİ

Çanakkale Onsekiz Mart University, Materials Science and Engineering, TURKEY

E-mail of Corresponding Author: sanidemiri@comu.edu.tr

Nowadays, electrochromic materials draw attention in the scientific area because of their color as a function of light intensity applied electric potential and changed the chemical properties. Electrochromic materials used in very different device technology, such as smart windows, flat displays, gas sensors i.e.

Depending on the application, there are many inorganic and organic designs used for electrochromic device construction. It should be different colors, but generally we seen that blue.

Thin films forming the basis of device technology have gained a great acceleration between the research and development studies in recent years. The resulting performance obtained from the thin films having a wide range of using area, is very important parameter, and this is also directly related to the production techniques.There are many methods used for produced thin film structures, such as thermal evaporation, sol-gel, spray pyrolysis and electrodeposition. Among them chemical bath deposition (CBD) prefer by the scientists because of having the cheap, simple and non-toxic method.

The prussian blue thin film form is not only cheap but also deposited simply to conductive surfaces.

In this study, we investigated the Prussian blue thin films produced by CBD. We changed the temperatures and concentrations of these thin films in this process and debated the results. We used the Uv-Vis spectrophotometer for the optical properties of films and the cyclic voltmeter for the reduction-oxidation treatments.

Characterization and Instrumentation

PB017

Improvement of sensing properties of WO_3 thin films by modifying of post-annealing conditions

Kaykhosrow KHojier

Central Tehran Branch, Islamic Azad University Physics, Iran

Email of corresponding author: khojier@iauc.ac.ir

This research reports the improvement of sensing properties of WO_3 thin films by variation of post-annealing conditions that can be used for development of metal oxide gas sensors. WO_3 thin films of 100 nm thickness were deposited by DC reactive magnetron sputtering technique on glass substrate and then post-annealed at different temperatures (300 and 400 °C), different times (60and 180 min) and different environments (air and oxygen flow). A detailed morphological and structural investigation has been carried out on all deposited and post-annealed samples by Atomic force microscopy and X-ray diffraction methods. The electrical response of all prepared films was tested to NO_2 gas. The results showed that the NO_2 gas sensitivity of WO_3 thin films can be improved by modification of post-annealing conditions.

Characterization and Instrumentation

PB018

Analysis on Aging Mechanism of Isothermal Aging and Thermal Fatigue of Thermal Barrier Coating

Yongseok Kim[1], Jeong-Min Lee[1], Hyunwoo Song[1], Sung-Hyuk Kim[1], JaeMean Koo[1], Chang-Sung Seok[1], SangHun Kim[2] and SungHo Yang[2]

[1]*Sungkyunkwan University, Mechanical Engineering*
[2]*Kepco Plant Service & Engineering Co., Ltd*

E-mail of Corresponding Author: seok@skku.edu

Isothermal aging and thermal fatigue are the two test methods which are most widely used to evaluate the durability of thermal barrier coating (TBC). Isothermal aging test is used to evaluate the inter-layer diffusion and the growth of thermally grown oxide (TGO), and thermal fatigue test is used to evaluate the delamination life caused by inter-layer thermal stress due to thermal expansion mismatch between the layers. In this study, isothermal aging and thermal fatigue tests on TBC (7~8% YSZ) produced by air plasma spray (APS) method were performed, and the tests results were arranged into delamination maps to evaluate the delamination life of the TBC at both test conditions. After the tests, microstructural change of the TBC was analyzed to compare the aging mechanism of the two test conditions. Finally, the relationship between the results of the two tests was obtained and as a result, the thermal fatigue life prediction method by the isothermal aging test instead of the difficult thermal fatigue test was suggested.

Large Scale Coating and Industry

B019

Comparison and Evaluation Between Used Gas Turbine Sample and Aged Thermal Fatigue Specimen Through SEM Analysis

Sung-Hyuk Kim[1], Yongseok Kim[1], Jae-Mean Koo[1] and Chang-Sung Seok

[1]*Sungkyunkwan University, Mechanical Engineering*

E-mail of Corresponding Author: seok@skku.edu

Gas turbine operates in high temperature and high pressure and especially, turbine inlet temperature (TIT) has been increased higher for effectiveness improvement. Development of thermal barrier (TBC) coating technique contributes to an increase of operating temperature. Thermal barrier coating protects substrate from the flame and assures the product life of turbine. Turbine blade is a component that undergoes mechanical fatigue caused by rotating, thermal gradient fatigue caused by cooling air and thermal fatigue due to startup and shutdown. In this work, comparison and evaluation between used turbine blade sample and aged thermal fatigue specimen were performed using cross-sectional analysis and surface analysis through SEM.

Large Scale Coating and Industry

PB020

Prediction of the Thermo-Mechanical Fatigue Life for IN738LC Using the Strain Energy Method

Jeong-min Lee[1], Dongkeun Lee[1], Yongseok Kim[1], Jae-mean Koo[1] and Chang-sung Seok[1]

[1]*Sungkyunkwan University, Mechanical Engineering*

E-mail of Corresponding Author: seok@skku.edu

In this paper, the thermo-mechanical fatigue characteristic was researched about the IN738LC which is used for the main materials of the gas turbine blade. Gas turbine blades are operated in the high temperature environment at least 1,300℃. Also, the mechanical loading is applied by the high-speed rotation. In addition, the low cycle fatigue is occurred by the frequent startup and shutdown. As a method for improving the durability of materials which operate in harsh environments, the thermal barrier coating technique is applied. the thermal barrier coating technique drops the substrate surface temperature by about 100~200℃. Thus, the integrity evaluation of the substrate should be performed in this situations. In case of the low cycle fatigue that a large plastic deformation mainly occurs, the fatigue life can be decided by the plastic strain amplitude. However, it is difficult to obtain the plastic strain under the thermo-mechanical fatigue loading. Therefore, in this paper, the thermo-mechanical fatigue test was performed to obtain the fatigue life for IN738LC, and the hysteresis loop was derived through the finite element analysis. Finally, received energy of material was obtained from hysteresis loop, and the fatigue life prediction equation was derived from the strain energy method.

Large Scale Coating and Industry

PB021

Thermal Fatigue Life Prediction of Thermal Barrier Coating Through Bond Strength

Hyunwoo Song[1], Yongseok Kim[1], Jae-Mean Koo[1] and Chang-Sung Seok

[1]*Sungkyunkwan University, Mechanical Engineering*

E-mail of Corresponding Author: seok@skku.edu

Thermal barrier coating (TBC), which is applied to a gas turbine blade, is used to protect the blade substrate from the high-temperature. Delamination of thermal barrier coating is initiated by repeated thermal fatigue during the operation of gas turbine, and this delamination leads to damage of gas turbine. Thus, thermal fatigue life evaluation of thermal barrier coating should be carried out but it spends a lot of time. Therefore, thermal fatigue life prediction of thermal barrier coating is needed. In this research, the TBC specimens with different damage levels were produced through the thermal fatigue test, and then bond strength test was performed with damaged specimens. Also, life prediction equation of thermal fatigue was derived through relation between thermal fatigue life and bond strength of specimens that have different levels of damage.

Large Scale Coating and Industry

PB022

The Use of Magnetron Sputtering For Conductive Coatings on Textile Surfaces

Dilek Çukul[1] and M.Mete Öztürk[2]

[1]*Anadolu University, Porsuk Vocational School, Turkey*
[2]*Department of Systems Engineering, University of Arkansas at Little Rock, Little Rock, AR, 72204, USA*

E-mail of Corresponding Author: dcukul@anadolu.edu.tr

Textile surface modifications or functionalization are becoming more essential to meet the requirements which arises with the recent developments in textile engineering such as UV radiation resistance, electrical conductivity, self cleaning, antibacterial property, flame retardancy, superhydrophobicity, etc. As the nanotechnology has immense potential in improving surface properties and performances of textiles and clothing, the high attention has been caught in textile industry. The application of nano films and coatings on the textile surface can be achieved by different methods. The most widely used nanocoating methods are sol-gel technique, magnetron sputter, plasma, layer-by-layer technique, and nanomaterial embedded textile [1]. Magnetron sputter coating, which is one of the physical vapour deposition (PVD) methods, has been used to deposit different type of materials on the textile surfaces [2-4] to improve the properties of the textile materials. Since the conductivity is one of the crucial properties to attain smart textiles, conductive polymers, fibres, yarns, fabrics, embroidery and finishing are widely used to produce smart clothing [5]. In addition to those methods, magnetron sputter technique provides coatings with a high chemical and structural complexity. In this study, the magnetron sputtering method, used to grow materials such as Cu, Cr, Ag, ITO etc., to develop conductive textile surfaces are presented. In this context, the deposition parameters associated with the coating materials that have been reported in literature are summarized in order to give an idea to understand the relation between the conductivity properties of the textiles and the coating parameters.

[1] M., P., Gashti, F., Alimohammadi, G., Song, A., Kiumarsi, Characterization of nanocomposite coatings on textiles: a brief review on Microscopic technology, Formatex, 1424-1437 (2012).
[2] B., Deng, X., Yan, Q., Wei, W., Gao, AFM characterization of nonwoven material funtionalized by ZnO sputter coating, Materials Characterization, 58, 854-858 (2007).
[3] Q., Wei, L., Yu, D., Hou, F., Huang, Surface characterization and properties of functionalized nonwoven, Journal of Applied Polymer Science, 107, 132-137 (2008).
[4] H., Wang, J., Wang, J., Hong, q., Wei, W., Gao, Z., Zhu, Preparation and characterization of silver nanocomposites textile, Journal of Coatings Technology and Research , 4(1), 101-106 (2007).
[5] G., Cho, S., Lee, J., Cho, Review and reappraisal of smart clothing. In: G., Cho (ed) Smart clothing technology and applications. New York: CRC Press, 1-36 (2010).

Metallurgical Coatings

PB023

Self-propagating High Temperature Synthesis and Microstructure of Al_2O_3 Coatings on Plane Substrate

Gang Wang

Hohai University, College of Mechanics and Materials, China

E-mail of Corresponding Author: muren_1979@163.com

The Al_2O_3 coatings were in situ prepared on Q235 plane steel substrates by self-propagating high temperature synthesis (SHS) process. The effects of the reagents proportion of composite thermit reaction systems on the morphologies and phase structure of Al_2O_3 coatings were investigated systematically. The test results of morphology, composition and phase structure present the main component of the ceramic coatings are Al_2O_3. The Fe and Al elements at the interface between the ceramic coating and the substrate diffuse in different levels. The preheating process before self-propagating high temperature synthesis and spraying NiCrAl transition layer on steel substrate can significantly improve the combination with the substrate and decrease the pore at the interface.

Metallurgical Coatings

PB024

Effect of Ti and C on Microstructure and Mechanical Properties of Co-Based Metallic Glass Coatings on Aluminum Surface

Ziya Ozgur YAZICI[1], Nuray SEYIS[1], Aytekin HITIT[1] and Suleyman AKPINAR[1]

[1]*Afyon Kocatepe University, Engineering Faculty, Materials Sci. and Eng., TURKEY*

E-mail of Corresponding Author: zyazici@aku.edu.tr

Lack of crystal structure of the metallic glasses lead to superior properties such as high fracture strength, hardness and corrosion resistance. Therefore the properties of the metallic glasses make them attractive materials. However they are expensive and it is difficult to obtain with bulk forms because of their low glass forming ability. For this reason a composite material is preferred for the industrial applications. In this study, Co-based metallic glass ($Co_{42}Cu_1Fe_20Ta_5.5B_{26}.5Si_5$) coatings with %0-8 Ti and C additions were produced by squeeze casting with copper molds and, their microstructure and hardness were investigated. Co-based metallic glass coatings of 10-20 µm in thickness were formed densely with Vickers hardnes of Hv=1100-1200. After annealing of the coated substrates, nano sized crystal phases such as TaC and (Co,Fe)2B were precipitated in glassy layer, and the hardness of the coatings were successfully enhanced.

Metallurgical Coatings

PB025

Characterization of Electrodeposited Ni Composite Coatings with Embedded SiC, Al_2O_3 Particles

BEN TEMAM Hachemi[1], E. GUETTAF TEMAM[1] and S. RAHMANE[1]

[1] *Laboratoire de Physique des Couches Minces et Applications, Université Mohamed Khider- Biskra, Algérie,*

E-mail of Corresponding Author: ha_bentemam@yahoo.fr

The electrodeposited composite coatings know an increase development thanks to their particular properties obtained by incorporation of solid particles. In the present work, we describe the electrodeposition of pure nickel and the codeposition of Ni-SiC, Ni-Al_2O_3 using nickel chloride bath with organic additives on pretreated steel substrates. A traditional characterization tests such as adherence, corrosion behavior in 0,6 NaCl, optical and scanning electronic microscopy, X-rays and Vickers microhardness show that the prepared coatings have a good adherence and hardness, and resist to corrosion. These coatings have a homogeneous, compact and bright morphology with a high degree of codeposition of incorporated particles in nickel matrix.

Keywords: Electrodeposition; Composite; Microhardness; Corrosion; Morphology

Metallurgical Coatings

PB026

A Comparison Study of Photocatalytic Effects of Pure $K_2La_2Ti_3O_{10}$ with Sm and Nd Doped $K_2La_2Ti_3O_{10}$ Films

Güneş Kurşun[1,3], Özlem Canpolat[2,3], Fatma Bakal[2,3], Erdal Celik[1,4] and Ayşegül Pala[1]

[1]*Dokuz Eylul University, Department of Environmental Engineering , Buca, Izmir*
[2]*Dokuz Eylul University, Department of Metallurgical and Materials Engineering, Buca, Izmir*
[3]*Dokuz Eylul University, The Graduate School of Natural and Applied Sciences, Buca, Izmir*
[4]*Dokuz Eylul University, Center for Production and Applications of Electronic Materials, Buca, Izmir*

Email of corresponding author: gunes.kursun1@gmail.com

In this study, the layered perovskite type oxides $K_2Ln_2Ti_3O_{10}$ thin films individually doped with Sm and Nd were prepared by sol-gel method by using silicon substrates for photocatalytic applications. Solutions were prepared from K, La and Ti based precursors and deposited on silicon substrates by using spin coating method. Photocatalytic experiments were carried out by using a solar simulator and investigated with the UV-spectrophotometer. It is aimed to compare the effect of Sm and Nd for photocatalytic applications of $K_2Ln_2Ti_3O_{10}$thin films and by using this process for degradation of methylene blue in industrial wastewaters.

Keywords: Thin films, Photocatalytic, $K_2Ln_2Ti_3O_{10}$, Methylene blue

Metallurgical Coatings

PB027

Roughness steel substrates effect on galvanization coatings

Younes BENARIOUA[1]

[1]*Université de M'sila, Génie Mécanique, Algérie*

Email of corresponding author: benariouayounes@yahoo.fr

The use of galvanization coating as material treatment to improve the chemical properties of steel parts has shown a large development. Zinc and some of its alloys have a number of characteristics that make it well suited for use as a protective coating against the corrosion of steel substrates under severe atmospheric conditions. Zinc metal, which represents the main galvanization element offers then a cathodic protection to the ferrous materials.

Because of these excellent characteristics, galvanization coatings are expected to be used for different protective applications fields. The aim of this research work is to study the effect of roughness steel substrates on intermetallic compounds of galvanization coatings obtained at different immersion time. Steels substrates to be coated in this case are used in agriculture field as tubes in pivot.

After a best preparation of here surfaces by different roughness process, various steel of substrates were galvanized by immersion in a molten zinc bath maintained at 450°C During the galvanization process, the chemical reactions that take place between the steel and the liquid zinc give rise to the formation of different intermetallic. Thus, three phases of Gamma, Delta) and Zeta are produced on the steel substrate. Theses metallic compounds have been coated then by a solid solution of iron in zinc as Eta phase.

These intermetallic compounds are hard and fragile and the product that is obtained is not suitable for working, since this would inevitably lead to cracking and detachment of the coating. The morphology and thickness of phases formed the coatings at different parameters took place with scanning optical microscope. Finally the hardness of coatings was measured with a Vickers hardness tester.

Metallurgical Coatings

PB028

The Growth of Self-Catalyzed GaAs Nanowires on (111) Si Substrates by Molecular Beam Epitaxy

Burcu Arpapay[1] and Uğur Serincan[2]

[1]Nanoboyut Research Laboratory, Department of Physics, Faculty of Sciences,
[2]Yunus Emre Campus, Anadolu University, 26470, Eskişehir, Turkey

E-mail of Corresponding Author: barpapay@anadolu.edu.tr

Gallium Arsenide (GaAs) nanowires on p-type (111) silicon substrates have been grown by using self-catalyzed vapor–liquid–solid mode in molecular beam epitaxy system. Before growth, gallium (Ga) was deposited to form the droplets and initiate nanowire synthesis on the native oxide layer. The growth temperatures of the samples were 580, 600 and 620 ^{o}C which were named as W1, W2 and W3, respectively and the V/III (As_4/Ga) flux ratio was kept constant for all the samples. The samples were then cooled rapidly and transferred out of the chamber. The nucleation and crystal structure of nanowires were detected in-situ by reflection high energy electron diffraction. Afterwards, the morphology and density of nanowires were studied by scanning electron microscopy. The sample grown at the lowest temperature has well defined vertically aligned nanowires. For W2, beside vertical nanowires, non-vertical nanowires are also observed and the fraction of vertical nanowires acutely decreases in W3. In addition, branch-like formations are identified on the nanowires in both W2 and W3. It is observed that the growth rate of GaAs nanowires isn't directly proportional to the growth temperature since the longest nanowire is obtained for W2. Comparing W1 and W2, it reveals that the nanowires grown at 580 ^{o}C exhibits lower density than 600 ^{o}C significantly. For all the samples, the loss of Ga droplets is observed and the parasitic growth on the substrates turns to clusters by increasing the growth temperature. In summary, under high V/III flux ratio, the effect of growth temperature on the structure and morphology of GaAs nanowires is examined. The results indicate the importance of optimizing growth parameters to achieve ideal conditions for GaAs nanowire growth.

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Nanostructured Growth

PB029

The Effect of Time on ZnO Nanorods Grown Hydrothermal Method

Zeynep TURGUT[1], Sibel MORKOÇ KARADENİZ[1] Çağrı ÇIRAK[1], Burcu BOZKURT ÇIRAK[2], Tuba KILINÇ[1], Mehmet ERTUĞRUL[3] and Ali Ercan EKİNCİ[1]

[1]*Department of Physics, Erzincan University*
[2]*Department of Alternative Energy Sources-Technologies, Erzincan University*
[3]*Department of Electrical and Electronics Engineering, Atatürk University*

E-mail of Corresponding Author: morkocsibel@gmail.com

Zinc oxide (ZnO), as wide and direct band gap (3.37 eV) semiconductor, has attracted much attention due to its novel optical and electronic properties as well as promising applications in solar cells, nanolasers and other nanodevices [1]. Great progress in nanostructured ZnO with diverse morphologies such as nanorods, nanowires, nanobelts and nanotubes has been made and In particular, well-aligned ZnO nanorods are highly desirable for their potential applications as electroluminescent devices, field emission devices, solar cells and nanogenerators [2]. Up till now, a number of physical and chemical techniques and such as the vapour liquid solid method, chemical vapour deposition and hydrothermal growth were used to fabricate well-aligned ZnO nanorod arrays [2]. İn this study, ZnO seed layers were prepared on ITO substrates by Chemical Bath deposition Technique. ITO substrates were immersed in aqueous solution of 0.1 M Zinc Acetate dihydrate and 0.1 M hexamethylenetetramine (VL: 1:1) at room temperature for 15 min. After immersing process, substrates heated at 100 °C for 15 min. The process repeated 10 times for achieving seed layer. After seed processing, Zinc oxide (ZnO) nanorods were prepared by hydrothermal method at 90 °C on the seed layers. A prepared Solution for Hydrothermal process contained 0.1 M Zinc Acetate dihydrate and 0.1 M hexamethylenetetramine (VL: 1:1). The solution was transferred into Teflon lined stainless-steel autoclave (50 ml). Then, the seed layer put into autoclave was taken at 90°C for different times. Each of these samples was characterized by SEM, XRD and UV for comparing morphological, structural and optical properties.

[1] Zikun Li, Xintang Huang, Jinping Liu,Yanyuan Li, Guangyun Li, Materials Letters, 62 (2008), 1503-1506.
[2] Zhaolin Yuan, Junsheng Yu, Yadong Jiang, Energy Procedia, 12 (2011) 502-507

Nanostructured Growth

PB030

Effect of Annealing Temperature on Structural and Luminescence Properties of EU_{3+}-doped Y_2O_3 Red Phosphor Thin Films by Pulse Laser Depostion Method.

Abdub Ali[1], FB Dejene[1] and Hendrik Swart[1]

[1]*Universty of the Free state, Physics, South Africa*

E-mail of Corresponding Author: aliag@qwa.ufs.ac.za

Pulse Laser Deposition was used to obtain nanocrystalline Y_2O_3:Eu_{3+} red-emitting thin film phosphors. x-ray diffraction (XRD) measurement confirmed the crystallinity of the films. It was observed that high temperature annealing improved the crystallinity of the films. Photoluminescence measurement indicates intense red emission around 626 nm due to $5D_0 \rightarrow 7F_2$ transition. Scanning Electron Microscopy (SEM) show agglomerates of non-crystalline particles with spherical shapes for as-prepared films. After annealing at high temperature, SEM also confirms that the crystallinity of the films improved. Atomic Force Microscopy (AFM) further confirmed the crystallinity of the films at higher annealing temperatures. UV measurement gave a band gap in the range of 4.6-4.8ev. It was concluded that the annealing temperature plays an important role in the luminescence intensity and crystallinity of these films.

Nanostructured Growth

PB031

Ethylene Glycol, Methanol and Ethanol Electro-Oxidation at Cu_2O Thin Film

Tayakout BEZGHICHE[1], T.Bezghiche-Imloul[2], H. Hammache-Makhloufi[2], N.Ait Ahmed[2] and L. Makhloufi[2]

[1]*University of Bejaia, Algeria, chemistry*
[2]*Laboratoire d'Electrochimie, Corrosion et de Valorisation Energétique, Université A.Mira Bejaia (06000), Algérie.*

E-mail of Corresponding Author: imloultayakout@yahoo.fr

Direct alcohol fuel cells (DAFCs) are being considered as power sources for portable electronic devices such as notebooks, mobile phones, etc. Low molecular weight alcohols such as methanol, ethanol and ethylene glycol have been generally proposed as the fuel for proton exchange membrane fuel cells (PEMFC) due to high mass energy density, simple set-up and availability of the liquid fuel (easy handling, storage and distribution). However, methanol presents some safety risks such as toxicity and inflammability. Besides, methanol crossover through ionomeric membranes cannot be avoided. On the other hand, ethanol (EtOH) or ethylene glycol (EG) appears to be potentially more attractive due to their low toxicity, low volatility, and high energy density, together with less pronounced crossover due to their larger molecular size [1]. Platinum is the best catalyst for alcohol oxidation, however, the high cost limits its use. Thus, a great effort has been devoted to the development of fuel cell electrocatalysts with the aims of increasing their activity and reducing the noble metal content [2]. Therefore, this work aims to prepare films of cuprous oxide Cu_2O by electrodeposition method and then study the electrochemical oxidation of ethylene glycol, methanol and ethanol on the as prepared film. A Cu_2O particle obtained has been characterized by various microscopic techniques as scanning electron microscopy (SEM), X-ray diffraction (XRD) and electrochemical (chronoamperometry, voltammetry). It has been found that, the electrodeposited Cu_2O film show higher catalytic activity and stability towards electrooxidation of these alcohols.

Keywords: Cu_2O; Electrodeposition; thin film; Methanol; Ethanol; Ethylene glycol

[1] An L, Zhao TS, Shen SY, Wu QX, Chen R. Performance of a direct ethylene glycol fuel cell with an anion-exchange membrane. Int J Hydrogen Energy 2010; 35:4329-35.
[2] Park B, Cairns EJ. Electrochemical performance of TiO2 and NiO as fuel cell electrode additive. Electrochem Commun 2011; 13(1):75-7

Nanostructured Growth

PB032

pH Sensing in Aqueous Solutions Using a Nanostructured MnO_2 Thin Film

Nabila CHERCHOUR[1], Bouzid Messaoudi[2], Claude Deslouis[3] and Alain Pailleret[3]

[1]*University of Bejaia-Algeria and University of Paris 6 France*
[2]*LECVE, A.Mira-Bejaia Univ., Algeria*
[3]*UPMC Univ. Paris VI, CNRS, UPR15, LISE, Paris, France*

E-mail of Corresponding Author: nabila.cherchour@gmail.com

Many materials were investigated for elaboration of pH sensors. Most them is based on the metals oxides. Among them, RuO_2 and IrO_2 seem to be the most promising ones, as a consequence of their chemical stability and high electronic conductivity [1]. On the other hand, the rather tricky and expensive synthesis of the promising oxide limited substantially their interest for the elaboration of pH sensors. In parallel, manganese dioxide is probably one of the most studied oxides among transition metal oxides and has applications in catalysis, ion exchange, molecular adsorption and energy storage. It was already shown to be a material sensitive to pH, due either to its electrochemical reduction mechanism involving presumably the introduction of protons and electrons in its structure or to ion exchange mechanisms involving surface hydroxyle groups [1,2]. In this study, a nanostructured MnO_2 thin film was electrodeposited on glassy carbon electrode by chronoamperometry technique from aqueous solutions containing sulfuric acid and manganese sulfate. The resulting films were found to have a nanostructured character presumably due rather to birnessite than to gamma-MnO_2, as suggested by their Raman and XRD signatures and they have also a semiconductor character showed by CS-AFM method with a low surface conductivity at the nanoscale. The growth of a nanostructured MnO_2 thin film depends on the synthesis conditions. The calculations of thickness of MnO_2 thin film led to thicknesses varying between 93 nm and 542 nm for electrolysis times varying between 30 s and 300 s. The influence of the deposition potential using different potential values with 60 s electrolysis time showed that the thickness of these films increases from 40 nm to 160 nm when the deposition potential varied from 625 to 695 mV vs SSE. Beyond this second value, the film thickness is stable and then slightly decreases as the deposition potential increases to reach 1086 mV vs SSE. Electrodeposited MnO_2 thin films lead to modified electrodes that present an obvious although complex pH dependent potentiometric response in aqueous solutions. This sensor indeed showed a single slope non-Nernstian linear behaviour over the whole pH range as this latter increased from 1.5 to 12 (trace) whereas a Nernstian two slopes linear behaviour is observed when pH decreased from 12 to 1.5 (re-trace). This peculiar behaviour was observed whether the trace and the re-trace were obtained both or each with a single manganese dioxide thin film, with a single aqueous solution having the adequate pH, whatever the pH of the starting point was (1.5 or 12).

Keywords: MnO_2, electrodeposition, nanostructure, growth, thin film, pH sensing.

[1] A. Fog, R.P. Buck, Sens. Actuators, B 5 (1984) 137-146.
[2] L. Qingwen, W. Yiming, L. Guoan, Sensors and Actuators B 59 (1999) 42-47.

Nanostructured Growth

PB033

Multifunctional Composite Coatings Formed by Plasma Electrolytic Oxidation

Dmitry Mashtalyar[1], Sergey Sinebryukhov[2], Igor Imshinetskiy[2], Konstantine Nadaraia[2] and Sergey Gnedenkov[2]

[1]*Institute of chemistry FEB RAS, Laboratory of nonstationary surface processes, Russia*
[2]*Institute of chemistry FEB RAS, Vladivostok, Russia*

E-mail of Corresponding Author: madiva@inbox.ru

Plasma electrolytic oxidation enables one to form the multifunctional protective coatings at the surface of various metals and alloys with a unique complex of properties, including anticorrosive, antiscale, bioinert, bioactive, wearproof etc. Heterooxide layers formed by this method have a porous rough surface of outer layer, good adhesion to the substrate, and therefore can be used as convenient basis for formation of the composite layers, which contain nanosized inorganic and polymeric particles in its composition. Thereupon, superdispersed polytetrafluoroethylene and its low-molecular fractions should be taken into account. It is caused by the varied properties of this fluoropolymer and its practical relevance. As inorganic materials for synthesis of the new composite layers improving properties of a surface, nanostructures powders (particle sizes <100 nm) W, WC, Co, SiO2, ZrO2 and Al2O3 were used.

We have developed a stable electrolytic systems having complex composition, which can be used for metals and alloys treatment by means of plasma electrolytic oxidation method. It have been ascertained that coatings possess by complex of practically useful properties.

The presented research demonstrated the availability of the application of various fractions of superdispersed polytetrafluoroethylene for the forming of the composite polymer-containing anticorrosion, bioinert, antifriction layers on metals and alloys. Application of multiple fluoropolymer spreading followed by heat treatment and inorganic nanosized compounds allow obtaining defectless composite layers, which have the optimal protection properties (the charge transfer resistance increases by 5-6 orders of magnitude, microhardness of 8-10 times, friction coefficient reduces by one order of magnitude compared with unprotected metal/alloy).

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Metallurgical Coatings

PB034

Synthesis, Characterization and Electrochemical Performance of Manganese Dioxide /Carbon Nanotubes Composite

S. Kendouli[1], N. Sobti[1] and S. Achour[1]

[1]*Faculty of science, Ceramic Laboratory. Constantine1 University, Constantine, Algeria*

Email of corresponding author: Souadken1@hotmail.fr

During the past decade, manganese oxides have attracted considerable research interest due to their distinctive physical and chemical properties and potential applications in catalysis, ion exchange, molecular adsorption, biosensor, and energy storage [1]. Literature reviews of electrodes made from MnO_2 showed that high specific capacitance and rate capability should be obtained in principle. However, a key weakness of the metal oxide material is its limited electric conductivity. To effectively utilize MnO_2 materials, binary composites of MnO_2 with either carbon nanotubes (CNTs) or conducting polymers have been explored and demonstrated improvement in the electrochemical performance [2]. In the present paper, we report a novel method to synthesis a binary MnO_2CNTs composite for improved electrochemical Performance. The MnO_2 nanoparticles were first prepared by polyol method using manganese chloride as the starting precursor, sodium hydroxide (NaOH) as a reducing agent and diethylene glycol (DEG) as a solvent and capping agent. After that, a kaolin membrane was first immersed in Carbone Nanotubes solution followed by drying several time until the color of the membrane became dark. Finally, the prepared membrane was immersed in MnO_2 nanoparticles solution and dried. The obtained CNTs and MnO_2/CNTs composite were characterized by various techniques such as, Fourier Transform Infrared (FTIR) and RAMAN spectroscopy. Electrochemical behavior of the as-prepared samples was assessed in K_2SO_4 electrolyte using a three-electrode electrochemical cell at room temperature under visible light.

Key words: Electrochemical, MnO2Nanoparticles, Carbone Nanotubes, Composite, Polyol.

[1] Mingtao Zheng, Haoran Zhang, Xuebin Gong, Ruchun Xu, Yong Xiao, Hanwu Dong, Xiaotang Liu and Yingliang Liu. Nanoscale Research Letters. 2013, 8:166.
[2] Ye Hou,Yingwen Cheng,Tyler Hobson, and Jie Liu. Nano Lett. 2010, 10, 2727–2733.

Nanostructured Growth

PB035

Correlation Between Sheet Resistance and Crystalline Texture in Thin Copper Films

Henry Fernández[1], Marcos Flores[2], Rodrigo Espinoza[3]

[1]*Universidad de Chile Física Chile*
[2]*Departamento de Física Facultad de Ciencias Físicas y Matemáticas Universidad de Chile*
[3]*Departamento de Ciencia de Materiales Facultad de Ciencias Físicas y Matemáticas Universidad de Chile*

Email of corresponding author: henry.fernandez@ing.uchile.cl

We present a study of the morphology, microstructure and electrical conduction properties of thin copper films deposited on thermal silicon oxide and muscovite mica substrates. The films were deposited in a high vacuum system for thicknesses ranged from 20 up to 100 nm. Due to the sample holder does not have a cooler system, the substrate temperature was increasing during the deposition, and the final temperature was close to 380 K. The deposition rate was varied among 1, 6 and 10 nm/min. The surface morphology and nanostructures of the samples were characterized by AFM and SEM. The surface roughness is linear dependent on nominal thickness with a maxima value of 12 nm for all of the depositions and the grain size of 80 nm. The oxidation state of the films by their exposure to the air was evaluated by XPS and the oxide layer thickness was estimated from cross sectional HR-SEM micrographs. We identify mainly a Cu_2O on the outer most surface film of a few nanometers. The microstructure and crystalline texture were studied by XRD. The films exhibit a linear relation between the mean size of the coherent crystalline domains depending on the film thickness, with no further influence of the substrate nor the deposition rate. Besides, the films exhibit a fiber texture type (111)[001] and this preferential orientation was quantified by the texture factor, f_t. We measured the misoriented Bragg planes from the (111) reflection, and this was represented semi-quantitatively by the full with of half maximum, \Delta \omega , of the orientation distribution in the iso-inclination measurement for each film. We found that \Delta \omega depends on the film thickness and the deposition rate. Additionally, measurements of sheet resistance, R_s, was carried out by a four point probe system. R_s shows a strong dependence on the film thickness and deposition rate. It was found that there is a correlation between f_t, \Delta \omega and Rs in dependence of the films thickness. We evidence a dependence between microstructural parameters and the electrical conduction properties, which can be controlled by the variation of the deposition conditions, allowing the optimization of the physical properties of the thin copper films. We propose a physical model explaining the causality enrolled in this correlation.

Nanostructured Growth

PB036

Porous Palladium Thin Films Fabricated by Hydrothermal Treatment in Aqueous Citric Acid Solution

Yohei Tamura[1], Takashi Harumoto[2] and Takashi Ishiguro[2]

[1]*Tokyo University of Science Department of Materials Science and Technology Japan*
[2]*Department of Materials Science and Technology, Tokyo University of Science*

Email of corresponding author: ishiguro@rs.noda.tus.ac.jp

Porous materials are applied to catalysts and sensors. In general, porous metals, such as porous Ni, can be produced by dealloying, a chemical process which dissolves one or more metallic components from a precursor alloy. The dealloying process is usually carried out using strong acidic or alkaline liquid, for instance, H_2SO_4, HNO_3, HCl and NaOH. However, as these strong acids or alkalis are not environment-friendly, another dealloying process which does not use strong chemicals is preferred. According to our research [J. Appl. Phys. 106, 023524 (2009)], sputter-deposited Al films could be transformed into aluminum hydroxide (AlOOH) films by the hydrothermal treatment in ultrapure water. As the surface morphology of the film is dramatically modified by the hydrothermal treatment, Al may dissolve once into the water and then precipitate on the substrate as AlOOH. Therefore, we expected that porous noble metal film could be fabricated by the hydrothermal treatment of Al-noble metal alloy film without strong chemicals. In this study, Al-Pd alloy thin films were adopted as a model case and deposited on Si substrates by rf-magnetron co-sputtering using Al-Pd target. After the deposition, Al-Pd alloys were boiled in ultrapure water (18.2 MΩ・cm) at 368 K for 110 minutes. The surface morphology was analyzed using a field emission scanning electron microscope (FE-SEM). The cross sectional observation was also conducted using a scanning transmission electron microscope (STEM). In addition, element mapping of the cross sectional specimen was performed by an energy dispersive X-ray spectroscopy (EDS) analysis. Referring to cross sectional STEM images, it was revealed that the specimen after hydrothermal treatment exhibits a characteristic double layered structure of a low-density upper layer of AlOOH and a porous Pd sublayer. Based on this result, we attempted to prevent formation of the AlOOH upper layer by adding citric acid. Accordingly, Al-Pd alloy films were boiled in a dilute aqueous solution of citric acid (1.0 × 10-5 mol/L) at 368 K for 110 minutes, and a 60-nm-thick mesoporous Pd film without AlOOH upper layer was fabricated. As conclusion, porous Pd films were fabricated by the hydrothermal treatment in the dilute aqueous solution of citric acid. Because no strong acids or alkalis are employed, this process is environment-friendly method compared to ordinary dealloying process."

Nanostructured Growth

PB037

Development of Magnetism in Iron Thin Film Grown on Patterned Surface

Daniel Merkel

ESRF Dynamics and extreme conditions France dmerkel@esrf.fr

Email of corresponding author: dmerkel@esrf.fr

Magnetic nanoparticles have attracted considerable interest in science and engineering because of their unique physical and chemical properties Two concepts exist to achieve patterned media: In the top-bottom approach (lithography [1], chemical reduction [2] etc.), the bulk system is modified to obtain the patterned structure and the bottom-up approach where the desired structure is achieved by “atom by atom” or “layer be layer”. Atomic deposition on a patterned template [3] is a bottom up method which can easily implemented to industrial purposes. In order to fully understand and control the magnetic, electric and structural properties of a magnetic patterned media, the initial parameters require precise characterisation and the change of these properties should be followed during deposition.

In this work we have investigated the evolution of magnetism in iron, grown on monodisperse 25 nm SiO_2 spheres prepared by Langmuir-Blodgett technique. From nuclear resonant forward scattering and grazing incident small angle scattering experiments we have found that the development of magnetism in a few monolayer regime is highly affected by the topology of the surface and differs significantly from what we have obtained in case of flat surface.

[1] D.G. Merkel, L. Bottyan, F. Tancziko, Z. Zolnai, N. Nagy, G. Vertesy, J. Waizinger, L. Bommer, J. Appl. Phys. 109, 124302 (2011)
[2] Y. Fu, A. Habtemariam, A. M. Pizarro, S. H. van Rijt, D. J. Healey, P. A. Cooper, S. D. Shnyder, G. J. Clarkson and P. J. Sadler, J. Med. Chem. 53, 8192 (2010)
[3] K Schlage, S Couet1, S V Roth, U Vainio, R Rüffer, M M Abul Kashem3, P M¨ uller-Buschbaum3 and R Röohlsberger1 New J. Phys. 14 (2012) 043007

Nanostructured Growth

PB038

Elaboration and characterization of polystyrene doped SnO_2 thin films

Fahima Boudjada[1], Abdelghani Djebli[1], Mouna Hallel[1], Boubaker Boudine[1], Hocine Chorfi[1] and Miloud Sebaïs[1]

[1]*Département de Physique, Université dConstantine1, Algérie*

Email of corresponding author: boudjadafahima@yahoo.fr

Thin films of tin oxide (SnO_2) dispersed in polystyrene nanocomposite (Ps/SnO_2) were successfully prepared at room temperature by mild chemistry and deposited on glass substrates by spin coating route.

A fine nanostructure characterization is revealed by the X-ray diffraction analysis and completed by the AFM morphology. Also, X-ray fluorescence, IR and Raman confirmed the incorporation of the nanoparticles of hexagonal structure SnO_2 (rutile type) in the polystyrene matrix with nanometric size and allowed vibrational modes relative to the SnO_2 molecule in developed thin films.

The optical absorption spectra Ps/SnO_2 nanocomposites showed the presence of peaks at exitonic character and a shift of absorption threshold towards blue compared to that of the bulk crystal by the quantum size effect (quantum confinement). The optical band gap and refractive index are estimated.

Keywords : Nanocomposite, SnO_2, Polystyrene, XRD, UV-Visible, optical properties , quantum confinement , FTIR, Raman.

Nanostructured Growth

PB039

Deposition of Nanocomposite Thin Films in Low-Pressure Microwave Plasma Effect of Nanoparticles Encapsulated in Amorphous Carbon Films

Kihel Mouloud[1], Clergereaux R[2] and Sahli S[3]

[1]*Université Constantine 1, électronique, Algeria*
[2]*Universités de Toulouse- LAPLACE- CNRS, 118 Route de Narbonne, 31062 Toulouse cedex, France*
[3]*Université Constantine 1, Laboratoire LMI Constantine 25017, Algérie*

E-mail of Corresponding Author: kihel_mouloud@hotmail.com

In previous work [1], it has been observed that nanopar-ticles grow in C2H2 plasma phase in low-pressure micro-wave plasmas excited at electron cyclotron resonance (ECR). Several studies have been initiated to determine the origin of these nanoparticles and find their compositions [2]. A key role of the magnetic field has been reported: it confines nanoparticles precursors up to a critical size where they leave the high magnetic field region to the diffusion plasma.

By embedding those nanoparticles in the deposited ma-trix, it is possible to form nanocomposite thin films in one single process.

We will report that nanoparticles highly affect the intrinsic properties of the matrix. For example, when the matrix is insulating layer (with a classical signature in the dielectric loss), in presence of nanoparticles a high relaxation peak appears. This phenomenon, related to photo-excited process, is directly related to the density of nanoparticles.

Then, the use of nanocomposite thin films formed in C2H2 ECR plasma will be described in different field of appli-cations.

[1] Calafat M, Escaich D, Clergereaux R, Raynaud P, and Segui Y 2007 Particle Formation In Acetylene Very Low-Pressure High Density Magnetized Plasmas Applied Physics Letters 91, 181502
[2] Calafat M, Yuryev P, Drenik A, Slim A, Clergereaux R 2011 Carbon Nanoparticle/Hydrogenated Amor-phous Carbon Composite Thin Films Formed in ECR Plasma Plasma Processes and Polymers 8, 401

Optical, Optoelectronic and Dielectric Coatings

PB040

Optical Nitric Oxide Sensor Properties of Phthalocyanine Based Dyes in Their Thin Film Forms

Ozlem Oter[1], Akif Cihan Aydın[2], Kadriye Ertekin[3] and Erdal Celik[4]

[1]*University of Dokuz Eylul Department of Chemistry, Turkey*
[2]*The Graduate School of Natural and Applied Sciences, Dokuz Eylul University, Kaynaklar Campus, 35160 Buca, Izmir, Turkey*
[3]*Department of Chemistry, Faculty of Science, Dokuz Eylul University, Kaynaklar Campus, 35160 Buca, Izmir, Turkey*
[4]*Center for Fabrication and Application of Electronic Materials (EMUM), University of Dokuz Eylul, 35160 Buca, Tinaztepe, Izmir, Turkey*

Email of corresponding author: ozlem.oter@deu.edu.tr

In this work, we have for the first time tested phthalocyanine based dyes in their thin film forms for detection of nitric oxide radical. Like other free radicals nitric oxide contributes to the development of several human diseases. Besides it takes place in many biological mechanisms occurring in human body. Nitric oxide is also a very toxic environmental waste of industrial processes or exhaust gases. Thus, the accurate measurement of nitric oxide is of great importance. The fluorescent dyes of different phthalocyanine derivatives (metal free, nickel, zinc, magnesium and cobalt phtalocyanines) were tested and compared for nitric oxide sensing with spectroscopic method. The dye doped polyvinyl chloride based thin films were tested for nitric oxide in phosphate buffer solution of pH 7.4. We have found that different from the other oxygen sensitive dyes such as pyrene and tris(2,2'-bipyridine)ruthenium ([Ru(bpy)3]2+), the phthalocyanine based dyes exhibited increasing response to nitric oxide. This increase in fluorescence intensity due to nitric oxide can be attributed to a complex formation between the free radical and the phytalocyanine dye. In conclusion, our method allows for detecting ppm levels of nitric oxide at intracellular pH. The limit of quantification was found as 0.76 ppm for magnesium phthalocyanine. Our data suggest that the method can be used for the quantification of nitric oxide based on not only the steady state fluorescence but also the time-resolved fluorescence measurements which is more suitable for in vivo measurements.

Optical, Optoelectronic and Dielectric Coatings

PB041

Improving the efficiency of dye–sensitized solar cells (DSSC) using metal transition doped TiO_2 as *semiconductor*

Lolwa Samet[1], Basma Yacoubi[2], Radhouane Chtourou[2]

[1]*Centre de Recherche des Sciences et Technologies de l'Energie Laboratoire de Photovoltaique Tunisia*
[2]*Laboratoire de Photovoltaique, Centre de Recherche des Sciences et Technologies de l'Energie, Technopole Borj Cedria, Tunisia*

E-mail of Corresponding Author: lolwasamet@gmail.com

TiO_2 doping has been widely used in photocatalysis and photovoltaic cells to improve the performance of this semiconductor. We present the doping by transition metal cations (M: Mn^{2+}, Co^{2+}, Cu^{2+}) effect on TiO_2-electrode used in dye sensitized solar cells. The pure and metal transition M-doped TiO_2 powders, with 0.6 % as atomic ratio of M to Ti, were prepared by sol-gel protocol and annealed at 400°C. The obtained transition metal cation doped TiO_2 powders were characterized by X-ray diffraction, Raman spectroscopy, FT-infrared spectroscopy and UV-Vis spectroscopy. Dye-sensitized solar cell efficiency fabricated with sol gel doped TiO_2 powder was remarkably better than that of undoped one. Doping TiO_2 led to significant changes in structural and optical sol gel powder properties and affects charge transfer kinetics and dye adsorption characteristics. The photoelectric conversion performances of DSSCs based on these photo electrodes were tested and compared.

Mn-doped TiO_2 powder presents the better crystallinity, the most reduced bang gap and the best value of power conversion efficiency for the dye sensitized solar cell assembled.

Thin Films in Photovoltaic Cells and Energy

PB042

Fabrication and Characterization of IZO Thin Films Prepared by The Colloidal Method

M. Medjaldi[1,2,3,] O. Touil[3], M. Zaabat[2], B. Boudine[3], O. Halimi[3] and M. Sebais[3]

[1] *Abbes Laghrour University, khenchela, Algeria.*
[2] *Laboratoire composants actifs et matériaux, Department of physics, Faculty of Sciences Exactes, Larbi Ben m'hidi University OEB, Algeria.*
[3] *Laboratoire de Cristallographie, Department of physics, Faculty of Sciences Exactes, Constantine 1 University, Algeria.*

Email of corresponding author: med_malika@yahoo.fr

In last decay, ZnO thin film has reached an important place in new technologies because of its several properties such as semiconducting and laser emitting devices. It has a large band gap of 3.37 eV and a large exciton binding energy of 60 meV which make it a good candidate for optoelectronic applications. The conductivity of ZnO will be largely enhanced by doping little In, but it still keeps high transparency. So, IZO film has been widely investigated and is considered to be a promising possible alternative to ITO films.

This work consist to the fabrication and characterization of ZnO:In thin films. The sample preparation was carried out by the colloidal method. The pure and IZO thin films were deposited using a dip-coating technique on glass matrix. The optimal condition for samples fabrication has been investigated. The XRD and Raman characterizations show that the ZnO thin film crystallize with a wurtzite structure. The optical properties of IZO thin films reveal that doping changes the optical gap of ZnO.

Optical, Optoelectronic and Dielectric Coatings

PB043

Production and Application of Al_2O_3 Dielectric Layer on Silicon Wafer using Magnetron Sputtering Method

Ümit Evren[1,2], Çağlar Özer[1,2], Ömer Mermer[1,3], Mustafa Toparlı[1,2,4], L. Zümre Alıcan Alıcıkuş[5], Fadime Akman[5] and Erdal Çelik[1,2,4]

[1] *Dokuz Eylul University, Center for Production and Applications of Electronic Materials (EMUM), Buca, Izmir, 35160, Turkey*
[2] *Dokuz Eylul University, Dept. of Metallurgical and Materials Engineering, Buca, Izmir, 35160, Turkey*
[3] *Ege University, Dept. of Electric and Electronic, Bornova, Izmir, 35160, Turkey*
[4] *Dokuz Eylul University, Dept. of Nanoscience and Nanoengineering, Buca, Izmir, 35160, Turkey*
[5] *Dokuz Eylul University, Faculty of Medicine, Dept. of Radiation Oncology, Balçova, Izmir, 35160, Turkey*

Email of corresponding author: umitevren64@gmail.com

In this study, alumina layers with different thicknesses will be formed on silicon wafer by using magnetron sputtering method and their electrical properties of these layers will be determined. The process of the optimum values will be done on the magnetron sputtering device to form Al_2O_3 dielectric layer. The caracterization of obtained layers will be performned using XRD, XPS, AFM and SEM devices. The optimum results will be discussed.

Key words: Dielectric layer, magnetron sputtering, Al_2O_3 coating

Optical, Optoelectronic and Dielectric Coatings

PB044

Effect of Crystallographic Texture of Aluminum Substrate on Optical Properties of Anodized Films

Nahid Sarrami and Maryam Bagheri

Isfahan University of Technology Materials Engineering, Iran

Email of corresponding author: n.sarami@ma.iut.ac.ir

Anodic oxidation of aluminum, an electrochemical process for increasing the thickness of surface oxide film on the metal, may be modified for optimum mechanical and optical properties. In this research, the effect of preferred orientation of the aluminum substrate on the characteristics of anodized layers has been studied. Samples made from a commercially pure aluminum sheet were treated by thermo-mechanical processing to obtain a series of crystallographic textures on the surface. The samples were then anodized in phosphoric acid under identical conditions, and some of them were color anodized. The thickness of oxide layers were measured by scanning electron microscope on metallographic sections. Crystallographic texture of the anodized layers was evaluated by calculation of texture parameter using data of x-ray diffraction patterns. Evaluation of optical properties was carried out by spectral reflectance in the range of visible light spectrum. Experimental results showed that strong (111) texture of the substrate material could produce increased mechanical and optimum optical properties. These characteristics are discussed in the present paper in terms of processing parameters of anodizing treatment.

Optical, Optoelectronic and Dielectric Coatings

PB045

Improved Crystallinity and Enhanced Photoluminescent Properties of Laser-ablated Eu^{3+} Doped YVO_4 Thin Films Produced by Optimizing the Deposition Time.

Foka Kewele[1], B.F Dejene[1] and H.C Swart[1]

[1]*University of the Free State, Physics, South Africa*

E-mail of Corresponding Author: fokake@gmail.com

Eu^{3+}-doped yttrium vanadate (YVO_4:Eu^{3+}) thin film phosphors have been given much attention because of its high resolution and high efficiency planar display. The oxide based phosphors appeared as a potential choice for the red field emission display (FED) phosphor [1]. YVO_4:Eu^{3+} thin films is one of the most promising red phosphor with application in high pressure mercury lamps, television cathode ray tube displays but mostly in plasma display panels. YVO_4:Eu^{3+} thin films have been prepared by pulse laser deposition (PLD) which is known as a unique process that provides stoichiometric transfer of target materials. In this study the YVO_4:Eu^{3+} thin films were grown at deposition pressure of 5 mTorr and the effect of the deposition time on the crystallization behaviour, the morphology, and the luminescence property of YVO_4:Eu^{3+} thin films were investigated. Photoluminescence spectra showed a strong red emission peak at 619 nm for ^5D_o-$^7F_2$ transition and have other emission peaks at 594 nm for ^5D_o-$^7F_1$ transition and 652 nm for ^5D_o-$^7F_3$ transition. This is due to energy transfer to Eu^{3+} ions followed by absorption of UV light in the VO_4^{3-} group [2]. Crystallinity of the thin films has been very important for the surface roughness. The diffraction data indicated a cubic structure and suggest that the (200) surface is preferably orientated for films grown on silica substrate. X-ray diffraction (XRD) spectra indicated that an increasing in time of the deposition the resulted in the growth of films. The SEM images of the YVO_4:Eu^{3+} thin films phosphor have shown that the grain size increases as the deposition time increased. It was observed that increase in deposition time to 45 min led to a remarkable increase of photoluminescence, and the intensity at 619 nm was increased by a factor of more than 10 times in comparison with that of samples grown at 30 and 60 min. The enhanced luminescence was regarded as resulting not only from the improved crystallinity but also from the reduced internal reflections caused by rougher surfaces.

Thin Film Growth & Epitaxy

PB046

SUPER INTENSITY LASER FIELD INTERACTED WITH ATOMIC SYSTEM AND HİGH HARMONİC SPECTRUM OBTAİNED FROM CHARACTERİSTİCS OF HİGH ENERGY

Dilan ALP[1]

[1]*Energy Systems Engineering Department, University of Sirnak, 73000 Sirnak, Turkey*

Email of corresponding author: dilanalp79@gmail.com

As a result of interaction of laser pulses and the resulting one-electron atomic systems with high harmonic spectrum obtained from the characteristics of high energy in recent years, the research topics of interest.

In this study, we describe analytic and quantum theory of high order harmonic generation by a multiphoton strong-field process.

All the calculation strong laser field currently available, simple description of multiphoton process based on non-relativistic Schrödinger equation and dipol approximation can breakdown. We discusses how non–dipole effects of order 1/c due to magnetic field componenet of laser pulse, influence harmonic generation. Than, the generation of high order harmonic in single atoms within framework of strong field approximation in semi-clasical and quantum mechanics model.

The attosecond pulses from high harmonic generation as a result of a lot of scientists have shed light on. Pulsed lasers in today serve many different purposes of use, and works very delicate. Rays, x-ray beam short-wave and long-wave infrared rays are scattered far field of the electromagnetic spectrum for all.

By this study, has offered a solution of high harmonic generation, large application and search area that uses new invented optical techniques.

Optical, Optoelectronic and Dielectric Coatings

PB047

Properties of Piezoelectric ZnO thin films grown by pulsed laser deposition onto glass and silicon substrates

Adel Taabouche[1,2], Abderrahmane Bouabellou[1], Fouad Kermiche[1], Faouzi Hanini[1] and Yacine Bouachiba[1]

[1]*Thin Films and Interfaces Laboratory, University of Constantine 1, Constantine, Algeria*
[2]*Welding and NDT Research Centre (CSC). BP 64 CHERAGA - ALGERIA*

Email of corresponding author: adelphm@gmail.com

ZnO piezoelectric thin films using a series of high quality ceramic targets have been deposited at 450 ºC onto glass and silicon substrates using pulsed laser deposition method. The used source was a KrF excimer laser (248 nm, 25 ns, 2 J/cm^2). The effects of glass and silicon substrates on structural and optical properties of ZnO films have been investigated. X-ray diffraction patterns showed that the ZnO films crystallize in a hexagonal wurtzite type structure with a strong (002) orientation and the grain sizes calculated from these patterns decrease from 37 to 22 nm by type of substrates. The optical waveguiding properties of the films were characterized by using prism-coupling method. The distinct M-lines of the guided transverse magnetic (TM) and transverse electric (TE) modes of the ZnO films waveguide have been observed. In the aim to study the optical properties of the ZnO films, an accurate refractive index and thickness measurement apparatus was set up, which is called M-lines device. An evaluation of experimental uncertainty and calculation of the precision of the refractive index and thickness were developed on ZnO films. The optical transmittance spectra showed a good transparency in the visible region and the band gap 3.23 eV.

Optical, Optoelectronic and Dielectric Coatings

PB048

Theoretical and experimental evaluation of magnetoelectric effect in $Pb(Zr,Ti)O_3/CoFe_2O_4$ thin film composite on $SrTiO_3$ substrate

Kazem Tahmasebi[1]

[1]*Payame Noor University (PNU), Materials Engineering, Iran*

E-mail of Corresponding Author: tahmasebi@shirazu.ac.ir

Thin layers of piezoelectric PZT, magnetic Co ferrite and conductive $SrRuO_3$ deposited on $SrTiO_3$ (001) substrate by pulsed laser deposition technique. The resultant composite $Pb(Zr_{0.95}Ti_{0.05})O_3/CoFe_2O_4/\ SrRuO_3$ exhibited a clear magnetic hysteresis loop with the maximum magnetization of 120 emu/cm^3 as well as a saturated polarization of 0.15 C/m^2. The combination of these layers shows magnetoelectric behavior with the magnetoelectric coefficient of 287 mV/cm Oe. Magnetoelectric properties for this composite also calculated based on piezoelectric, dielectric, piezomagnetic and compliance coefficients for PZT and $CoFe_2O_4$ phases. Caparisoning of the results, shows good correlation between theoretical predictions and experimental evaluations, and magnetoelectric coefficient versus bias DC magnetic field diagrams are almost identical, based on theoretical calculations and experimental measurements.

Optical, Optoelectronic and Dielectric Coatings

PB049

VOC Sensitivity Characterization of a Novel Polymer Spin Coated Thin Film

Murat Evyapan[1], M. Evyapan[1], W. S. Hanoosh[2], A. K. Hassan[3]

[1]*Department of Physics, University of Balikesir, Balikesir 10145, TURKEY*
[2]*Department of Chemistry, College of Science, University of Basrah*
[3]*Materials and Engineering Research Institute, Sheffield Hallam University, Sheffield S12NU, United Kingdom*

E-mail of Corresponding Author: mevyapan@gmail.com

A new synthesized Polymer material was selected to produce spun films in order to investigate the detection of volatile organic vapors (VOCs). Thin films were prepared by spin coating method using different spin speeds. The produced films were characterized by UV-vis spectroscopy and Surface Plasmon Resonance (SPR). The reproducibility and uniformity of spun films were investigated and the film thickness and refractive index were evaluated. The thicknesses of spun films were found between 4.5 to 24.5 nm depending on the spin speed. The refractive index of the new polymer material was determined as n=1.72. Detection of various organic vapors was investigated using SPR system and polymer material was found to be sensitive to VOCs. Sensitivity of sensor material was investigated by exposure of various concentrations of vapors. New sensor material had a short response time and the reversibility was also fast and fully recovered.

Organic Thin Films

PB050

An Investigation of 1,7- dibromo- n,n'-(bicyclohexyl)- 3,4:9,10- Perylendiimide Langmuir-blodgett Film for Organic Vapor Sensing Using Surface Plasmon Resonance Technique

Yaser Açıkbaş[1], Rıfat ÇAPAN[2], Matem ERDOĞAN[2], Funda YÜKRÜK[3],

[1]*Usak University, Faculty of Engineering Materials Science and Nanotechnology Engineering, Uşak*
[2]*Balikesir University, Faculty of Arts and Science, Physics Deparment, Balikesir, Turkey,*
[3]*Balikesir University, Faculty of Arts and Science, Chemistry Deparment, Balikesir, Turkey,*

E-mail of Corresponding Author: yaser.acikbas@usak.edu.tr

Novel 1,7-dibromo- N,N'-(bicyclohexyl)-3,4:9,10- perylendiimide deritave synthesized for this work was used as a sensor element. Different number of LB thin film layer was deposited onto a glass coated gold substrate to produce a thin film sensor element. Fabrication processes were monitored by Surface Plasmon Resonance (SPR), Fluorescence spectroscopy and Atomic Force Microscopy (AFM) techniques. The experimental SPR data were fitted using the Winspall software in order to evaluate the film thickness and refractive index of this novel material. Values of the thickness of LB films obtained by the Winspall curve fitting program and the fitting calculations produce a mean value of 0.54 nm for the thickness per monolayer, and values between 1.34 and 1.53 for the refractive index. Layer of LB thin film sensor element exposed to chloroform, benzene, toluene, ethyl alcohol vapors. SPR measurement technique was employed to investigate the their interaction mechanism(s). It can be proposed that this sensing element deposited onto gold coated glass substrates has a good sensitivity and selectivity for chloroform vapor.

Organic Thin Films

PB051

Vibrational and Electrical Analysis of Molecular Based Electronics

Fredy Mesa[3], B.A Paez-Sierra[1,2], F. Mesa[3] and A. Dussan[4]

[1]*Grupo de películas delgadas y nanofotónica, Pontificia Universidad Javeriana Bogotá-Colombia*
2QUBITeXp International Trade S.A.S. Bogotá-Colombia,
[3]*Unidad de Estudios Universitarios, Universidad del Rosario, Cra. 24 Nº 63c-69, Bogotá-Colombia,*
[4]*Dpt. de Física, Universidad Nacional de Colombia, Cra 30 Nº 45-03, Bogotá-Colombia,*

E-mail of Corresponding Author: fredy.mesa@urosario.edu.co

Semiconducting organic polymers are of great interest due to bond conjugation and delocalization of electrons at orbitals. These interesting properties make organic molecules arestructures for molecular plastic electronic applications. In this report, the simultaneous Raman spectroscopy and electrical analysis techniques to investigate organic-based devices and molecular structures is discussed. Combination of vibrational investigations by Raman spectroscopy and electrical characterization proves in real time both structural and electrical properties of organic-based devices, and in addition teststheir performance as well. For the experiments, two types of encapsulated devices were used (insets FIGURE 1). One series of structures were made from poly-3-hexylthiophene (P3HT)-based inks while the other one consisting of a blend composed of P3HT and the fullerene derivative [6,6]-phenyl-C61-butyric acid methyl ester (PCBM). The organic inks were patterned onto Glass/ITO/Poly(3,4-ethylenedioxythiophene) poly(styrenesulfonate) (PEDOT:PSS) substrates, followed by vacuum evaporation of the Al top electrode through a shadow mask. The resulting structures were encapsulated. In order to avoid memory effects in the experiments, similar devices from the same series were opto-electrically analysedin forward (Vf) and reverse bias (Vr), separately. In all experiments the applied bias started at zero voltage, followed by increment of the voltage.

The measured Raman bands of the structures proved to be well sensitive to the applied bias in contrast with the current-voltage (I-V) measurements, where the reversible region of the device is overestimated. In particular, the P3HT-based device revealed pronounced changes of the vibrational bands at reverse and forward bias voltages.

From the simultaneous optical and electrical characterization experiments, a reversible working bias window of about (-7 ; +3) V for P3HT-based devices, and (-17 ; + 11) V for P3HT:PCBM structures were found. In order to avoid the influence of the active layer thickness, the relative working bias for both devices was computed through the relation , which gives values 1.31 and 1.38 for P3HT and P3HT:PCBM organic interlayers, respectively. On the other hand, we suggest that the formation of polymorph phases at the polymer layers is enhanced, if “irreversible” bias voltages are applied.

Organic Thin Films

PB052

Polypyrrole Coated Cellulosic Substrate Modified by Copper Oxide Nanoparticles as Electrode for Nitrate Electroreduction

Makhloufi laid[1], A. Hamam[1], D. Oukil[1] and A. Dib [1]

[1]*L. Makhloufi Laboratory, Chemical Engineering Department, Faculty of Technology, University of Bejaia, 06000, Bejaia, Algeria*

E-mail of Corresponding Author: laid_mak@yahoo.fr

The aim of this work is to synthesize modified Polypyrrole films (PPy) containing nanoparticles of copper oxides in view to use them in the nitrate electroreduction process.

Firstly, the chemical polymerization of polypyrrole onto cellulosic substrate is conducted by using $FeCl_3$ as an oxidant and Pyrrole as monomer. Different parameters were tested (monomer concentration, duration of the experiment, nature of supporting electrolyte, temperature, etc…) in view to obtain films with different thickness and different morphologies. Thickness and topography of different PPy deposits (films) were estimated by a profilometer apparatus. The electrochemical reactivity of the obtained electrodes was tested by voltamperometry technique (CV) and electrochemical impedance spectroscopy (SIE).

Secondly, the modification of the PPy film surface by incorporation of copper oxide nanonoparticles is conducted by applying a galvanostatic procedure from a $CuCl_2$ solution. Surface characterization has been carried out using scanning microscope (SEM) coupled with energy dispersive X-ray analysis (EDX), Fourier-transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD). The analysis showed clearly the presence of the copper oxide nanoparticles (CuO and Cu_2O) in the polymer films with dimensions less than 50 nm.

Finally, from cyclic voltamperometry experiments, the composite activity and selectivity for the nitrate electroreduction reaction were evaluated and compared to that of metallic copper sample (Cu) and of PPy. The obtained results showed that the composite (PPy/copper oxide) performed the best electrocatalytic effect against the electroreduction of nitrate ions. The peak of nitrate reduction is found to vary linearly with initial nitrate concentration. This electrode could be used in environmental remedies for nitrate removal from water by electrochemical methods.

Organic Thin Films

PB053

Electrochemical Behaviour of Complexes of Copper(II) with Polyphosphonate Acid

Aliouane Nabila[1], Houa Hammache[1] and Gilles bouet[2]

[1]*University of Bejaia, génie des procédès*
[2]*University D'angers France*

E-mail of Corresponding Author: nabila_aliouane@yahoo.fr

The electrochemistry of copper(II) with polyphosphonate acid ligand (L) have been studied by cyclic voltammetry in the potential range +1.5 to −1 V in aqueous solution. Both anodic and cathodic electrode processes involve complicated mechanisms. The cyclic voltammetric study of the complexes shows irreversible redox peaks corresponding to Cu(II/I) couple and quasi-reversible redox peaks corresponding to copper(II/III) oxidation. nevertheless cyclic voltammetry at high potential scan rates allowed evaluation of the $E_{½}$ values for the couples $[CuL]^{3+}$–$[CuL]^{2+}$ and $[CuL]^{2+}$–$[CuL]^{+}$. Reduction and oxidation mechanisms have been studied and the half-life of the species $[CuL]^{3+}$ anodically electrogenerated has been evaluated. The passivating layer can be related to the formation of polymer like Cu(I)–L layers.

Organic Thin Films

PB054

Oxygen Sensing Properties of Nano-silver Doped Tetraphenylporphyrine Derivatives in Refinery Related Workplace Environments

Zeynep AY[1], Kadriye Ertekin [2,3], Cevher Gündoğdu Hızlıateş [2], Yavuz Ergün [2,3] and Erdal Celik [3,4]

[1]Dokuz Eylul University Nanoscience And Nanoengineering, TURKEY
[2] Department of Chemistry, Faculty of Science, DEU
[3] Center for Fabrication and Application of Electronic Materials (EMUM), DEU
[4] Department of Metallurgical and Materials Engineering, DEU

Email of corresponding author: ayzeynep@gmail.com

In workplaces, especially in refineries, volatile petroleum solvents are usually in form of mixtures of alkanes, cyclic alkanes, alkenes (olefins) and the aromatics. Such atmospheres deficient in oxygen may not provide adequate sensory warning of danger. Therefore correct and continuous monitoring of oxygen levels in such environments is quite important. On the other hand, tetraphenylporphyrines are known as oxygen sensitive dyes [1]. In this work emission-based oxygen sensing properties of highly luminescent tetraphenylporphyrine derivatives (TPP) were tested in presence of some volatile organics. The TPP doped oxygen sensitive films and fibers of polymethyl methacrylate, silicon, poly-1-(trimethyl)-1-propyne and ethyl cellulose were fabricated by electrospinning technique. Utilization of electrospun fibers for optical gas sensing purposes resulted with many advantages such as increasing in surface area, sensitivity and an enhancement in all sensor dynamics. We utilized nano-silver particles, ionic liquid, and perfluoro compounds (PFCs) as additives to enhance the response to oxygen. Steady state and lifetime based spectral response of the fluorescent dye was measured as analytical signal in the absence and presence of the gaseous oxygen. Sensing characteristics of the offered design was also tested in presence of vapors of benzene, toluene, ethylbenzene, and xylene.

[1]. Sevinc Z. Topal, Kadriye Ertekin, Derya Topkaya, Serap Alp, Berrin Yenigul, Emission based oxygen sensing approach with tris(2,2′-bipyridyl)ruthenium(II)chloride in green chemistry reagents: room temperature ionic liquids Microchimica Acta , 2008, Volume 161, Issue 1-2, pp 209-216

Organic Thin Films

PB055

Electrical Characteristic Parameters of an Organic-inorganic Device Based on Quinoline Yellow Dye

A. Ugur[1], A. Gencer Imer[1] and Y.S. Ocak[2]

[1]*Department of Physics, Faculty of Science, University of Yüzüncü Yıl, 65080, Van, Turkey*
[2]*Department of Science, Faculty of Education, University of Dicle, 21280, Diyarbakır, Turkey*

Email of corresponding author: gencerimerarife@gmail.com

We have produced a quinoline yellow / p-Si organic-inorganic device by forming quinoline yellow thin film on a p-Si semiconductor. The electrical parameters of the device were determined from current-voltage (I-V) measurements in dark at the room temperature. The device revealed a satisfactory rectifying behavior for the forward bias I-V measurements. The optical energy bandgap of thin film was determined as 2.7 eV. The electrical parameters such as, the ideality factor and barrier height were calculated from I-V measurements. Furthermore, Cheung and Norde functions were used to obtain and verify of the some electrical parameters of the organic-inorganic device. The obtained results from all methods are compared and discussed.

Organic Thin Films

PB056

Color Tunability in Multilayer OLED Based on DCM Doped in a PVK Matrix

Petia Petrova[1], Petar Ivanov[2] and Reni Tomova[2]

[1]*Bulgarian Academy of Sciences Institute of Optical Materials and Technologies "Acad. J. Malinowski", Bulgaria*
[2]*Institute of Optical Materials and Technologies, Bulgarian Academy of Sciences, Bulgaria*

Email of corresponding author: petia@iomt.bas.bg

Organic light-emitting diodes (OLEDs) have attracted much scientific and commercial interest because of their high-potential application as backlight for liquid crystal displays, paper-like light sources, and full-color OLEDs. Recently, white OLEDs with the ability to be self-emissive, extremely thin, and light are particularly suitable to be the future commonly used light sources. White light emission can be obtained from OLED with different configurations, such as multilayered structure built by small-molecular organic compounds emitting in different colors of light (red/green/blue), a single-layer blend of polymers comprising red, green, and blue light emitting materials, hybrid inorganic/organic composite emitters, and the excimer with single host–dopant system. However, fine tuning of the color emission and achievement of bright white emission are still problematic.

In this work, we present our achievements in color tunability in a novel multilayer OLED based on DCM (4-(Dicyanomethylene)-2-methyl-6-[p-(dimethylamino)styryl]-4H-pyran) as red emitter doped in a composite PVK:TPD hole-transporting layer, DPVBi [4,4′-Bis(2,2-diphenylvinyl)-1,1′-biphenyl] as a separate blue emitting layer and zinc bis(2-(2-hydroxyphenyl) benzothiazole) (Zn(BTz)2) as yellow emitter and electron transporting layer. To investigate the performance and the color-control potential of the investigated structures, the quantity of DCM as red dopant in the matrix in the range of 0 up to 5 %, and the positions and thicknesses of the different emitting layers were changed. The efficiencies, luminance and chromaticity coordinates of the fabricated OLED structures have been specified.

It was established that, in all of the OLED structures with doped DCM, independently of presence of the blue emitting layer, the red emission color is predominated according to the DCM concentration in the matrix. The doped OLED by DCM concentrations from 0.075 to 0.3% show the maximum current efficiency - two times higher in comparison with undoped structure.

Organic Thin Films

PB057

STRUCTURAL AND OPTICAL STUDY OF Co DOPED ZnO THIN FILMS

Khantoul Ahmed Reda[1]

[1]*University Constantine, Physique, Algerie*

Email of corresponding author: reda_khantoul@yahoo.fr

ZnO is a n-type II-VI semiconductor with a wurtzite structure, a wide direct band gap of 3.37eV, and a large exciton binding energy of 60meV. It occupies a particular place among wide bandgap semiconductors (GaN, ZnS…), which have been actively studied because of their exceptional electrical and optical properties. There are different ways to synthesize ZnO nanostructures which improve these properties. The present study deals with to the fabrication and characterizations of ZnO thin films and Co doped ZnO with different concentrations. The samples preparation was carried out by Colloidal method and films were deposited onto glass substrates by dip-coating technique. Zinc acetate dehydrate, cobalt acetate, methanol and ethanolamine were used as starting materials. The obtained films were characterized by different techniques such as X-ray diffraction and Scanning Electron Microscopy (SEM) from which we deduce the orientation along (002) plan of ZnO crystals and their nanoscale size (R = 48 nm). The UV-Visible absorption of Co doped ZnO thin films shows a shoulder at 366 nm and a blueshift of the band gap □Eg = 1,01 eV, which confirms the confinement induced by the nanometric size of ZnO crystallites.

Organic Thin Films

PB058

Synthesis and characterization of polyaniline - silicon carbide prepared by electrochemical method

M. Berouaken[1], H.Menari[1], A. Keffous[1], N. Gabouze[1], M. Trari[2]

[1]*CRTSE, Division Thin films, Surfaces and Interfaces. 2, Bd Frantz Fanon, BP 140 Alger 7-Merveilles 16038, Algeria*
[2]*U.S.T.H.B, Chemical Faculty, Algiers, Algeria*

Email of corresponding author: lamias19@yahoo.fr

The aim of this work consist to elaborate and characterization of Polyaniline (PANI) doped with sulfuric acid (H_2SO_4) and hydrochloric acid (HCl) prepared by cyclic voltammetry (CV) method onto a thin hydrogenated amorphous silicon carbide (a-SiC:H) films, which deposited onto p-type silicon and glass substrates by using a DC magnetron sputtering. The films are developed using a target of polycristalline silicon carbide (6H-SiC) with a mixture of 90%Ar/10%H_2 at different experimental conditions such as power and deposition time. The structure and the morphological of PANI / a-SiC:H samples were investigated by Fourier transform infrared spectroscopy (FTIR), contact angle measurements, electrical conductivity, photoluminescence (PL) and scanning electron microscopy (SEM). This structure can be used for gas detection.

Organic Thin Films

PB059

A Comparison Study of RF Plasma Polymerization Of Aniline Derivatives

Melek Kiristi[1], Aysegul Uygun Oksuz[2] and Lutfi Oksuz[1]

[1]*Suleyman Demirel University, Chemistry, Turkey*
[2]*Suleyman Demirel University*

E-mail of Corresponding Author: ayseguluygun@sdu.edu.tr

Aniline derivatives were polymerized onto indium tin oxide (ITO)/glass substrate by low pressure radio frequency (RF) plasma at constant duration. It was applied variety power during polymerization process and compared with each other regarding electrical and morphological properties. Optical emission spectroscopy (OES) measurement was used for determining plasma species. The thin films were characterized by scanning electron microscopy (SEM) and Energy-dispersive X-ray spectroscopy (EDS). The electrochemical properties of thin films were investigated by cyclic voltammetry (CV). It was shown that applied power significantly affected thin film morphology and stability.

Organic Thin Films

PB060

Preparation and electrochemical characterization of thin film polyvinyl chloride baesd/chitosan-co-iron nickel oxide nanoparticles composite heterogeneous cation exchange membrane

Sayed Mohsen Hosseini[1], E. Salehi[1], A. R. Hamidi[1], S. Ansari[1] and S. S. Madaeni[2],

[1] *Arak University, Chemical Engineering, Iran*
[2] *Razi University*

E-mail of Corresponding Author: mohsen_ho61@yahoo.com

In this research polyvinylchloride based composite heterogeneous cation exchange membrane were prepared by solution casting technique. Chitosan-co-iron nickel oxide nanoparticle was also utilized as membrane surface modifier to improve the membrane electrochemical properties. Also the effect of additive nanoparticles concentration in modifier solution on properties of composite membranes was studied. SOM images showed uniform particles distribution and relatively uniform surfaces for the membranes. Results showed that membrane transport number, selectivity and surface charge density were improved slightly by composite layer formation on membrane surface. Also, results showed that membrane ionic permeability and flux was decreased initially by CS-co-Fe_2NiO_4 layer introducing on membrane surface and increased again by more increase in iron-nickel oxide nanoparticles ratio from 2 to 4 %wt in modifier solution. Also the PVC/CS-co-Fe_2NiO_4 nanoparticles composite membranes showed higher electrical conductivity compared to unmodified membrane. The results are valuable for electro-membrane processes especially in electro-dialysis process for water recovery and waste water treatment.

Organic Thin Films

PB061

Effect of Post-heating Temperature on Structural and Optical Properties of Sol-gel Derived ZnO Thin Films

Sinem Aydemir and Ferhunda Atay

Eskisehir Osmangazi University Physics, Turkey

Email of corresponding author: saydemir@ogu.edu.tr

Transparent conductive ZnO films were deposited on the corning glass substrates by sol-gel multilayer dip-coating. The effects of post-heat treatment processing conditions, on the structure, optical and electrical poperties of the ZnO films were investigated by XRD, AFM, SEM, spectrophotometer, PL and four-point prober (FPP) measurements. XRD patterns confirm the hexagonal wurtzite type polycrystalline structure of the films. Photoluminescence (PL) spectra show gradual decrease of intensity of exitonic and defect related peaks with decreasing post-heating temperature. The transmittance of ZnO thin films pre-heated at 300 oC and post-heated at 650 oC are over 80% in visible range and exhibit absorption edge about 368 nm. Thickness and some optical parameters such as extinction coefficient and refractive index have been determined by spectroscopic ellipsometry (SE).

Science of Thin Films and Quantum Effects

PB062

Analysis of Interface Charge Densities for High-k Dielectric Material Based Metal-Oxide-Semiconductor Devices

N. P. Maity[1], R. Maity[1], K. Thapa[1] and S. Baishya[2]

[1]*Mizoram University (A Central University), Department of Electronics & Communication Engineering*
[2]*Dept. of Electronics & Comm. Engg., National Institute of Technology*

E-mail of Corresponding Author: maity_niladri@rediffmail.com

In this letter the interface charge densities (Dit) are studied and analyzed for thin dielectric metal oxide semiconductor (MOS) devices using different high-k dielectric materials such as Si_3N_4, Al_2O_3, ZrO_2 and HfO_2. As the value of dielectric constant increases for the materials, Dit also increases for constant oxide thickness. The Dit have also been calculated using conductance method and it indicates that by reducing the thickness of the oxide, the Dit increases and similar increase is also found by replacing SiO_2 with high-k. For the same oxide thickness SiO_2 has the lowest Dit and found to be the order of 10^{11} $cm^{-2}eV^{-1}$. Linear increase in Dit has been observed as the dielectric constant of the oxide increases. The Dit is found to be in good agreement with published fabrication results at p-type doping level of 1×10^{17} cm^{-3}. Numerical calculations and solutions are performed by MATLAB and device simulation is done by ATLAS.

Theory of Structure, Surface and Interface

PB063

Effect of Seed Layer Thickness on the Perpendicular Magnetic Anisotropy and Spin-orbit-torque Driven Switching in Hf/CoFeB/MgO Structure

Mustafa Akyol1, Guoqiang Yu1, Wanjun Jiang1, Juan G Alzate1, Pedram Khalili Amiri1, Ahmet Ekicibil2 and Kang L. Wang1

[1]*University of California, Los Angeles Electrical Engineering United States of America*
[2] *Çukurova University*

Email of corresponding author: m.akyool@gmail.com

One of the major research topics in the spintronic community is the manipulation of the magnetization through spin-orbit torques (SOTs) induced by in-plane current [1-3]. The SOTs originate from the spin-orbit coupling in a structurally asymmetric system, such as in heavy metal/ferromagnetic layer/oxide heterostructures. When a charge current flows inside the heavy metal, spin-polarized electrons are generated and accumulated in the ferromagnetic/metal interface, generating the SOT on the magnetization of the ferromagnetic layer. By utilizing this effect as the writing method, the writing energy can be further reduced compared to the conventional spin-transfer torque writing method [2]. Many heavy metals have been used as the SOT material, such as Pt, Ta and W. Recently, spin Hall effect was observed in structures involving Hf layers , which can enhance the perpendicular anisotropy and consequently increase the stability compared with the other materials [4]. However, the detailed study about this material is still absent.

In this work, we study the seed layer thickness dependence of perpendicular magnetic anisotropy (PMA) and studied the spin Hall effect in Hf(t)/CoFeB(1.1)/MgO(2)/Ta(2) (thickness in nanometers) structures. All of the samples were deposited on Si substrates with a thermally oxidized SiO_2 by an AJA Magnetron Sputtering System. The films were patterned into 20 × 130 μm^2 Hall bar structures by photo-lithography and dry-etching techniques. The thickness dependence of PMA was firstly studied through a magneto-optical Kerr effect (MOKE) measurement. The PMA of the films depended on the seed layer thicknesses. While the perpendicular easy-axis loops displayed a square shape when the thickness of Hf was higher than 1nm, it has a linear behavior with the external magnetic field below 1nm, indicating that the magnetic anisotropy changed from in-plane to perpendicular when the thickness of Hf is increased. In addition, we performed transport measurements to investigate the SOT driven switching in devices with different seed layer thickness using Anomalous Hall Effect (AHE) measurements under in-plane magnetic bias field (H_x). We observed that all films with different seed layer thickness showed current-induced magnetic switching under an in-plane magnetic field. Since the PMA in the thicker Hf thickness samples is stronger than the others, there is more external magnetic field and current needed to switch fully at thicker Hf thickness layer using currents.

In conclusion, we report the effect of Hf seed layer thickness in Hf/CoFeB/MgO/Ta structures using MOKE for magnetic properties of the films and AHE measurement for transport properties of the devices. The seed layer thickness also has a pronounced effect on the magnetic switching behavior. The results are important for the design and optimization of magnetic random access memory (MRAM) devices utilizing SOT switching, to achieve low energy dissipation and high density.

Science of Thin Films and Quantum Effects

PB064

Surface Electronic Structure of Semimetal/metal Bi Films on GaAs (110) Study by UV Photoemission Spectroscopy

Mahmoud Abusamak

Al-HUniversityussein Bin Talal , Physics, Jordan

Email of corresponding author: mabusamak@ahu.edu.jo

A high-resolution ultraviolet photoelectron spectroscopy (HRUPS) investigation of a semimetallic Bi nanofilms 0n GaAs (110). Bi occupied electronic states close to Fermi level in different growth morphology condition on Bi/GaAs (110) interface at low temperature (LT) and room temperature (RT) is presented. The photoemission results, obtained with a helium-discharge lamp on the Bi/GaAs(110) interface shows strong modifications in the electronic structure of the LT deposited Bi overlayer upon annealing to RT, accompanied by developing of a sharp low energy electron diffraction (LEED) pattern. This behavior is consistent with the hypothesis of quantum size effects (QSE) influence on growth morphology.

Science of Thin Films and Quantum Effects

PB065

Effect of the Metal Content on Structure and Magnetism of the Cobalt-fullerene Mixed Films

Vasily Lavrentiev

Nuclear Physics Institute AS CR NS Lab Czech Republic

Email of corresponding author: lavrent@ujf.cas.cz

Controllable combination of magnetic metal with carbon is an attractive route in design of new nanomaterials with application potential in novel technologies, i. e. information storage, spintronics, and molecular electronics. Thus, the attempts to combine cobalt and fullerene within a continuous thin layer have revealed several remarkable outputs of this strategy, such as the nanostructure self-assembling, giant magnetoresistance, superparamagnetism, etc. In this report we demonstrate a drastic effect of the metal content on nanostructure and magnetic properties of the Co-C60 thin films. Two kinds of the CoxC60 thin films including respectively very low ($x < 1$, UDM) and very high ($x > 20$, SSM) content of Co were fabricated on clean Si(100) substrates using method of simultaneous deposition. Structure and composition of the deposited films were analyzed using atomic force microscopy, Rutherford backscattering, and Raman spectrometry. Analysis of the magnetic properties of the films was carried out using superconducting quantum interference device (SQUID). The performed structural analysis argues the formation of the cobalt fulleride phase in the UDM films and nanocomposite structure in the SSM films, respectively. The magnetic properties of the mixed films show dramatic change upon the composition variation revealing stable ferromagnetism in UDM and superparamagnetic effects in SSM. The obtained results allowed us to discuss the composition-dependent structure self-assembling in the deposited mixed films.

Science of Thin Films and Quantum Effects

PB066

Analytical Study on electron-beam Processing for Nanoscale Films

Y. H. Tsai[1], C. Y. Ho[1] and B. C. Chen[2]

[1]*Department of Mechanical Engineering, Hwa Hsia Institute of Technology, Taipei 235, Taiwan*
[2]*Department of Chinese medicine, Buddhist Dalin Tzu Chi General Hospital, Chiayi 621, Taiwan*

Email of corresponding author: csg3411@yahoo.com.tw

This paper analytically investigates an electron-beam processing for nanoscale films. Nanoscale film is widely utilized to fabricate the microelectronical devices. Some patterns and nanostructures need to be formed on the film. Electron beam is applicable tool to achieve these patterns and nanostructures on the nanoscale film. In nanoscale, physical and chemical properties of materials are different from the bulk materials and the traditional thermal transport model can not well-suited. This study employs the nanoscale thermal transport model to analyze an electron-beam processing for nanoscale films. The effects of material properties and processing parameters on the electron beam ablation of nanoscale film are discussed.

Science of Thin Films and Quantum Effects

PB067

Magnetic Anisotropy in Bicomponent Self-assembled Ni-Pd Nanowires Studied by Magnetic Resonance Spectroscopy

Konrad Kierczynski[1], V. Bayev[2], J.A. Fedotova[2], A. Maximenko[2], E. Streltsov[3], M. Malashchonak[3], M. Milosavljević[4], P. Zukowski[5], T.N. Koltunowicz[5] and K. Kierczynski[5]

[1]*Lublin University of Technology Department of Electrical Devices and High Voltage Technology Poland*
[2]*NC PHEP Belarusian State University, 220040 Minsk, Belarus*
[3]*Belarusian State University, 220030 Minsk, Belarus*
[4]*Vinča Institute of Nuclear Sciences, 11001 Belgrade, Serbia*
[5]*Lublin University of Technology, 38a Nadbystrzycka Str., 20-618 Lublin, Poland*

Email of corresponding author: k.kierczynski@pollub.pl

Self-ordered arrays of Ni, Ni(50)Pd(50) and Ni(78)Pd(22) nanowires were synthesized by simultaneous electrochemical deposition of Ni and Pd components into porous templates of anodic aluminum oxide using alternating current.

Investigation of structure and chemical composition of bicomponent nanowire arrays along the cross-section shows intrinsic inhomogeneous metal distribution where areas of high Ni concentration, containing metal nanoparticles with diameter less than 5 nm, alternate with amorphous Pd enriched areas.

Magnetic anisotropy of nanowires is studied with magnetic resonance spectroscopy by analyzing the values of demagnetizing factors calculated for nanowire arrays and for a single nanowire. Perpendicular magnetic anisotropy is observed for Ni and Ni(78)Pd(22) nanowire arrays while Ni(50)Pd(50) reveals an easy in-plane magnetization. At the same time an easy magnetization axis of every particular nanowire is directed along its long axis. Thus magnetic anisotropy of Ni and Ni-Pd nanowire arrays is governed with competition between the shape of metal nanowires and their exchange interaction.

Science of Thin Films and Quantum Effects

PB068

Dielectric Properties and Model of the Impedance Formation of $(Co45Fe45Zr10)_x(PZT)_{(100-x)}$ Nanocomposites Produced by Means of Ion Sputtering

P. Żukowski[1], T.N. Kołtunowicz[1], O. Boiko[1], J.A. Fedotova[2], A.K. Fedotov[3] and A. Larkin[3]

[1]*Lublin University of Technology Department of Electrical Devices and High Voltage Technology, 38a Nadbystrzycka Str., 20-618 Lublin, Poland*
[2]*National Centre for Particles and High Energy Physics of Belarusian State University, 153 Bogdanovich Str., 220040, Minsk, Belarus*
[3]*Belarusian State University, 4 Independence av., 220030, Minsk, Belarus*

Email of corresponding author: p.zhukowski@pollub.pl

The paper presents investigation results of frequency and temperature dependences of the electrical properties of nanocomposite produced by means of ion sputtering targets consisting of metallic alloy plate Co45Fe45Zr10 with marked ferroelectric stripers $(Pb81Sr_4(Na50Bi50)15(Zr57.5Ti42.5))O_3$ on it, under an argon atmosphere with a low oxygen content with its partial pressure PO_2 = 4.2•10-3 Pa

Measurements of electrical parameters for $(Co45Fe45Zr10)_x(Pb81Sr4(Na50Bi50)15(Zr57.5Ti42.5))O3]_{(100-x)}$ nanocomposite are made for the measurement frequency range from 50 Hz to 1 MHz and temperature range from 77 K to 373 K. During the tests the sample was subjected to 15 minutes annealing. Hopping conductivity model for nanocomposite of metal-dielectric type, produced by means of ion sputtering , was elaborated. The model includes the structure and electrical properties of nanocomposites for nanoparticles of the metallic phase and the dielectric matrix. The paper includes comparison of the results of modeling and experimental data.

Isochronous annealing caused appearence of rapid frequency and temperature dependences of conductivity. It can be explained by additional oxidation of nanograins surface of metallic content during annealing process, what can cause changes in conduction type from metallic to the hopping. According to the hopping conductivity model the conduction of resistive or capative type can be observed in low frequency range. Voltage resonance also can be observed in the intermediate frequency rage [1, 2].

[1] T.N. Kołtunowicz, P. Zhukowski, A.K. Fedotov, A.V. Larkin, A. Patryn, B. Andriyevskyy, A. Saad, J.A. Fedotova, V.V. Fedotova; Electronics and Electrical Engineering 19 n. 4 (2013) pp 37-40.
[2] T.N. Kołtunowicz, J.A. Fedotova, P. Zhukowski, A. Saad, A. Fedotov, J.V. Kasiuk, A.V. Larkin; Journal of Physics D: Applied Physics 46 n. 12 (2013) 125304.

Science of Thin Films and Quantum Effects

PB069

Resonance Properties at Alternating Current of Nanocomposite $(CoFeZr)_x(CaF_2)_{(100-x)}$ Produced by Ion Beam Sputtering

T.N. Kołtunowicz[1], P. Żukowski[1], V. Bondariev[1], J.A. Fedotova[2], A.K. Fedotov[3] and A. Larkin[3]

[1]Lublin University of Technology Department of Electrical Devices and High Voltage Technology, 38a Nadbystrzycka Str., 20-618 Lublin, Poland
[2]National Centre for Particles and High Energy Physics of Belarusian State University, 153 Bogdanovich Str., 220040, Minsk, Belarus
[3]Department of Energophysics, Faculty of Physics, Belarusian State University, 4 Independence av., 220030, Minsk, Belarus

Email of corresponding author: t.koltunowicz@pollub.pl

The paper presents results of investigations composition of nanocomposite $(CoFeZr)_x(CaF_2)_{(100-x)}$ produced in the atmosphere of pure argon. Sputtered target consist of plate of ferromagnetic alloy $Co_{45}Fe_{45}Zr_{10}$ with dielectric plates CaF_2 on the surface.

Atomic percentage of elements obtained by Method Standartless Quantitative Analisis and compared with the stoichiometric composition of the sample. The actual composition bit different from the stoichiometric composition. This is related to the dispersion of fluorine in vacuum during sputtering target.

The measurements have been performed at a testing stand that has been elaborated and made in the Department of Electrical Devices and High Voltage Technology of the Lublin University of Technology. The electrical properties were performed at altering current frequency ranging from 50 Hz to 5 MHz for measuring temperature values from 77 K to 373 K. Each time, after measurement the sample has been subjected 15-minute annealing in the tubular furnace at a temperature range from 398 K to 573 K at the 25 K step [1]. Frequency dependences of phase angel, capacity and conductivity have been determined for nanocomposite $(CoFeZr)_x(CaF_2)_{(100-x)}$. Analysis shown that the material after annealing exhibit phenomenon of voltage resonance and current resonance [2].

[1] T.N. Kołtunowicz, P. Zhukowski, V. Bondarie, J.A. Fedotova, A.K. Fedotov; Acta Physica Polonica A. 123 n.5 (2013), pp 932-934.
[2] T.N. Koltunowicz, P. Zhukowski, V. Bondariev, A. Saad, J.A. Fedotova, A.K. Fedotov, M. Milosavljevic, J.V. Kasiuk; Journal of Alloys and Compounds (2014). DOI: 10.1016/j.jallcom.2013.12.125.

Science of Thin Films and Quantum Effects

PB070

Exchange bias effect in Mn rich $YMnO_3$ thin films

Manish Kumar[1], R. J. Choudhary[2] and D. M. Phase[2]

[1]*UGC-DAE Consortium for Scientific Research, Thin Film LAB, India*
[2]*UGC-DAE Consortium for Scientific Research*

E-mail of Corresponding Author: manish.ugcdae@gmail.com

Multiferroic hexagonal $YMnO_3$ (YMO) material has attracted considerable attention of the scientific community over last decade as the absence of non volatile elements makes it a suitable candidate for memory devices. Particularly the thin films of YMO are more attractive because they show enhanced polarization as compared to their bulk counterpart. Recent reports suggest that the nanoparticles of YMO can display exchange bias phenomenon caused by the exchange interaction between the compensated antiferromagnetic (AF) spins and uncompensated surface spin of the nanoparticles.[1] Pure YMO depicts AF transition around 70K, but when Mn concentration is in excess, YMO can display spin glass behaviour.[2,3] The growth mechanism of YMO thin film is very complex and the concentration of Y or Mn ions can vary in the thin film of YMO depending on the deposition parameters.

In this work, we have grown the single phase thin films of YMO which have excess Mn. The excess Mn in YMO results in introduction of Mn^{2+} ions with some oxygen vacancies. The Mn rich YMO film shows metastable magnetic behaviour at low temperature. The ferromagnetic interaction between Mn^{2+}/Mn^{3+} ion compete with the frustrated AF ordering of YMO and induces metastable magnetization. A hysteresis in the magnetization verses field (M-H) curves measured at 2K is observed. The striking feature named as exchange bias (EB) is observed in the ZFC (zero field cooled) M-H curves. The ZFC EB is investigated further by a set of magnetization measurements and is attributed to the newly formed interface between different magnetic phases during the initial magnetization process. The observed EB behaviour In Mn rich YMO films may add new research dimensions to this multiferroic material for device's fabrication.

[1] Samta Chauhan, S. K. Srivastava and R. Chandra, Appl. Phys. Lett. 103, 042416 (2013).
[2] Manish Kumar, R. J. Choudhary and D. M. Phase, Appl. Phys. Lett. 102, 182902 (2013).
[3] W. R. Chen, F. C. Zhang, J. Miao, B. Xu, X. L. Dong, L. X. Cao, X. G. Qiu, B. R. Zhao and Pengcheng Dai, Appl. Phys. Lett. 87 , 042508 (2005).

Science of Thin Films and Quantum Effects

PB071

Effect of doping on ZnO thin films prepared by spray pyrolysis technique

Mohamed Mahtali, Afifa Derrouiche, Kalida Benzouai, Zahia Daas and Abderahmane Boutelala

Laboratoire Couches Minces et Interfaces, université Constantine I, Algeria

Email of corresponding author: msmahtali@yahoo.fr

Mg-doped zinc oxide thin films have been prepared by spray pyrolysis (SP) technique of zinc acetate and magnesium nitrate, and the effect of thickness on structural and optical properties has been investigated. The structural and optical characteristics of the undoped and doped films were examined by X-ray diffraction (XRD), UV-visible and raman spectroscopy. These films, deposited on glass substrates at an optimal substrate temperature (T_S = 300, 350 and 400 °C), have a polycrystalline texture with a hexagonal structure. Transmission measurements showed that for visible wavelengths, the Mg-doped ZnO films have an average transmission of over 90%. The optical parameters have been calculated. The dependence of the refractive index, n, and extinction coefficient, k, on the wavelength for the sprayed films is also reported. Optical band gap of the Mg-doped ZnO is 3.30 and 3.55 eV, respectively, depending on the film thicknesses.

Science of Thin Films and Quantum Effects

PB072

Fabrication of Hot Electron Bolometer from High Temperature Superconductor Bi2212

T. Semerci[1], M. Kurt[1], Y. Demirhan[1], H. Koseoglu[1], H. Alaboz[1], N. Miyakawa[2], H. B. Wang[3] L. Ozyuzer[1]

[1]*Department of Physics, Izmir Institute of Technology, Urla, 35430, Izmir, TURKEY*
[2]*Tokyo University of Science, Tokyo, JAPAN*
[3]*National Institute for Materials Science, Tsukuba, JAPAN*

E-mail of Corresponding Author: tugcesemerci@iyte.edu.tr

There is a growing interest in and technology of electromagnetic waves (EM) in terahertz frequency region (0.1-10 THz) due to their variety of application areas in the physical, astronomical, medical and biological sciences, including imaging, spectroscopy, information technology, medical diagnosis and the detection of explosives [1]. Rapidly increasing applications of the EM waves in the under developed terahertz frequency range requires a well understood technique of efficient terahertz wave detection. Single crystal of Bi2212 has natural the intrinsic Josephson junctions (IJJs) which are homogeneous in the atomic scale along the c-axis of Bi2212 single crystals. Highly-uniform junction arrays can use as oscillator and detector for THz electromagnetic wave. Intense, coherent and tunable THz radiation from intrinsic Josephson junctions (IJJs) in layered high temperature superconductor has been reported recently [2]. As a type of detectors, emitting Josephson junctions made from Bi2212 provide sufficient power to allow room temperature THz detectors, such as Golay cells and pyroelectric detectors, due to the high emitted power [3]. In this work, we investigated various experimental techniques to fabricate hot electron bridge bolometer for efficient THz detection. Nowadays, for detection of THz waves several instructive ideas have been proposed and tried to construct different types of bolometers [4, 5] but they require very difficult and costly cryogenic spending and slow response times. Among them hot electron bolometers (HBE) holds a great potential because of their fast response time. Another advantage of HBEs is that arrays of them could be placed on a single chip. HEB gets lots of interest and many different works have been published [6]. In the experimental procedure, for high sensitive terahertz radiation detection, log-periyodic antenna like bridge structure of a bolometer have been fabricated from cleaved and coating with 100-150 nm gold on Bi2212 crystals by using electron beam lithography and ion beam etching techniques. For the electrical characterization, resistance v.s. temperature (R-T) behavior was measured by four probe technique in He flow cryostat controlled by Labview program.

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[1] M. Tonouchi, Nat. Photonics 97, 1 (2007).
[2] L. Ozyuzer et al., Science 318, 1291 (2007).
[3] F.Turkoglu et al., Supercond. Sci. Technol. 25, 125004 (2012).
[4] A. Luukanena and J. Pekola, Appl. Phys. Lett. 82, 3970 (2003).
[5] P. L. Richards, J. Appl. Phys. 76, 1 (1994).
[6] X. Wang, L.X. You, D.K. Liu, C.T. Lin, X.M. Xie, M.H. Jiang, Physica C 474, 13 (2012).

PB073

Effect of Different Areas of Superconducting $Bi_2Sr_2CaCu_2O_{8+D}$ Mesas for Terahertz Emission

Sena Gülen[1], Hilal Sağlam[2], Yasemin Demirhan[1], Kazuo Kadowaki[3] and Lütfi Özyüzer[1]

[1]*Department of Physics, Izmir Institute of Technology, Urla, 35430, Izmir, TURKEY*
[2]*Illinois Institute of Technology, Chicago, U.S.A*
[3]*University of Tsukuba, Tsukuba, Japan*

E-mail of Corresponding Author: senagulen@iyte.edu.tr

Terahertz wave is a subject of active research that can be used for variety of applications such as secure wireless communications, cancer detection, airport screening of passengers for weapons, explosives, drugs, etc. Aim of this study to demonstrate that coherent continuous-wave THz radiation of sizable power can be extracted from intrinsic Josephson junctions in the layered high-temperature superconductor $Bi_2Sr_2CaCu_2O_8$ (Bi2212) [1]. In addition, we have fabricated rectangular triple mesa structures on a same chip with various mesa surface areas. E-beam lithography and ion beam etching techniques were used to fabricate such kind of mesas. In this study, mesa structures were created which have different areas (300×50, 200×50, 100×50 μm2) on the same crystal. First of all, single crystal of Bi2212, which is highly anisotropic high-Tc superconductor, is considered as a stack of intrinsic Josephson junctions (IJJs) on atomic scale is glued onto a sapphire substrate from its smooth a-b surface by silver epoxy and then the crystal was cleaved using an adhesive tape [2]. Subsequently, gold layer about 100 nm was evaporated on to the sample to protect the smooth layer of Bi2212 from chemical reactions. Also this step relieves to get electrical contacts for characterization. After that, e-beam lithography process was completed to fabricate the rectangular mesa structures on the surface of an underdoped Bi2212 crystal. After the fabrication of mesa part, atomic force microscope, SEM, surface profilometer were used to determine accurate dimensions of triple mesa structure. In order to characterize the Bi2212 mesas, c-axis resistance versus temperature (R-T), and current-voltage behavior (I-V) were measured. By using result of I-V characteristics, critical current of each mesa structure having different dimension was achieved, critical current densities of each mesa structure were calculated. As a result, relation between current density and surface area, and their effect on THz emission were examined by this study.

Superconducting Thin Films

PB074

Effect of Oxidation Thickness on Tensile Deformation Behavior of Al Nanowire: A Parallel Molecular Dynamics Study Using the Variable Charge Method

Gurcan Aral1

[1]*IYTE, Physics, TURKEY*

E-mail of Corresponding Author: gurcanaral@iyte.edu.tr

We demonstrate that oxidation over Al crystalline nanowire surface may play an important role or not in the tensile deformation mechanism during room temperature. The effect of native oxidized over metallic Al nanowire is known little about deformation mechanisms. The effects of surface oxide thickness on deformation behaviors of crystalline Al nanowires are studied with molecular dynamics (MD) simulations at room temperature (300K) under uniaxial tensile strain with the variable charge model that allows charge dynamically transfer among atoms. The present simulations are performed on crystalline aluminum nanowire with the diameter 10 nanometers and length 30 nanometers for different oxide thicknesses over Al nanowire surface. Al nanowires are stretched along the [001] direction at a constant strain rate of 108 s-1, using the Reactive Force Field interatomic potential model proposed by Adri van Duin. This potential model results provide a powerful tool to quantifying and understand the atomic level deformation mechanism controlling the oxidation thickness over Al metallic nanowire. In particular, we investigate the relation between strain-stress as a function of oxidized thickness over Al nanowire. MD simulation results show that the oxidation thickness around Al nanowire is sensitive to the Young's modules constant.

Theory of Structure, Surface and Interface

PB075

Inhomogeneous Photocatalytic System on TiO2 in Contact with Aqueous Sodium Carbonate Solution

Mitsutake Oshikiri[1]

[1]*National Institute for Materials Science, Environment and Energy Materials Division, Japan*

E-mail of Corresponding Author: oshikiri.mitsutake@nims.go.jp

It is known that the photocatalytic activity of the TiO_2 on splitting water into oxygen and hydrogen is enhanced very much by adding some sodium carbonate into the reactant water [1]. In this conference, to elucidate the role of the sodium carbonate, molecular dynamical properties on the ions originating from sodium carbonate in water around at the TiO_2 photocatalyst surface investigated by first principles molecule dynamics simulation at room temperature condition will be discussed. In this study, a super cell model including a slab (thin film) exposing (001) surface of rutile TiO_2 at the cell bottom was used. Four-fold oxygen coordinated Ti (4c-Ti) atoms were exposed at the surface. During the dynamical simulation under thermal equilibrium state at 300 K, a stable -Ti-O-C(O)O-H adsorbate structure was found at the surface in addition to the –Ti-O-H or –Ti-O-H_2 adsorbate structure originating from dissociative or nondissociative adsorption of a water molecule. Sodium ions are also moving around the exposed O atoms at the surface with keeping the atomic Na – O distance to be 2.3 ~ 2.5 Angstroms. Since the main differences in the concerned system from the simple inhomogeneous system including TiO_2 and water is the presence of the Na_2CO_3, the -Ti-O-C(O)O-H and the –O-Na structures should bring us the clues to elucidate the origin for the high performance in the inhomogeneous photocatalytic system constructed by the TiO_2 in contact with aqueous sodium carbonate solution. In addition to the characteristic adsorbate structures, some related electronic structures of the inhomogeneous system will be also discussed in this conference. It should be profoundly interesting since it will be discussed comparing with the system in absence of the sodium carbonate.

Reference:
[1] K. Sayama and H. Arakawa, "Significant Effect of Carbonate Addition on Stoichiometric Photodecomposition of Liquid Water into Hydrogen and Oxygen from Platinum Titanium(IV) Oxide Suspension", J. Chem. Soc.-Chem. Commun., pp. 150-152, (1992)

Theory of Structure, Surface and Interface

PB076

A Sensitive Nonenzymatic H_2O_2 Sensor Based on Silicon Nanowires

Chafiaa YADDADEN[1]

[1] *CRTSE, CMSI, Algeria*

E-mail of Corresponding Author: chaf598@yahoo.fr

Reactive oxygen species (ROS), including hydroxyl radicals (HO), superoxide anion (O^{2-}) and hydrogen peroxide (H_2O_2) are produced in various physiological processes and can be used as an early indicator for cytotoxic events and cellular disorders.[1], [2] Among all ROS, H_2O_2 is the most stable species and can be particularly harmful since it can diffuse across membranes through water channels and cause biological modifications such as peroxidation of cell membrane lipids, DNA bases and backbone hydroxylation at distal areas.[1] H_2O_2 is also a by-product of many oxidative biological reactions, including those of glucose oxidase, cholesterol oxidase, alcohol oxidase, galactose oxidase, etc, and an essential mediator in food, pharmaceutical, clinical, industrial and environmental analyses.[3] Thus it is of prime importance to design biosensors for detection of H_2O_2 with high sensitivity, good stability, large detection range and good selectivity. While enzymatic biosensors for H_2O_2 detection have shown good performances with low detection limits, there are several drawbacks associated with enzyme-modified electrodes such as the high cost of enzymes, long-term stability and complexity of immobilization.[3] Furthermore, the enzyme activity is highly affected by the temperature and the pH of the sensing medium. To alleviate these hurdles, there has been recently a huge focus on the development of nonenzymatic sensors for the detection of H_2O_2 and other bio-relevant species.[4]

In this work, we show for the first time that silicon nanowires can be successfully applied for H_2O_2 sensing using a colorimetric assay in an aqueous solution of 2,2'-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) (ABTS). The sensor exhibits a good detection limit of 35 nM.

Theory of Structure, Surface and Interface

PB077

Influence of Nano-Scale Particles and Nanocluster on the Wetting Behavior and Corrosion Resistance Ability of Metal in Humid Air

Nan Wang[1] and Dangsheng Xiong[1]

[1]*School of Materials Science and Engineering, Nanjing University of Science and Technology, Nanjing, Jiangsu 210094, PR China*

E-mail of Corresponding Author: zzwangnan@163.com

Nano-scale roughness (i.e., nano-scale particles) and micro-/nano- hierarchical structures were fabricated on steel substrate by sol-gel method. The same wetting behavior observed on the films indicated that the superhydrophobicity could be fabricated without the micro-/nano- hierarchical structures. It has been proved that the superhydrophobicity is not adequate to evaluate the anti-corrosion ability in humid air. The particle size of the nano silica is crucial for the formation of electrolyte film, which thereby results in the better corrosion resistance in humid air. Compared with the surface chemical compositions, the nanocluster plays more important role in anti-corrosion ability.

Theory of Structure, Surface and Interface

PB078

Influence of Process Parameters on the Properties of TiO_2 Films Deposited by A D.C. Magnetron Sputtering System on Glass Support

Bogdan Toma [1], Raluca Baciu[1] , Stefan Lucian Toma[1,3] and Lucian Eva[2]

[1]*Univ of Med. & Pharm. "Grigore T Popa", Fac. of Medicine, Iasi, 700115, Romania Morphopath, Romania*
[2]*Clinical Emergency Hospitals "Prof. Dr. Nicolae. Oblu": Iasi , 700050, Romania*
elucian73@yahoo.com
[3]*Technical University "Gheorghe. Asachi" Fac Mat. Sci& Engineering Iasi, 700050, Romania*

Email of corresponding author: stl_toma@yahoo.com

In this paper it has been deposited films of titanium oxide (TiO_2), on a support of glass, by A D.C. magnetron sputtering system, by varying the working pressure (p = 5-20mTorr) of the substrate temperature on three levels.
The obtained layers were investigated and characterized by optical microscopy, Scanning Electron Microscopy SEM, X-ray diffraction and Atomic Force Microscopy. It was observed that, by modifying technological parameters of the process (working pressure and substrate temperature) it is changing the initial orientation of the compounds ((100) turns into (101) or (002)). The AFM analysis has allowed the observation of the fact that the average roughness of the Ti deposition increases with the working pressure and substrate temperature.
SEM analysis showed that the density of the deposit increases with substrate temperature with values of over 11%. The granulation of the films obtained, presents an increasing trend with the variation of process parameters.

Theory of Structure, Surface and Interface

PB079

The Influence of the Surface on the Thermoelectric Properties of SnTe:Bi Thin Films

Lyubomyr Nykyruy[1], Rasit Ahiska[2], Ivan Chavjak[3] and Nataliia Freik[3]

[1]Vasyl Stefanyk Precarpathian National University Physical-Technical Ukraine
[2]Gazi University, Ankara, Turkey
[3]Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine

Email of corresponding author: lyubomyr.nykyruy@gmail.com

Tin telluride is widely used in semiconductor technology. It is promising as material for thermoelectric medium temperature range (500-750) K.

This paper presents the results of study of the structure and thermoelectric properties of Tin Telluride thin films doped bismuth derived by vapor-phase deposition in vacuum on fresh chips (0001) single crystals of mica-muscovite substrates at evaporation temperature Te = 870 K, and temperature of substrate (deposition) Ts = 470 K at the different times of deposition times τ = (5-360) sec. The above conditions provided the thickness of the condensate within d = (40-800) nm. These nanostructures were studied by methods of atomic force microscopy (AFM) by Nanoscope 3a Dimention 3000 in the periodic contact.

The enriched p-type layer form on films surface during their exposure on air due of the acceptor action of oxygen. The analysis of the electrical properties of the films made on the basis of two-layer model of Petritz to estimate the conductivity of the surface layer. Thin films in this model are contains two layers: the near-surface (I) (area of surface charge) and bulk (II), and these layers are connected in parallel.

The surface layer parameters estimated by the model of Petritz satisfactorily describe the experimental results.

Was investigated that all SnTe:Bi films, regardless of the conditions of obtaining them are characterized by stable p- type of conductivity. The concentration of holes in surface layer more than an order of magnitude higher than bulk concentration for all samples irrespective of type of substrate. We explain this result to the adsorption of oxygen by free surface of condensates. And conductivity increases with next saturates with increasing of the thickness of condensate. It reaches significant values (5000-6000) $Ohm^{-1}cm^{-1}$ at thickness 600 nm. The Seebeck coefficient also increases to value (100-120)mV/K, but this take place with decrease of the thickness of condensate less than 100 nm.

As for the other transport coefficients (Hall concentration and carrier mobility), the thickness dependence have opposite character of changes. Was obtained that concentration of holes decreases with increasing of the thickness of condensate and with increases of mobility. Note, that the dominant role in the thickness dependence of electrical conductivity of the condensates have the mobility rather than the carrier concentration.

Thus, a high conductivity coupled with a significant value of Seebeck coefficient of SnTe:Bi films enabling stable over time thermoelectric material of p-type of the conductivity which is promising for building film microcouples for thermoelectric energy conversion.

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Theory of Structure, Surface and Interface

PB080

Modeling and Simulation of Tunneling Current using High-k Material Al_2O_3 Based MOS Devices

N. P. Maity[1], R. Maity[1] and S. Baishya[2]

[1]*Mizoram University (A Central University), Department of Electronics & Communication Engineering*
[2]*Dept. of Electronics & Comm. Engg., National Institute of Technology*

E-mail of Corresponding Author: maity_niladri@rediffmail.com

In recent times the gate oxide thickness has been reduced significantly. The progressive miniaturization of metal-oxide-semiconductor (MOS) devices has caused a number of phenomena to emerge such as quasi-breakdown, direct tunneling and stress induced leakage currents. Such phenomena drastically modify the performance of the scaled-down MOS devices. Attempts are being made across the world to replace the conventional silicon di-oxide (SiO_2) with different high-k dielectric materials. In this regard Aluminum Oxide (Al_2O_3) has got a lot of Interest and a promising material for future Integrated Circuit (IC) technology. As a part of this research work, an effort has been made to model and measurement of tunneling current for thin oxide thickness based MOS devices. A simple possible mathematical modeling has been proposed to calculate the tunneling current keeping charge particles involved as free particles using high-k dielectric material Al_2O_3 as oxide material and compared it with conventional SiO_2 based MOS devices. It has been found that, as oxide thickness is reducing an increase in tunneling current was observed. For the same oxide thickness Al_2O_3 has lower tunneling current than SiO_2. Good agreement has been observed for theoretical and simulation result. The simulation has been done using device simulator ATLAS, a commercial TCAD tool from SILVACO and the numerical computation has been done using MATLAB.

Theory of Structure, Surface and Interface

PB081

Detailed Morphological Analysis of Vanadium Pentoxide Thin Films

Meltem Dönmez[1], Buse Cömert[1], Nihan Akın[1], Mehmet Çakmak[1], Süleyman Özçelik[1],

[1]*Gazi University, Physics, Turkey*

Email of corresponding author: meltemmdonmez@hotmail.com

In this study, vanadium pentoxide (V2O5) thin films were deposited onto n-type silicon (n-Si) and glass substrates by radio frequency (RF) magnetron sputtering at 100 oC. The deposited films were annealed using convensional thermal annealing (CTA) system in air atmosphere for 1 h at temperatures of 200 oC, 300 oC, 400 oC and 500 oC. The deposition temperature and post-deposition annealing effects on morphological properties of the films were investigated by high performance atomic force microscope (hpAFM) using dynamic mode scanning. The scan area was 3x3 μm2 and the scan rate was 1 μm/sec. All measurements were made at RT. It was found that the films deposited at various substrate temperatures had different root mean square (RMS) values of the surface roughness. RMS values and grain size which was evaluated by measuring the size of hillock increased with increasing the deposition and post-deposition annealing temperature. The surface morphology of the films, except deposited on glass substrate at 500oC, was quite uniform at nanoscale. It was clear that the quality of the surface morphology of the films on glass substrate was disappeared at 500 oC. The AFM results indicated the surface morphology of the films was largely affected by substrate temperature.

Characterization and Instrumentation

PB082

A Comparison Study of Green Luminescence Quenching and UV Emission Enhancing in Oxygen Deficit and Annealed Nano Crystalline ZnO Thin Films

Taj Khan

tcd, school of physics, ireland, NILOP, Photonics, Pak, Physics

E-mail of Corresponding Author: tajakashne@gmail.com

We reported ultraviolet-green luminescence, optical phonon modes and surface morphologies of oxygen deficit and annealed nano-crystalline ZnO thin films. Photoluminescence study established the green emission quenching with reduction of oxygen vacancies and show no more stability with annealing while ultraviolet emission was considerably enhanced. The green and orange emissions were not observed simultaneously, however orange emission was obtained at the expense of green emission quenching. Raman scattering demonstrated that the intensities of E2 (high), E1 (low) and A1 (LO) modes strongly depend on oxygen vacancies and were correlated to the density of oxygen vacancies. The atomic force microscope showed that the film has smooth morphology with root-mean-squared roughness 48.6 nm after annealing while the oxygen deficit film presented a rough surface. Transmission and optical band-gap was increased while the Urbach-energy was decreased after annealing. These properties manifested compatibility and incongruity of these materials for the fabrication of shorter-wavelength light-emitting devices.

Thin Film Growth & Epitaxy

PB083

Influence of Metal Impurities and Surface Temperature to the Formation of Thin (Me)-aC:H Film

Zivile Rutkuniene[1] and Lina Vigricaite[1]

Kaunas University of Technology, Physics department

E-mail of Corresponding Author: zirut@ktu.lt

The aim of this experimental work is identify most important physical and chemical processes on the surface during hydrogenated amorphous carbon films formation on the silicon surface with various chemical activities of metals clusters (Cu, Ag, Au).Duration of films deposition on different temperature (25 °C, 100 °C and 250 °C) of n type silicon (100) surface was 45 s. Velocity of film growth from C_2H_2 gas plasma depends on nature of metals and surface temperature and is variable (0.2-0.5 nm/s). Data of null ellipsometry, Raman spectroscopy and EDS show that formation of amorphous carbon film is in the early stage and mixture of Si-C, Si-COH and graphite like carbon (GLC) fragments is dominant on the surface.

Thin Film Growth & Epitaxy

PB084

Characterization of VO_2 Films grown by Magnetron Sputtering for Field Effect Transistor Applications

Hurriyet Yuce*[1], Sena Gulen[1], Mehtap Koklu[2], Gulnur Aygun[1], Lutfi Ozyuzer[1]

[1] *Department of Physics, İzmir Institute of Technology, Urla, 35430, İzmir, TURKEY*
[2] *Department of Electrical and Electronics Engineering, Gediz University, İzmir, TURKEY*

*E-mail of Corresponding Author: hurriyetyuce@iyte.edu.tr

Vanadium dioxide (VO_2) which is a transition metal compound demonstrates metal insulator transition (MIT) property**.** VO_2 used as a channel layer in field-effect transistor (FET) has changing characteristic from insulator with monoclinic structure to metal phase with tetragonal rutile structure when heated to about 67 °C [1]. Electrical resistivity at MIT changes by a factor of 10^4, while the optical properties also change according to the metallic phase [2]. When MIT feature of VO_2 can be triggered by electrically (E-MIT), it has high potential for the applications in microelectronic devices. VO_2 is used not only for FET applications, but also for other devices including nonvolatile resistive memories, optical sensors and termochromic smart windows [3,4].

In this work, sapphire (Al_2O_3) was used as substrate due to its good thermal conductivity. 60 nm thick with high MIT performance VO_2 films were deposited in vacuum chamber on c-Al_2O_3 (0001), heated up to 550 °C, by rf magnetron sputtering technique. The grown films were characterized using various techniques which are X-ray diffraction (XRD) for identifying atomic and molecular structure of the crystal, Raman microscopy for observing vibrational and rotational modes, atomic force microscopy (AFM) for generating high-resolution topographic images of the surface and energy-dispersive X-ray spectroscopy (EDX) for determining the elemental analysis/chemical characterization of the film. In addition, the resistance of VO_2 films were analyzed at different temperatures.

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[1] M. Hada *et al*, Phys. Rev. B. 82, 153401, (2010)
[2] J. Wu *et al*, Nano Lett. 6, 2313 (2006)
[3] M.Tangirala *et al*, ECS Journal of Solid State Science and Technology, 3, N89-N94 (2014)
[4] D. Ruzmetov *et al*, J. Appl. Phys. 107, 114516 (2010)

PB085

ZnO Flower-Like Morphology Prepared by Electrodeposition on Silicium Substrate

Hammache Houa[1], N. Ait Ahmed[2], H. Hammache[2], S.Sam [2], A. Keffous[2] and N.Gabouze[2]

[1]*University of Bejaia, faculté de technologie*
[2]*Laboratoire d'Electrochimie, de Corrosion et de Valorisation Energétique, Université de Bejaia, Algérie.*

E-mail of Corresponding Author: houahammache@yahoo.fr

Zinc oxide is one of the most promising materials for nanotechnology due to its range of potential applications such as sensors, photovoltaic cells, light-emitting diodes and nanogenerators. Because the properties of determining the performance of ZnO-derived devices strongly depend on the size and the shape, precision control of the morphology of ZnO crystals is a matter of considerable importance for exploring the potential oxide material. In this study, flower-like ZnO nanorods were prepared by electrochemical deposition method from aqueous zinc nitrate solution at 70°C onto silicon n-type Si (100) substrates by using appropriate electrodeposition parameters without using any template, catalyst, additives or seed layer. Scanning electron microscopy images showed that the ZnO flower-like morphologies grown at the potential of -1.2 V were uniformly and fully covered the substrate. The corresponding X-ray patterns of the ZnO flower-like exhibited the dominant peaks corresponding to the ZnO wurtzite structures.

Thin Film Growth & Epitaxy

PB086

Composition Effect on the Optical Parameters of Ge-Se-Te Thin Films

Mansour Mohamed[1]

[1]*Faculty of Science, Assiut University, Physics Department*

E-mail of Corresponding Author: m.mohamed@aun.edu.eg

The present work reported the influence of Germanium content variation on the optical properties of GexSe50Te50-x (x = 0, 5, 15, 20, 35 at%). Vacuum thermal evaporation technique was employed to prepare amorphous GexSe50Te50-x thin films. The stoichiometry of the chemical composition was checked by energy dispersive X-ray spectroscopy (EDX), whereas the thin films structure was determined by X-ray diffraction. The optical absorption measurements were performed at room temperature in the wavelength range of 200-900 nm. Many optical constants were calculated for the studied thin films utilizing the optical absorption data. It was observed that the optical absorption mechanism follows the rule of the allowed non-direct transition. The optical band gap was found to decrease from 2.31 to 2.60 eV as the Ge content increase from 0 to 35 at%. This result was explained in terms of the chemical bond approach.

Thin Film Growth & Epitaxy

PB087

Hybrid Orientation Structure Fabrication on SOI Substrates Using Orientation Selective Epitaxy

Tomoyasu Inoue1 and Shigenari Shida[1]

[1]*Iwaki Meisei University, Department of Science and Engineering*

E-mail of Corresponding Author: tomo@iwakimu.ac.jp

Cerium dioxide (CeO$_2$) is an attractive insulating material with a high dielectric constant of 26, a high dielectric breakdown voltage, high chemical stability, transmission in the visible and infrared wavelengths and high efficiency ultra-violet absorption. On the other hand, in the field of large scale integration (LSI) devices, hybrid orientation technology is strongly desired to create higher speed substrates for n- and p-channel MOS devices maximizes the crystal orientation-dependent mobilities of electrons and holes. Several methods have been reported for the fabrication of hybrid orientation substrates for CMOS LSI, such as the direct wafer bonding of a Si layer with a different orientation than the Si substrate and subsequently growing a Si epitaxial layer after locally removing the bonded Si layer, and an amorphization/templated recrystallization method. These methods require complex processes including lithography, etching and chemimechanical polishing, resulting in long manufacturing times and high costs.

As a simpler and preferable method, we are studying the hybrid orientation structure of the CeO$_2$(100) and (110) regions on Si(100) substrates using electron beam induced orientation selective epitaxial (OSE) growth by reactive magnetron sputtering. Two separate areas of growth are seen, with CeO$_2$(100) layers found to grow in areas irradiated by electrons during the growth process, and the CeO$_2$(110) layers growing in the areas not irradiated by the beam. The lateral orientation mapping obtained by x-ray diffraction measurements reveals the existence of transition regions between these two orientation areas. The width of the transition region is found to decrease proportionally as the logarithm of the underlying Si substrate resistivity.

To make a breakthrough in the limitation in reduction of the transition region width, we propose a new method of electron beam induced OSE growth on silicon-on-insulator (SOI) substrates by using lithographically formed trenches. These trenches are expected to prevent spread of the potential distribution to the neighboring Si island. Here, we report the experimental results showing perfect isolation of hybrid OSE growth regions on SOI substrates, which show that perfect isolation of the two areas becomes possible by optimizing the geometry of the trenches .

Thin Film Growth & Epitaxy

PB088

Epitaxial Calcite Growth on Highly Ordered Gold, Silver and Copper Surfaces Without Use Templates

Hassiba TEGHIDET[1,2], Lila CHAAL[1], Suzanne JOIRET[2] and Boualem SAIDANI[1]

[1] *University of Algeria*
[2] *University of Paris6 (France)*

E-mail of Corresponding Author: teghidet.hassiba@gmail.com

Development of experimental strategies for the synthesis of inorganic materials with controllable shape and crystallography is important for application in catalysis, medicine, hybrid materials, ceramics, and cosmetic formulations. Such materials are produced successfully by the organisms which exert an exquisite control over the minerals they deposit. One of the most challenges of scientists is to form materials with analogous crystalline forms to those produce by nature. In recent years, researches have used new concept based on macromolecules incorporation which acts as templates nucleation of the inorganic phase [1,2]. Although these organic surfaces are able to induce oriented growth of crystals, the specificity of face-selective nucleation has generally not been high, and the processes could not be easily controlled. The experimental approach in our study concerns a successful crystallization of epitaxial calcite on different substrates without use any template. We choose calcite because it is the first stable polymorph of $CaCO_3$ and is by far the most common among some 60 biological known minerals.

Calcite crystallization was induced by electrochemical way in undersaturated solution of calcium carbonate at 3 mM concentration. The well-ordered thin films of gold, silver and copper were characterized by Electron BackScattered Diffraction analysis (EBSD) and the calcite crystals formed are analyzed by micro-Raman Spectroscopy and Scanning Electron Microscopy (SEM).

The results showed that the calcite crystals so obtained were uniform in size and orientation and presented a (001) face parallel to the Au or Ag (111) surface. This calcite epitaxy appeared only on Au or Ag substrate when various rhombohedra could be evidenced on the copper modified surface. From these results, an epitaxial relationship has been suggested where hexagonal symmetry of the (001) calcite plane was in a R30° $\sqrt{3}\times\sqrt{3}$ arrangement on the Au (111) surface. This led to a mismatch for lattice parameters below 0.5% [3].

Thin Film Growth & Epitaxy

PB089

Growth and Characterization of ZnO Nanostructures with Different Morphologies by Hydrothermal Technique

Sule Erten Ela

Ege University Sola Energy Institute 35100 Bornova, Izmir

Email of corresponding author: suleerten@yahoo.com

Among environment-friendly and renewable energy sources, dye sensitized solar cells have always been high on the list of likely candidates. As one of the most important oxide semiconductor materials, ZnO has attracted considerable attention due to its good optical, electrical, and piezoelectrical properties and its potential applications in the blue ultraviolet region owing to its direct wide bandgap (3.37 eV) and large excitation binding energy (60 meV at room temperature) [1-4].
In this study, an additive-free method has been developed to prepare zinc oxide nanorods from commercially available zinc acetate precursor using solution-phase reactions. One-dimensional (1-D) and additive-free ZnO nanorods are prepared by using simple solution phase method, autoclave and microwave oven. We obtained different morphologies like nanoflower, nanorod, nanowire, nanobutterfly, nanocapsule according to synthesis techniques. The ZnO nanostructures are characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) measurements.
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Keywords: ZnO, nanostructures, nanocapsule, nanorod, nanowire

References

[1] S. Erten-Ela, S. Cogal, S. Icli , Inorganica Chimica Acta, 362 (2009) 1855.
[2] a) S. Erten-Ela, J. Brendel, M. Thelakkat, Chemical Physics Letters, 510 (2011) 93.
b) S. Erten-Ela, A.C. Cakir, Energy Sources, Part A, 2014 in press.
[3] S. Erten-Ela, S. Cogal, G. Turkmen, S. Icli, Current Applied Physics,10 (2010)187
[4] L. Vayssieres L, Adv Mater 15 (2003) 464.

Thin Film Growth & Epitaxy

PB090

Properties of Al Doped ZnO Thin Films Grown by Pulsed Laser Deposition

F. Kermiche, A. Bouabellou, A. Taabouche, F. Hanini and Y. Bouachiba

Université Mentouri Constantine, physic, Algeria

Email of corresponding author: fouadker@yahoo.fr

Highly textured pure and Al doped; AZO (Al: 3, 5 at.%) ZnO thin films have been produced by pulsed laser deposition at 450ºC onto glass substrates. The used source was a KrF excimer laser (248 nm, 25 ns, 2 J / cm^2). The influence of dopant concentration on the structural, morphological, optical, and electrical properties of the films were investigated. X-ray diffraction patterns showed that the Al-doped ZnO films crystallize in a hexagonal wurtzite-type structure with a strong (0002) orientation, and the grain sizes calculated from these patterns decrease with increasing Al doping.

The optical and electrical analysis shows that our films can be used as TCO, because of their good transparency in the visible region and high conductivity.

The specroscopy M-Lines analysis confirms the application of our films as optical waveguides.

Keywords: AZO, Pulsed laser deposition, transparency, TCO, M-Lines, optical waveguides.

Thin Film Growth & Epitaxy

PB091

Formation and Thermal Stability of Ternary Silicide $(Co_xNi_{1-x})Si_2$ Thin Films

Sedrati Charafeddine[1], Abderrahmane Bouabellou[2] and Achour Derafa,Laboratoire[2]

[1]*Laboratory of Thin Films and Interfaces physics, Algeria*
[2]*Laboratoire Couches Minces et Interface, Université Constantine [1]- Algérie*

Email of corresponding author: charaf.eddine@hotmail.fr

In this study, the thermal stability of a ternary silicide (CoxNi1-x)Si_2 formed by Ni and Co thin films deposited on Si(100) substrate is studied.
For that aim, a 50nm-Co/10nm-Ni/p-Si(100) was thermally annealed for 20 minutes at 300-800°C using a conventional furnace. The obtained samples were investigated using X-ray diffraction (XRD), Raman spectroscopy and Rutherford backscattering spectroscopy (RBS).
XRD and Raman spectroscopy data Show that the formation temperature of the Ternary silicide (CoxNi1-x)Si_2 phase is rather low compared with the disilicide $NiSi_2$ and $CoSi_2$. RBS results indicate a ternary silicide layer of approximately 200 nm, with the simulation spectra in close agreement with experimental data.

Thin Film Growth & Epitaxy

PB092

Characterization of Thin CeO_2 films electrochemically deposited on platinum

Firas Faisal[1], A. Toghan[2], I. Khalakan[3], V. Matolin[4] and J.Libuda[2]

[1]Friedrich-Alexander-Universität Erlangen-Nürnberg Physikalische Chemie II Germany
[2]Lehrstuhl für Physikalische Chemie II, Friedrich-Alexander-Universität
[3]Department of Surface and Plasma Science, Charles University in Prague
[4]Faculty of Mathematics and Physics, Department of Surface and Plasma Science, Charles.de

Email of corresponding author: arafat.toghan@yahoo.com

Electrodeposition is widely used for industrial applications to deposit thin films, coatings, and adhesion layers. Herein, CeO_2 thin films were deposited on polycrystalline platinum substrates by cathodic electrodeposition. The influence of deposition parameters on the yield and on film morphologies is studied and discussed. The morphology and composition of the electrodeposited films were characterized by atomic force microscopy (AFM), scanning electron microscopy (SEM), energy-dispersive spectrometry (EDS), and X-ray photoelectron spectroscopy (XPS). The results of AFM indicate that the thickness of CeO_2 films strongly depends on the Ce(II) concentration and the deposition time. After exposing the films to ambient air, cracking structures are formed, which were analyzed AFM in detail. The XPS data indicate the formation of stoichiometric CeO_2.

Thin Film Growth & Epitaxy

PB093

Electrochemical Synthesis and Electrochromic Device Applications of PEDOT/WO_3 Composites in Different Ionic Liquids

Çiğdem Dülgerbaki[1] and Aysegul Uygun Oksuz[2]

[1]Suleyman Demirel University,Chemistry Turkey
[2]Suleyman Demirel University, Faculty of Arts and Science Department of Chemistry

Email of corresponding author: cigdembaki2002@yahoo.com

A series of ionic liquids such as 1-Butyl-3-methylimidazolium hexafluorophosphate (BMIMPF6), 1-Butyl-3-methylimidazolium bis(trifluoromethylsulfonyl) imide (BMIMTFSI), and 1-Butyl-1-methylpyrrolidinium bis(trifluoromethylsulfonyl) imide (BMPTFSI) were used as both electrochemical growth media and electrolytes for the synthesis of PEDOT/WO_3 composite films for electrochromic device applications. The surface and electrochromic properties of the composites changed depending on characteristic of ionic liquids. The maximum transmittance window 41.3 % was obtained at 620 nm with the operating potentials between +2 and -2V, for the BMPTFSI synthesized composite. Reasonable optical modulations (32.8 % and 22.3 % at 620 nm), were achieved for the $BMIMPF_6$ and BMIMTFSI synthesized composites, respectively. In this work, we studied, among other things, the synthesis and polymerization rate of the composite films in the different ionic solvents.

It is our privilege to report, that to the best of our knowlege, no previous work on the electrochemical synthesis of PEDOT/WO_3 composites in ionic liquids has been reported in any earlier study. Our electrochemical experimental results confirm that the polymerization rate of the composite films changes with the different ionic solvents used. Also, both imidazolium and pyrrolidinium-based ionic liquids have an influence on the electrochemical activity of the PEDOT/WO_3 composite film. Most importantly, we observed a better electrochemical activity for the PEDOT/WO_3 composite films than for either the WO_3 or PEDOT films.

Thin Film Growth & Epitaxy

PB094

Generating New Magnetic Properties in Organic-Inorganic Hybrid Langmuir-Blodgett Films

Jiquan Wu, Régis Y. N. Gengler, Jacob Baas, Naureen Akhtar, Thomas T.M. Palstra and Petra Rudolf

University of Groningen, Applied Physics, Netherlands

Email of corresponding author: j.wu@rug.nl

Spintronics is an emerging form of electronics which uses the spin of electrons to encode and process data, rather than using electric charge. Developing materials in which one can manipulate and control the electron spin orientation is a necessary step in order to develop spintronic devices. The focus of present work is on hybrid structures that can combine the versatility of organic materials with the intriguing magnetic properties of inorganic materials. Multifunctional organic-inorganic hybrid films are deposited by means of the Langmuir-Blodgett (LB) technique which provides intrinsic control over the molecular organization and film thickness down to the molecular level. The inorganic component consists of a magnetic divalent transition 3d-metal chloride MCl_2 with M = $Co^{2+,}$ which introduces magnetism as well as giving thermal stability to the hybrid. The structural and magnetic properties of the hybrid films are presented.

Thin Film Growth & Epitaxy

PB095

The Surface Chemistry of Atomically Thin Graphene Film Grown onto Large Area Copper Substrate Using Low Pressure ICP-CVD

Mehmet Hancer[1], Sami Pekdemir[1] and Mehmet Hancer[1]

[1]*Erciyes University Material Science and Engineering Department, Talas Kayseri, 38039 Turkey*

E-mail of Corresponding Author: mhancer@erciyes.edu.tr

Atomically thin film of graphene has great potential as semiconductor substrate for the next generation of electronic devices. However, the production of single layer crystalline graphene requires a method of forming high quality films on a large scale substrates. In this present work, single crystalline graphene was grown onto atomically smooth crystalline copper substrates according to semiconductor device fabrication schemes (in clean room, and on large scale) using low pressure inductively coupled plasma chemical vapor deposition (LP ICP-CVD) method. Unlike similar studies reported in the literature, single crystalline graphene of single layer was grown using high purity CH_4 precursor only. A powerfull plasma (300W) available in our system allows us to both pricely control the reactiveness of our gas phase precursors at the surface and interface and to grow graphene onto copper substrates at much low temperatures (200 ^{O}C) then that of similar studies appeared in the literature (110^{0} C). In this way, a possible Cu contamination onto graphene surface and interfaces and wrinkle formation due to the differences of thermal expansion coefficient were eliminated. The graphene film characterisation was then performed using atomic force microscope (thickness, surface topography), scanning electron microscope (thickness, surface topography and elemental analysis), and Raman spectroscopy (graphen crystalline/amorph ratios). The film sheet resistance was also measured using a four probe system.

Thin Film Growth & Epitaxy

PB096

AlN Thin Films Deposition on Glass Substrate by Radio Frequency Magnetron Sputtering

HASAN SATILMIŞ[1], Mehmet Özkan[2], Şükrü Taktak[2], Ö.Faruk Emrullahoğlu[2], Suat Pat[3], Soner Özen[4]

[1]*Pamukkale University, Materials Science and Engineering, Turkey*
[2]*Afyon Kocatepe University*
[3]*Eskişehir, Turkey*
4Department of Physics

Email of corresponding author: hasansatilmis@pau.edu.tr

Aluminum nitride (AlN) thin films were deposited on glass substrates using Radio frequency Magnetron Sputtering method. The microstructure and surface morphology of the AlN thin films were investigated using X-ray diffraction Technique (XRD) and Atomic Force Microscopy (AFM). Moreover, inferometric filmetrics was used to characterize the thicknesses of AlN thin films. The obtained experimental results were compared with literature.

Thin Film Growth & Epitaxy

PB097

Optical and structural characteristics of $(Y\text{-}Gd)_3\ Al_5O_{12}:Ce^{3+}$ thin films fabricated by pulsed laser deposition in different gas atmospheres.

ALI Wako[1], Fancis B. Dejene[1] and Hendrik C. Swart[1]

[1]*University of the Free State, Physics Department, South Africa*

E-mail of Corresponding Author: wakoah@qwa.ufs.ac.za

Cerium doped yttrium - gadolinium aluminate garnet $(Y\text{-}Gd)_3\ Al_5O_{12}:Ce^{3+}$ (YGAG:Ce) thin films were deposited on Si(100) substrates by a pulsed laser deposition (PLD) technique using a 266 nm Nd:YAG laser. The influence of different working atmospheres; vacuum, oxygen and argon at a particular substrate temperature on the structure and photoluminescent (PL) properties of the (YGAG:Ce) thin films were investigated. X-Ray Diffraction (XRD) patterns reveal that the films crystallize well in vacuum, 5mtorr Oxygen and 20 mtorr Argon for all cases. Excitation with 230 nm gives a broad band emission ranging from 547 nm to 551 nm with a shoulder at 485 nm attributed to the 2D–2F7/2 and 2D–2F5/2 transitions of Ce^{3+} ions, respectively. For Argon the PL intensity is high at 5 mtorr and is seen to decrease with increasing deposition pressure from 5-20 mtorr while for oxygen the PL intensity increases from 5 – 10 mtorr and drops at 20 mtorr. A slight shift in the emission wavelength of the PL spectra was observed for the thin films with respect to the different gases and also when compared to the PL spectra of the powder which is probably due to a change in the crystal field.

Thin Film Growth & Epitaxy

PB098

EFFECT OF TUNGSTEN ADDITION ON Mo-Si SILICIDES FORMATION

A. Derafa[1], M. C. Record[2] and D. Mangelinck[2]

1- LP3M, Department of Optics and Mechanic of Precision, University of Sétif 1, Algeria.
2-IM2NP, UMR CNRS 6242 Université Aix-Marseille, France

Email of corresponding author: aderafadz@univ-setif.dz

The molybdenum silicides are probably the newest class of materials considered as highly promising for structural applications at high temperatures, in aerospace and energy-related industries due to the combination of high melting point, relatively low density and good corrosion resistance. Refractory metal disilicides with symmetrical crystal structures such as the C11b, C40 and C54-types are candidates for super-high-temperature-resistant structural materials. The crystal structures are different in appearance but have a close relationship to each other because the atomic arrangements are quite similar on the close-packed planes. Two good examples of complete solid solubility are Mo-W silicides, both tetragonal at high temperature, and the fluorite-type $CoSi_2$ and $NiSi_2$. Finstad et al, addresses the solubility of these two silicides. Because of the close atomic masses and structures, Rutherford Bacscattering spectrometry, X-ray diffraction and Auger electron spectroscopy cannot distinguish between interdispersed phases or true solid solution. However, it is show that annealing of Mo-W bilayers led to the formation of $MoSi_2$ at 600°C and WSi_2 at 800°C and the disilicides form a solid solution at temperature above 1000°C . Hence to understand the phase formations temperatures in co-sputtered and bilayer deposition; in situ X-ray diffraction, RBS and in situ fore probe resistivity measurements, as will elucidated below.

Thin Film Growth & Epitaxy

PB099

Bioactive Calcium-Phosphate Coatings on the Surface of Titanium Implants

Vladimir Egorkin[1], A.V. Puz'[2], S.L. Sinebryukhov2 and S.V. Gnedenkov[2]

[1]*Institute of Chemistry FEB RAS , Laboratory of Non Stationary Surface Processes, Russia*
2Institute of Chemistry FEB RAS

E-mail of Corresponding Author: egorkin@ich.dvo.ru

The creation of new materials for implant surgery is the actual task that demands of long temporal and financial expenditures. At the pre-sent time the implants made from titanium alloys have a wide spreading and popularity in medicine. In the modern stomatology, oral surgery, traumatic surgery for the bone defects improving or for replacing of tissues parts damages the implants consisting of the metallic base and biocompatible coating can be used as an optimal variant.

At the present time the possibility of formation by plasma electrolytic oxidation method (PEO) on the surface of macrocrystalline and nanostructured titanium VT1-0 of the surface layers possessing acceptable adhesion characteristics and containing hydroxyapatite. The electrolytes and regimes of PEO for hydroxyapatite formation in the surface layers composition, with Ca/P = 1,4 that is close to the ratio of these elements in human's bone tissue (1,67). According to the experiments results, the formation the implant's surface of hydroxyapatite layer accelerates essentially the velocity of osteogenesis that allows providing the reliable conjunction of implant with bone.

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Thin Films in Biology

PB100

Investigation of Cellular Viability of Graphene Reinforced Chitosan Thin Films in terms of Electrical Conductivity

Cigdem Serdengecti[1], İbrahim Sen[2], Mert Duman[3], Aylin Sendemir Ürkmez[3], Yoldaş Seki[2] and Omer Mermer[3]

[1]*Ege University, Biotechnology, Turkiye*
[2]*Dokuz Eylül Unv.*
[3]*Ege Unv.*

Email of corresponding author: cgdmcan@yahoo.com

Chitosan and the miracle material graphene have wide application areas in biomedical sciences. In this study, the effect of electrical conductivity on cellular viability of graphene reinforced chitosan composite thin films was investigated. As a first step, chitosan solution was prepared by acedic acid and distilled water with ratio %4 and put on the magnetic stirrer overnight. Sonicator was used to provide dispersion of graphene into chitosan solution with ratio %0.1. Spin coating deposition method was preffered to fabricate thin films by applying 1000rpm for 30 second and deposited on glass lamellae. To evaluate the cellular viability, B35 neuroblastoma cells and MTT that is one of the most reliable assay to asses cell proliferation were chosen. Measurement of electrical conductivity was ensured by four probe method and the results confirmed the augmenter effect of graphene on electrical conductivity. MTT results showed that cellular viability of graphene reinforced chitosan thin film was better than bare chitosan thin film. According to these results, we can conclude that graphene has fair effects on cellular viability of nerve cells depending on its electrical properties.

Thin Films in Biology

PB101

OPTICAL, SURFACE MORPHOLOGICAL, AND ANTIBACTERIAL PROPERTIES OF NANOSTRUCTURED TiO_2:M (M=Fe, Ce, Ag) THIN FILMS

Farhad E.Ghodsi[1], H. Dadvar[1] and G. Khayati[2]

[1]*Department of Physics, Faculty of Science, University of Guilan, P.O. Box 41335-1914, Rasht, Iran*
[2]*Department of Chemical Engineering, Faculty of Engineering, University of Guilan, P.O. Box 419961-3769, Rasht, Iran*

Email of corresponding author: feghodsi@guilan.ac.ir

In this research, undoped and doped (Fe, Ce, and Ag) antibacterial coatings of nanostructured Caldera Volcano Shape Porous (CVSP) TiO_2 films have been prepared by sol-gel dip coating method. Doped and undoped TiO_2 films were exited with ultraviolet radiation to improve their photocatalytic activity. The antibacterial activity against Staphylococcus Aureus bacteria have been studied with antibacterial–drop test and colony count method. The Fe doped TiO_2 films exhibited higher antibacterial activity than other samples. The bacteria killing percentage of bare glass substrate, four layers deposited undoped, Ce, Ag, and Fe doped TiO_2 thin films (after UV illumination) have been achieved about 8, 24, 50, 58, and 70%. Uv-Visible Spectrophotometry, Photoluminescence (PL), X-ray Diffraction (XRD), and Atomic Force Microscopy (AFM) carried out to study the relation between optical, luminescence, structural, and morphological characteristic of the samples with their antibacterial activity. Several parameters such as thickness of films, porosity in films, crystallization, surface roughness, defect states, oxygen vacancies, interstitial atoms, and magnetic dipole transitions can affect the antibacterial activity of doped TiO_2 thin films.

Thin Films in Biology

PB102

Optimal Deposition Parameters of Silicon Nitride for Solar Cells

EL AMRANI Abdelkader[1], A. Bekhtari[1], A. El Kechai[1], H. Menari[1], L. Mahiou[1] and M. Maoudj[1]

[1]*CRTSE, DDCS, Algeria*

E-mail of Corresponding Author: elamrani@msn.com

In photovoltaic silicon solar cells fabrication, the excellent antireflection (AR) and passivation quality of Plasma Enhanced Chemical Vapor Deposition (PECVD) silicon nitride film (SiN) have obvious effect on efficiency of solar cells. The AR effect consists of the deposition of an adequate thickness of the SiN film. The passivation effect is more complicated. It consists of optimizing all of the film deposition parameters. In this paper, we investigated the optimization of the main deposition parameters of the SiN film deposited on multicrystaline silicon solar cells. The parameters investigated were deposition temperature, electrical power of deposition and refractive index of the film which is determined by varying the process gas flow ratio SiH_4/NH_3.

Using a symmetrical structure of SiN/Si/SiN and QSSPC characterization we have found that 380°C and 4600 W are the optimal temperature and power, respectively.

The optimal refractive index was determined using a method which encompasses optical and electrical properties of SiN films deposited on multicrystalline silicon solar cells. This method is based on the calculation of the short circuit current densities. The optimal film corresponds to the maximum short circuit current density.

Films with the following refractive indices were studied: 1.9, 2.0, 2.1 and 2.4. The optical characterization of these films deposited on multicrystalline silicon wafers and on corning glass gave a minimal weighted reflection for refractive index of 2.0 and a maximum transmission for refractive index of 1.9, respectively.

The QSSPC characterization revealed that the annealed film refractive index of 1.9 performed the best passivation quality. Internal quantum efficiencies of simulated multicrystalline silicon solar cells coated with these SiN films were determined by PC1d program simulation.

Short-circuit current densities calculated using these experimental and simulated data revealed that the optimal refractive index is 1.9.

In summary the optimal deposition parameters are 380°C, 4600W and refractive index of 1.9.

Thin Films in Photovoltaic Cells and Energy

PB103

Thermally Evaporated CuIn7S11 Thin Films for Photovoltaic Applications: Structural, Optical and Electrical Analysis

Naoufel khemiri[1], N. Khemiri[1] and M. Kanzari

[1]*Laboratoire de Photovoltaïques et Matériaux de Semi-conducteurs- ENIT- Université de Tunis El Manar, BP 37, le belvédère 1002-Tunis, Tunisie*

E-mail of Corresponding Author: naoufel_khemiri@yahoo.fr

CuIn7S11 compound was prepared by direct reaction of high-purity elemental copper, indium and sulphur. CuIn7S11 thin films were prepared by high vacuum evaporation on glass substrates. The glass substrates were heated to 30, 75, 100, 150 and 200 °C. The powder was characterized for their structural and compositional properties by using X-ray diffraction (XRD) and energy dispersive X-ray (EDX) measurements. The films were characterized for their structural, compositional morphological, electrical and optical properties. X-ray diffraction analysis revealed that the film deposited at a room temperature was amorphous in nature while those deposited on heated substrates were polycrystalline with a preferred orientation along the (311) plane of the spinel phase. The surface morphological analysis revealed that the films grown at different substrate temperatures had an average roughness between 1 and 5 nm. The energy bandgap values changed from 2.30 to 1.58 depending on the substrate temperature. The resistivity values of the films increased from 3 to 1700 Ωcm and a transition from p-type conductivity to a highly compensated state is observed by increasing the substrate temperature.

Thin Films in Photovoltaic Cells and Energy

PB104

Optical and Structural Study of In_2S_3 Thin Films Growth by Co-Evaporation and CBD on Cu_3BiS_3

Fredy Mesa[1], William Chamorro[2], Mikel Hurtado[3] and Gerardo Gordillo[4]

[1]*Universidad del Rosario, Unidad de Estudios Universitarios, Colombia*
[2]*CNRS, Institut Jean Lamour, Université de Lorraine, UMR7198, Nancy F-54011, France*
[3]*Departamento de Química, Universidad Nacional de Colombia, Cra. 30 Nº 45-03, Bogotá, Colombia*
[4]*Departamento de Física, Universidad Nacional de Colombia, Cra. 30 Nº 45-03, Bogotá, Colombia*

E-mail of Corresponding Author: fgmesar@gmail.com

This work presents results about of synthesis and characterization of In_2S_3 thin films deposited on Cu_3BiS_3 layers. The films were grown via a chemical reaction by CBD and from co-evaporation of their precursor elements on a soda-lime glass substrate. The effect of the experimental conditions on the optical and structural properties was studied through spectral transmittance and X-ray diffraction (XRD) measurements, respectively. The results showed that In_2S_3 thin films with thickness less than 100 nm deposited by the CBD method grows with amorphous structure, however, in the diffractogram of samples with thicknesses of about 170 nm has two peaks associated with the reflections of the planes (103) and (107) of the β-In_2S_3 phase with tetragonal structure. It was also found that the In_2S_3 films present an energy band gap (Eg) of about 2.75 eV, regardless of the thickness of the samples.

Thin Films in Photovoltaic Cells and Energy

PB105

Modeling of plasma expansion during pulsed electron beam ablation: Case of graphite for thin film deposition

Muddassir Ali[1] and Redhouane Henda[1*]

[1]*Bharti School of Engineering, Laurentian University, 935 Ramsey Lake Road, Sudbury, ON P3E 2C6, Canada*

Email of corresponding author: rhenda@laurentian.ca

Pulsed electron beam ablation (PEBA) has proven to be a promising and powerful technique for the growth of high quality thin films. Pulsed electron beam ablation consists of many physical processes starting from target heating, phase change, and plasma plume expansion towards a substrate. Plasma plume expansion into an ambient gas is a fundamental issue in PEBA as the quality of thin films deposited onto the substrate depend on the energy and density of particles ejected from the target. In the present study, gas-dynamics equations are solved to investigate plasma plume expansion induced by interaction of a nanosecond electron beam pulse with a graphite target in an argon atmosphere. The effect of the distance between the target and substrate and ambient gas pressure on plume expansion is assessed. The temperature, pressure, velocity and density profiles of the plasma plume are numerically simulated as a function of time. Assessment of the model is done by comparing the obtained simulation results with experimental observations heretofore available in the literature.

Thin Film Growth & Epitaxy

PB106

The Structural Characterization of CZTS Thin Films and Band Alignment at CdS/CZTS Interface

Ayten CANTAŞ[1], Sebnem Yazici[1], Fulya Turkoglu[1], Gulsah Akca[1], Gulnur Aygun[1], Lutfi Ozyuzer[1]

[1] *Izmir Institute of Technology, Physics, Turkey*

E-mail of Corresponding Author: aytencantas@iyte.edu.tr

The kesterite/stannite structure Cu_2ZnSnS_4 (CZTS) is a p-type semiconducting compound with high absorption coefficient (~ 104 cm^{-1}) in visible spectrum range and optimum direct band gap energy (1.5 eV)[1]. Also it is well known that CZTS is an excellent new material not only for low-cost thin film solar cells with constituents of naturally abundant elements but also environment-friendly due to having been non-toxic materials. Because of these advantages, CZTS is seen as a future replacement for $CuInGaSe_2$ (CIGS) solar cells in photovoltaic (PV) industry. In our study, CZTS absorber films were prepared by two independent stages. CZTS precursors were grown on the Ti or Mo deposited soda-lime glass with deposition order from top to bottom Cu/Sn/ZnS by using DC magnetron sputtering technique. The deposited precursors were sulphurized for 2 hours at 560 ^{o}C under Argon (Ar) exposure by using sulphur powder. Finally, the CdS/CZTS multilayer structures were obtained by depositing a 50 nm CdS layer on CZTS by magnetron sputtering technique. To date, the development of CZTS-based thin film solar cells was surveyed in detail. The structural characterizations were occured by Raman Spectroscopy, X-Ray Diffraction (XRD) and Energy Dispersive X-ray Spectroscopy (EDX). For future study, the compositional ratio of atoms will be studied using X-Ray photoelectron spectroscopy (XPS). The determination of the valence band (VB) and the conduction band (CB) offset at the CdS/CZTS interface is planned by ultravoilet photoelectron spectroscopy (UPS) [2].

REFERENCES:

[1] H. Katagiri, et al., Solar Energy Materials and Solar Cells, 49, 407, (1997)
[2] A. Santoni, et al., J.Phys. D: Appl. Phys. 46, 175101, (2013)

Thin Films in Photovoltaic Cells and Energy

PB107

Copper Oxide Thin Films Deposition by Spray Pyrolysis: Influence of Solution Precursor

Meryem lamri zeggar[1], M.S. Aida aida[2] and N. Attaf[2]

[1]Laboratory of Thin Films and Interfaces, Faculty of Science, physics, University of Constantine1
[2]University of Constantine1, Algeria

E-mail of Corresponding Author: algeria meryemlamri@gmail.com

In the present work copper oxide (CuO) thin films were prepared using ultrasonic spray pyrolysis technique. In order to investigate the influence of precursor nature on physical properties of CuO films, we have used two salts as source of cu namely $CuCl_2.2H_2O$ and $Cu(CH3COO)_2$ while the other deposition parameters such as substrate temperature , solution morality , flow rate and deposition time were fixed . Films structure was studied using XRD, Raman spectroscopy and SEM. The optical characterization was achieved using the UV visible transmittance. The obtained results indicate that chloride precursor yields to a larger deposition rate, stoichiometric and denser films with well defined structure. The optical gap is reduced from 1.47 to 1.3 eV when using copper chloride and acetate chloride respectively. The electrical conductivity, carrier mobility and concentration were determined by Hall effect measurements.The results revealed that copper acetate have a relatively high charge concentration and conductivity.

Thin Films in Photovoltaic Cells and Energy

PB108

Investigation on Cu(In,Ga)Se2 Layers Grown on Si Surfaces

Soumaya Mehdaoui[1], N. Benslim[2], M. Benabdeslem[2], L. Bechiri[2] and Cimap-ENSICAEN[3]

1Al-Tref university science and technologu faculty, Algeria
[2]laboratoire (LESIMS), Département de Physique, Université Badji Mokhtar, ANNABA, Algeria
[3]Université, 14050 Caen France

E-mail of Corresponding Author: fac782004@Yahoo.fr

The highest efficiencies for thin film solar cells based on $Cu(In,Ga)Se_2$ (CIGS) absorber layers have been achieved owing their stability and microstructure characteristics. In this work, we present the preparation and structural properties of $CuGaSe_2$ thin films grown on the glass and silicon substrates. The samples were prepared by direct thermal evaporation of fine-grained powder from a tungsten crucible onto precleaned substrates, using a LEYBOLD coating unit. The microstructures of the $CuGaSe_2$ layers are investigated by X ray diffraction (XRD), transmission electron microscopy (TEM) and scanning electron microscopy (SEM). The analysis of X ray diffraction results showed chalcopyrite structure with the predominant growth direction <112>. From the high resolution transmission electron microscopy (HRTEM) micrographs, the interreticular distances have been determinate. The composition of samples was found near-stoichiometric from the energy dispersive x-ray analysis (EDAX).

Thin Films in Photovoltaic Cells and Energy

PB109

Optical, Structural and Morphological Properties of CdS Thin Films Prepared by Chemical Bath Deposition for Solar Cell Application

Moualkia Hassiba[1], Oum El Bouaghi[2], abdelhakim mahdjoub[1], L. Hadjeris[1], L. Remache[1], louardi remache[1], L. Herissi[1]

[1]*Laboratory of materials and structure of electromechanical systems and their reliability, Faculty of Sciences and applied sciences, University Larbi Ben M'Hidi,*
[2]*Algeria Sciences and technology*

E-mail of Corresponding Author: moua_lkia@yahoo.fr Faculty

Solar cells are promising devices to diminish the environmental pollution and the climate change. However, a lot of work needs to be done to increase the actual efficiency of solar cells. Cadmium sulfide which is a material with a direct and wide band gap (2.42 eV), can provide good matching between the lattice and absorption layer, which favors the stability of copper-indium-galium-diselenide (CIGS) solar cells. The highest conversion efficiency of CIGS solar cells that has been reported to date is 20.3%. Hence, a large number of studies have been carried in order to produce CdS thin films with suitable properties for photovoltaic applications. The good performance of solar cells depends on several aspects such as: growth technique, optical range of absorption, crystalline structure, among others. Several techniques have been used to prepare CdS thin films namely: electrodeposition, spray pyrolysis, thermal evaporation and chemical bath deposition. Chemical bath deposition, CBD, has demonstrated to be a simple and low cost technique to prepare CdS films as optical windows for solar cells of the type CdS/CdTe and CdS/CIGS. In this study, CdS thin films are grown by chemical bath deposition. The optical, structural and morphological properties of CdS thin films have been investigated as a function of deposition time in order to optimize their properties. The optical transmittance of the films is studied using a Shimadzu 1650 PC UV-visible spectrophotometer in the wavelength range 300–1100 nm. Layers thickness (d) is measured by fitting the transmittance spectra. The deposition rate is estimated from the ratio of film thickness on the deposition time. The crystalline structure is analysed using a BRUKER D8 Advance X-ray diffractometer with line (wavelength: 1.54Å). Surface morphology is performed by atomic force microscopy (AFM) using a Pacific Nanotechnology Advancing Nanotechnology. The photoluminescence measurements are carried out using a spectrometer of luminescence using a Perkin-Elmer LS 50B luminescence spectrometer. The photolumenescence (PL) spectra are recorded with the excitation wavelength of 457 nm using the Ar laser. The transmission spectra, recorded in the UV visible range show a relatively high transmission coefficient (85%) in the obtained films. The transmittance data analysis indicates that the optical gap is closely related to the deposition time. From this analysis, the band gap ranging from 2.2 and 2.4 eV is deduced. The films exhibit a cubic phase with (111) preferential orientation and the crystallite size varies between 13 and 35 nm. From the morphology characteristics we conclude that the growth process is through ion by ion mechanism. The low deposition rate supported this result.

Thin Films in Photovoltaic Cells and Energy

PB110

Effect of ODC Thin Layer on Bifacial Solar Sells Based on $CuGa_xIn_{1-x}Se_2$ Thin Films Absorbers

Abdesselam Bouloufa[1], Abdelhafid Mouhoub[2] and Kamal Djessas[3],

[1]*Setif-1 University, Setif, Algeria*
[2]*Laboratoire d'Electrochimie et Materiaux, Setif-1 University, 19000, Setif, Algeria.*
[3]*Laboratoire Procédés Matériaux et Energie Solaire PROMES-CNRS, 66100 Perpignan, France*

E-mail of Corresponding Author: abdeslam_bouloufa@yahoo.fr

Developing a high-quality transparent back contact, while maintaining efficient light transmission through the top absorber layer, are key components for achieving high-efficiency I-III–VI2 polycrystalline thin-film solar cells.In this study we have simulated ultra-thin bifacial solar cellsZnO:Al/i-ZnO/In_2Se_3/CIGS/SnO_2:F structure.The effect of SnO_2:F transparent back contact and the ZnO:Al front contact has been examined. An n-type inverted surface layer: ordered defect compound (ODC), is inserted between In_2Se_3 buffer and CIGS absorber layers [1-6]. The simulation program AMPS-1D (Analysis of Microelectronic and Photonic structures) was used in this study [7-11]. Device analysis, using (J–V) and QE curves, shows that the loss in efficiency is due to lower RSh and J0 as well as lower.At the rear side illumination the efficiency of the cell decreased with the increase of CIGS thickness absorber layer. This was because the light is absorbed far from the junction and near the high recombination back contact region. So that the generated electron-hole pairs are recombined before they reach the junction to separate. The losses in the generated electron-hole pairs increase as the thickness of the CIGS absorber layer increase and this is clearly shown in the variation of the quantum efficiency with the absorber thickness at the rear side illumination. Combining two transparent contacts, achieved efficiencies of 14.8% and 12.2% were obtained with illumination from the front and the back contact, respectively.

Thin Films in Photovoltaic Cells and Energy

PB111

A Detailed Investigation of Equivalent Circuits for Thin Film CdTe/CdS Solar Cells by Impedance Spectroscopy

Sadan OZDEN[1], Adem DONMEZ[1], Cagdas KOCAK[1], Yasemin ALTINAY[1], Habibe BAYHAN[1], Murat BAYHAN[1], Jonathan MAJOR[2] and Ken DUROSE[2]

[1]*Mugla Sıtkı Kocman Üniversity,, Physics Department, Mugla, Turkey*
[2]*University of Liverpool, Stephenson Renewable Energy Institute, Liverpool, U.K*

E-mail of Corresponding Author: sozden@mu.edu.tr

CdTe/CdS solar cells are one of the most promising candidates for large scale, low cost and high efficiency thin film photovoltaic applications. Although there are many publications on the electrical properties of CdS/CdTe solar cells, limited study has been reported particularly on the ac electrical response measured by using the impedance spectroscopy (IS) technique. In this study, IS technique has been applied on CdTe/CdS solar cells which are post deposition processed with CdCl_{2} and annealed at different durations in air. A generalized impedance model including the separate contributions from different layers of the solar cell was developed and applied to a series of samples. It has been recognized that the capacitance elements representing of both CdS/CdTe junction and the Schottky junction formed at the back Au/CdTe contact should be denoted in terms of a constant phase element (CPE) to indicate the effects of spatial in homogeneities and trapping states.

Thin Films in Photovoltaic Cells and Energy

PB112

Relationship between Morphology and Surface Treatments of Flexible Materials: Wettability, FTIR Spectroscopy, AFM Investigations

L. Guedri-Knani[1,2], M. Khelifa [1,2], M. Sahraoui[1], C. Dridi [1,2] and N. Yaakoubi[3]

[1]*Université de Monastir, Faculty of Sciences of Monastir, LIMA, Tunisia*
[2]*Université de Sousse, ISSAT de Sousse, 4003Ibn Khaldoun Sousse, Tunisia*
[3]*Université du Maine, ENSIM, Laboratoire d'Acoustique de l'UM, Le Mans, France*

Email of corresponding author: lamia_guedri@yahoo.fr

Because of the new design and applications of large area flexible electronics different commercial flexible materials have been developed such as metal foils, plastic or polymeric films and flexible glasses. In this work, in order to characterize the adhesion properties of such flexible materials to suitable coating layers contact angle measurements have been achieved and surface energies have been calculated for different surface preparation. Different flexible substrates (flexible glasses (commercial soda-lime), polymers: kapton, PEN, PET and metal foil: flexible copper) with different preparation protocols using ultrasonication and organic solvents have been studied. Surface substrate films have been investigated before and after various cleaning treatments. Moreover, these pre-cleaned surfaces have been investigated by FTIR spectroscopy and atomic force microscopy (AFM). The results show that the vibration bands intensity change under different chemical ultrasonic cleaning. Surface of the flexible films are analyzed by atomic force microscopy (AFM) technique to correlate the surface nanostructuration to type and duration of chemical treatments. Thanks to this work it has been possible to show that we can optimize surface properties of flexible substrates with a low coast approach.

Key words: flexible materials, wettability, FTIR spectroscopy, AFM.

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Thin Films in Photovoltaic Cells and Energy

PB113

Dye Sensitized Solar Cells Using Star Shaped Triphenylene Diamine Material Comprising Anchoring Group

Sule Erten Ela

Ege University Solar Energy Institute 35100 Bornova, Izmir, Turkey

Email of corresponding author: suleerten@yahoo.com

The first solar cell based on a nanoporous TiO_2 layer with an iodine-iodide electrolyte was realized by O'Regan and Graetzel in the 1990s [1]. The dye-sensitized solar cell is a non-conventional solar technology that has attracted much attention owing to its stability, low cost and device efficiency. Power-conversion efficiencies of over 11 % have been achieved for devices that contain liquid electrolytes [2-4].

We present the synthesis, electrochemical properties and device-based investigation of organic sensitizer with an extended π system consisting of donor, electron conducting and anchoring group for dye-sensitized solar cells. Dye sensitized solar cells based on star shaped triphenylene diamine material using nanoporous TiO_2 electrode. Photoelectrodes with a 7 µm thick nanoporous layer and a 5 µm thick light-scattering layer were used to fabricate dye sensitized solar cells. DSSCs were fabricated in a FTO/nc-TiO_2/organic dye/I-/I3-/Pt/FTO device geometry. Dye sensitized solar cell was characterized by current density-voltage (J-V) measurement. All current voltage (I-V) measurements were done under 100 mW/cm^2 light intensity and AM 1.5 conditions.

Keywords: dye-sentisized solar cells (DSSCs), triphenylene diamine dye

References

[1] B. O'Regan, M. Grätzel , A low-cost, high-efficiency solar cell based on dye-sensitized colloidal TiO2 films , Nature 353 (1991) 737.

[2] J. Hagen, W. Schaffrath, P. Otschik, R. Fink, A. Bacher, H.-W. Schmidt and D. Haarer, Novel hybrid solar cells consisting of inorganic nanoparticles and an organic hole transport material , Synth. Met. 89 (1997) 220.

[3] M. Thelakkat, J. Hagen, D. Haarer and H.-W. Schmidt, Poly(triarylamine)s- synthesis and application in electroluminescent devices and photovoltaics , Synth. Met. 102 (1999) 1125.

[4] a) S. Erten-Ela, A. C. Cakir, Dye Sensitized Solar Cells for Conversion of Solar Energy into Electricity, (2011), Energy Sources, Part A, in press .

b) S. Erten-Ela, G. Turkmen, Perylene imide dyes for solid-state dye-sensitized solar cells: Spectroscopy, energy levels and photovoltaic performance, Renewable Energy, 36 (2011) 1821.

Thin Films in Photovoltaic Cells and Energy

PB114

TIO_2 Layers As Antireflection Coating For Crystalline P-N Junction Silicon Based Thin Film Solar Cells

Özgün Boray Yurdakoş [1,2], Salih Alper Akalın [1,2], Selçuk Kılınç[3], Mustafa Erol [2,4] and Erdal Çelik [1,2,4]

[1] Dokuz Eylul University, Dept. of Nanoscience and Nanoengineering, Buca, Izmir, 35160, Turkey
[2] Dokuz Eylul University, Center for Production and Applications of Electronic Materials (EMUM), Buca, Izmir, 35160, Turkey
[3] Dokuz Eylul University, Dept. of Electric and Electronic, Buca, Izmir, 35160, Turkey
[4] Dokuz Eylul University, Dept. of Metallurgical and Materials Engineering, Buca, Izmir, 35160, Turkey

Email of corresponding author: ozgunborayyuyrdakos@hotmail.com

This work has focused on the comparison of the properties of monocyristalline silicon solar cells which depended on the kind of following antireflective layers: TiO_2 (sol gel) b: TiO_2 (magnetron sputtering) and Al_2O_3-TiO_2 (magnetron sputtering). These three different coatings of TiO_2 were compared according to their results such as reflactance and I-V characterisation. The TiO_2 thin-film deposition process has to be adjusted carefully to realize a transparent and sufficently conductive film for the solar cells. Reflative index and thickness of the film affect the the final features of the antirefletive coating. Optimisiation of these parameters and the experimental verification lead to the minimalisation of the reflection coefficient that decide about the quality of the antireflective layer.
Key words: Antireflective coating (ARC), deposition process, I-V characterisation

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Topological Insulator Based Photonic Crystal and Efficiency of Solar Thermo-Photovoltaic Integrated Structure: FDTD Calculation

Filiz Karaomerlioglu[1], Amirullah M. Mamedov[2] and Ekmel Ozbay[2]

[1]*Mersin University Department of Electrical and Electronics Engineering, Turkey*
[2]*Nanotechnology Research Center, Bilkent University, Ankara, Turkey*

Email of corresponding author: filizkrm@gmail.com

We simulated a novel type of the solar thermo-photovoltaic integrated structure on a topological insulator base photonic crystal. We calculated efficiency of solar thermo-photovoltaic integrated structure by using the finite-difference time-domain method. Organic semiconductor has been used as photonic crystals and topological insulator as a substrate for solar thermo-photovoltaic integrated structure. The photonic crystals hold a great potential in order to design new optical devices because of the possibility of manipulation light with the photonic crystals. The photonic crystal gratings are an effective approach to light trapping in solar cells. There has been an increase in research on tuning the optical properties of the photonic crystals to design devices.

Thin Films in Photovoltaic Cells and Energy

PB116

Admittance Spectroscopic Estimation of the Interfacial Traps In Non-ideal Heterojunctions

Murat Bayhan, Bülent KOCAKIR, Habibe BAYHAN, Emre KARAMAN, Adem DÖNMEZ, and Şadan ÖZDEN

Muğla Sıtkı Koçman University, Faculty of Science, Physics Department, 48170, Kötekli, Muğla, Turkey

Email of corresponding author: mbayhan@mu.edu.tr

The basic objective of the work is to investigate in detail the dynamics of charge transport in the presence of localized energy levels associated with the presence of impurities and the defects (i.e., trapping centers) may promote e/h recombination by either capturing or emitting electrons thus reducing excess carrier life time by utilizing the admittance spectroscopy. The frequency dependent effects of self-induced of voltages and the electrostatic charge storage which forms the imaginary part of complex admittance whilst conductance assembles the real part are well analyzed in the scope of equivalent circuit modeling via RC methodology.

The plots of Im(C) vs Reel(C) as a variation of Rp1 displayed vertical spurs whose reel component increases as Rp1 increases with a distinct gaps and is observed to be decreasing as the Cp1 lowers in magnitude. On the other hand, absolute value of C has kept almost zero over the frequency range 10^9-10^2 rad/s followed by a sharp increase with a negative slope. This was moving en route for lower frequency regime as Rp1 increases.

Moreover, the variation of loss angle as a function of frequency exhibits in general two main aspects: Two distinct extremes corresponding to a region of G(w) proportional to w^2 followed by a saturated value of conductance, were noticeable and secondly a sharp fall-off with increasing w to zero due mainly to dc component. All the characteristics converged virtually to a single one (Rp1-free) thereafter. It was also observed that it has kept to moving on the way to lower frequency regime.

Thin Films in Photovoltaic Cells and Energy

PB117

Bragg Mirrors Porous Silicon For the Light Trapping in Hydrogenated Amorphous Silicon

Seba Hadj Yahia1, Toufik HADJERSI2 and Nacera ZEBBAR3

[1]*SEBA University of Sciences and Technology Houari Boumediene, USTHB Laboratoire de physique des matériaux, équipe couches minces et semi-conducteurs.Faculté de physique, BP. 32, EL ALIA 16111 Bab Ezzouar, Algiers ALGERIA*
[2]*Centre de recherche de la Technologie du Silicium pour l'énergétique CRTSE 02, Bd Frantz Fanon, Algiers, ALGERIA*
[3]*Laboratoire de physique des matériaux, équipe couches minces et semi-conducteurs, Faculté de physique, Algiers, ALGERIA*

Email of corresponding author: hseba@usthb.dz

In this communication we report on the photosensitivity of the electrical properties of a structure based on a thin film of hydrogenated amorphous silicon (a-Si:H) deposited onto a multilayer porous silicon (Bragg mirrors) formed in crystalline silicon (c-Si). We present the results obtained from dark and under illumination I-V characteristics of Al/a-Si:H/PSi/c-Si structure. The aim of this study is to evaluate the influence of Bragg mirrors porous silicon at back-side on the electrical photosensitivity. In this purpose, samples of multilayer silicon have been formed in crystalline silicon by electrochemical etching method. The morphology and optical properties of these samples have investigated by scanning electron microscopy (SEM), gravimetric and reflectivity measurements. The a-Si:H thin films were deposited by the DC magnetron sputtering technique in a mixture of argon and hydrogen atmosphere. These films were characterized by FTIR spectroscopy and optical transmission. The I-V results obtained from dark show a decrease in current of Al/a-Si:H/PSi/c-Si structure compared with Al/a-Si:H /c-Si structure while there is enhancement of the photocurrent in the structure with Bragg mirrors back side reflector. This result attests that the Bragg mirrors formed on crystalline silicon play an important role in the light trapping.
Keywords: light tapping, hydrogenated amorphous silicon, Bragg mirrors, back reflector, photosensitivity.

Thin Films in Photovoltaic Cells and Energy

PB118

Impact of CdS Annealing Atmosphere on the Characteristics of CdS/CdTe Solar Cell

NataliaMaticiuc, Nicolae Spalatu, Valdek Mikli and Jaan Hiie

Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, Estonia

Email of corresponding author: nataliamaticiuc@yahoo.com

CdS thin films obtained by chemical bath deposition and annealed in the hydrogen, nitrogen and air ambient were combined with CdTe absorbers obtained by close spaced sublimation. CdS/CdTe solar cells in superstrate and substrate configurations were characterized by current-voltage and quantum efficiency measurements while the analysis of annealed CdS films was made by scanning electron microscopy, atom force microscopy, X-ray diffraction, UV-VIS spectroscopy and electrical measurements. Annealing in H_2 removes oxygen compounds from the CdS grain boundaries and opens them for formation of shortcutting through the CdS layer. The processing in air is most advantageous due to simultaneous presence of chloride and oxygen, contributing to the recrystallization and sintering of the highly textured columnar CBD CdS. Optimization results of chloride concentration and oxygen partial pressure will be presented. It was found also that in the superstrate configuration the gas emission from CdS film at high temperature deposition of the absorber contribute to the delamination of layers. The processes behind these gas emissions are presented. The direct influence of the CdS annealing on the solar cell parameters is presented for CdS/CdTe solar cell in substrate configuration.

Thin Films in Photovoltaic Cells and Energy

PB119

Efficiency Improvement of Superstrate CIGS Solar Cells with Enhanced Carriers Collection

Idris Bouchama [1,2] , Kamal Djessas [3,4], Abdessalam Bouloufa [2] and Ammar Messous [2]

[1] *Département d'Electronique, Faculté de Technologie, Université de Msila, Algérie.*
[2] *Laboratoire d'Electrochimie et Matériaux, Université de Sétif-1, Algérie.*
[3] *Laboratoire Procédés Matériaux et Energie Solaire PROMES-CNRS, Rambla de la Thermodynamique, Technosud, 66100 Perpignan, France.*
[4] *Université de Perpignan Via Domitia, 52 avenue Paul Alduy, 68860, Perpignan Cedex9, France.*

Email of corresponding author: bouchama.idris@yahoo.fr

In this work, one-dimensional device simulator AMPS-1D (Analysis of Microelectronic and Photonic Structures) was employed to study the performances of superstrate SLG/TCO/Cu(In,Ga)Se_2 (CIGS)/OVC/In_2Se_3/Metal thin film solar cells and the impacts of the interfaces n-In_2Se_3/ Metal and TCO/p-CIGS on the structure. The simulation has been carried out by lighting through TCO front contact layer. The combination of optical transparency and electrical conductivity for TCO front contact layer is capable of yielding high efficiency. Several transparent conducting oxides (TCOs) materials and metals have been tested respectively as a front and back contacts for superstrate CIGS-based solar cells. The presence of barriers in the front and back contact in the structure can significantly affect the cell performance by limiting the carriers current flow. The influence of various parameters for the front and the back contacts was studied and the corresponding design optimization was provided. The depletion region overlapping between the TCO/CIGS and In_2Se_3/Metal junctions will result in the decrease of the solar cell performance. The In_2Se_3/Metal Schottky contact can be utilized as the back reflector in the buffer layer. The best energy conversion efficiencies have been obtained with SnO_2:F contacts. An efficiency of 19.3% (with Voc ≈ 0.78 V, Jsc ≈ 33.5 mA/cm^2 and FF ≈ 0.82) has been achieved with SnO_2:F-based as TCO front contact layer and Zn-based back contact layer. All these simulation results give some important indication to lead to higher efficiency of superstrate CIGS solar cells for feasible fabrication.

Key words: Superstrate solar cells, Cu(In,Ga)Se_2, Thin films, AMPS-1D.

Thin Films in Photovoltaic Cells and Energy

PB120

Chemical Bath Deposition of In_2S_3 thin films

Stanislav Tulenin

Ural Institute of State Fire Service of EMERCOM of Russia Department of chemistry and burning processes, Russia

Email of corresponding author: mln@ural.ru

1. Introduction

The solar energy is power field of non-traditional energy nowadays. Solar calls possess more and more high transformation coefficient of solar energy. It is more then 21 %. But the material of this cells is main problem. We needs effective, safety to environment and inexpensive material which is cupper indium disulfide.

$CuInS_2$ have obtain by means of chemical vapor deposition, spray pyrolysis, magnetron deposition, molecular beam epitaxy. But the chemical bath deposition is another promising method. It is fast, low temperature, no vacuum, inexpensive method. Also we well know that $CuInS_2$ as well as $CuInSe_2$ or In_2S_3 are very difficult compound to preparation.

This method allow obtain two different thin films In_2S_3 and Cu_2S or InS and CuS us that together will give cupper indium disulfide.

We described preparation and research of In_2S_3 thin films in this abstract.

2. Experiment

The indium precursor in the solution that gave indium-ions was indium chloride $InCl_3$ (1M). The tartaric acid (1M) was used for complexation indium-ion which inhibited reaction of sulfide formation. A precursor of sulfide-ions was 1M tioacetamide (TAA) that is unstable in a solution. A solution contained all components was than mixed and thermostated at 80 ºC in Mo-glass beaker.

After two hours' deposition uniform orange films with good adherent were observed on sitall substrates and walls of beakers. Thin films were washed and dried. Thickness of obtained thin films was nearly 1500 nm.

The composition of thin films was investigated by X-ray photo-electron spectroscopy (XPS), in which an MgKα line at 1253.6 eV was used with X-ray source run at 14.5 V. The calibration line was used C1s-line of carbon at 284.5 eV.

3. Results and discussion

peak also is accurate and good define. However it include two components. First component have high bonding energy that correspond to sulfate phases (162.05 eV). The low bonding energy (161.4 eV) interquartily correspond to sulfide phases because we have not any literature date about this.

The α-parameter gave us more information about compound. This value is 852.22 eV but it is some more literature date for In_2S_3.

We obtained by means of XPS that composition of prepared thin films meet to In_2S_3. The surface of thin films include some oxidation phases (in films no more 8.5 at.% of oxygen) for example different sulfates, carbonates and same other organic impurities.

PB121

ZnO Thin Film as an Anti-Reflection Coating for β –$FeSi_2$ on Textured Silicon Substrate for Solar Cells Applications

Sali Samira

Research Center for Semiconductor Technology for Energy Division: DDCS, Algeria

Email of corresponding author: samira_sali@yahoo.fr

A ZnO thin film was successfully synthesized on glass, textured silicon and β-$FeSi_2/S_i$ substrates by chemical spray deposition. The textured silicon substrate was carried out using Na_2CO_3 solution. The sample surface exhibits uniform pyramids with an average height of 5 µm. β-$FeSi_2$ is expected to be a potential constituent in Si-compatible optoelectronic and photovoltaic devices. Of great importance for estimating the prospects of β –$FeSi_2$ as device material is the knowledge of its optical properties, especially the value and nature of band gap (0,87 eV) make this material very useful for solar cells applications. In this paper, particular attention is given to the β-$FeSi_2$ films prepared by RF sputtering system at low pressure. The properties of films as a function of different parameters (power, thickness and annealing) were investigated using SEM morphology and optical transmission analysis. Due to its high refractive index (›5.6), however, suitable antireflection coating (ARC) is necessary. In this paper ZnO is used as an anti- reflection coating due to its good transparency and appropriate refractive index (2.1). The transmittance of ZnO films was found higher than85%. The average reflectance of the β-$FeSi_2$ surface was found to be around 30%. Used textured silicon substrate it decreases up to 8, 23 %; after deposition of a ZnO antireflection coating the average reflectance decreases dramatically to 3,24 %.

Key words
β-$FeSi_2$; ZnO, textured silicon, Sputtering; Spray, antireflection coating.

Thin Films in Photovoltaic Cells and Energy

PB122

Characterization of $CuInTe_2$ Thin Films Synthesized by Co-Electrodeposition Process

Assia Bouraiou[1], Omar Meglali[2], Nadhir Attaf[3] and Mohamed Salah Aida [3]

[1]*Université de Ziane Achour Sciences de la matière, Algeria*
[2]*Faculté des sciences, Université M'sila, Algeria*
[3]*Département de Physique, Université de Constantine 1, Algeria*

Email of corresponding author: a_bouraiou@yahoo.fr

$CuInTe_2$ is a direct band gap semiconductor (E_g=0.96-1.06 eV)[1-2] and has large absorption coefficient near the fundamental energy gap (104-105cm^{-1}), it can thus be used as an absorber layer in heterojunction or multi-junction devices with other I-III-VI2 semiconductors and it can be prepared as both p and n types conduction [3]. $CuInTe_2$ films have been grown using several techniques, including flash evaporation [4], electrodeposition [5-7], pulse laser deposition [8], etc. Electrodeposition as a method for $CuInTe_2$ thin film preparation has many advantages over other physical and chemical deposition techniques; it is easy to carry out, low cost, safe and after annealing of as deposited films permits to obtain the $CuInTe_2$ single phase. These advantages are highly desired in the research into fabrication of thin films.

Polycrystalline $CuInTe_2$ films were grown onto ITO substrate by one-step electrodeposition technique from acidic aqueous solutions. The influence of the deposition time on the properties of the thin films was examined using x-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive x-ray analysis (EDAX), optical transmittance, Raman spectroscopy and electrical properties measurements. The XRD investigation proved that, the films deposited during 5 and 10 min exhibits only the $CuInTe_2$ chalcopyrite structure. However, the films deposited at 15 and 20 min exhibits the $CuInTe_2$ chalcopyrite structure as the major phase with $In4Te_3$ as additional binary compounds. The preferential orientation is along the (112) direction for all films. The elaborated films show the direct allowed band gap and their energy band gap varied within 1.06-0.99 eV. Hall effect measurements show that the deposition time change the conductivity type and carrier concentration of films. The observed Raman modes in the films deposited during 5 and 10 min match well with those reported for single crystal $CuInTe_2$, confirming the crystalline quality of these films.

[1] W. Horig, H. Neumann, V. Savelev, V. Lagzdonis, B.Schuhmann and G. Kiihn, Cryst. Res. Technol. 24 (1989) 823.
[2] M.J. Thwaites, R.D. Tomlinson and M.J. Hampshire, Phys. Status Solidi (b) 94 (1979) 211.
[3]T. Ishizaki, N. Saito, Fuwa, Surface and Coatings Technology 182 (2004)156-160.
[4] M.R.Ananthan, S.Kasiviswanaathan, Solar Energy Mater. Sol. Cells 93(2009)188-192.
[5] T. Ishizaki, N. Saito, Fuwa, Surface and Coatings Technology 182 (2004)156-160.
[6] C.D. Lokhande, S.H. Pawar, J. Phys. D: Appl. Phys. 20 (1987) 1213-1214.
[7] G.E.A. Muftah, A.P.Samantilleke, P.D. Warren, S.N. Heavens, I.M. Dharmadasa, J. Mater. Sci: Mater Electron 21 (2010) 373-379.
[8] V.F Gremenok, I.A. Victorov, I.V. Boudnar, A.E. Hill, R.D.Pikington, R.D. Tomlinson, et al., Materials Letters 35 (1998) 130-134.

PB123

Annealing Temperature Effect on $CuInSe_2$ Properties Prepared by Electrodeposition

Fatma Zohra Mechrouh[1], Ahmed Mamdouh Younsi[2] and Assia Bouraiou[2]

[1]*Université de Ziane Achour Sciences de la matière, Algeria*
[2]*Faculté des sciences et technologie, Université de Ziane Achour, Djelfa, Algeria*

Email of corresponding author: mechrouhmaria@yahoo.fr

Chalcopyrite $CuInSe_2$ is considered one of the most important semiconductors that can be used to make low-cost photovoltaic devices. It has high absorption coefficient [1,2], reasonable work function, suitable band gap, and it can be prepared from this material the homojunction or heterojunction [3].

Various technique such as close-spaced vapour transport (CSVT) [4], R.F. sputtering [5], co-evaporation [6], spray [7], electrodeposition [8], chemical bath deposition [9] etc. have been adopted for the growth of $CuInSe_2$ films.

In this work, polycrystalline chalcopyrite $CuInSe_2$ (CIS) thin films were deposited by electrodeposition technique onto ITO coated glass substrates. The used bath solution is formed by dissolution of $CuCl_2$, $InCl_3$, and SeO_2 salts in de-ionized water. The as-deposited films were annealed under vacuum for 30 min at temperature ranging between 200˚C and 400˚C. The structural, optical band gap and electrical resistivity of elaborated thin films were studied, respectively using x-ray diffraction, UV spectrophotometer and Hall effect method. The lattice constant and structural parameters of the films were calculated. After vacuum annealing, x-ray diffraction results revealed that all films were polycrystalline in nature and exhibit chalcopyrite structure with (112) as preferred orientation. The crystallite size increases with annealing temperature, reaching a minimum value for 250˚C. We have also found that the electrical resistivity of films is controlled by annealing temperature rather than by their mobility.

[1] Kavcar N., Carter M. J., Hill R. (1992) Sol. Energy Mat. Sol. Cells 27, 13.
[2] C.J. Huang, T.H. Meen, M.Y. Lai, W.R. Chen, Sol. Energy Mater. Sol. Cells 82 (2004) 553.
[3] H. Sakata, H. Ogawa, Sol. Energy Mater. Sol. Cells 63 (2000) 259.
[4] Zouaoui A., Lachab M., Hidalgo M.L., Chaffa A., Llinares C., Kesri N. (1999) Thin Solid Films 339, 10.
[5] Parretta A., Addonizio M.L., Agati A., Pellegrino M., Quercia L., Cardellini F., Kessler J., Schock H.W. (1993) Jpn. J. Appl. Phys. 32, 80.
[6] Moharram A.H., Hafiz M.M., Salem A. (2001) Appl. Surf. Sci. 172, 61.
[7] Tembhurkar Y. D., Hirde J. P. (1994) Bulletin Mate. Sci.17, 465.
[8] Fahoume M., Chraibi F., Aggour M., Ennaoui A. (1998) Ann. Chim. Sci. Mater. 23,373.
[9] Murali K.R. (1988) Thin Solid Films 167, 19.

Thin Films in Photovoltaic Cells and Energy

PB124

Optical and Structural Properties Thin Films of SiC: Effect of Annealing

S. Merazga[1,2,3], A. Keffous[1],A.Brighet[2] , K. Mirouh[3], M.SIAD[4] and M. Kechouane[2]

[1]Centre de Recherche en Technologie des Semi-conducteurs pour l'Energétique 02 Bd Frantz Fanon, BP 140 Alger 7 merveilles, Alger, Algérie
[2]Faculté de Physique, Université des Sciences et de la Technologie Houari Boumediene, EL Alia BP 32, 16111, Alger, Algérie
[3]Euniversité Mentouri, Constantine
[4]Research Nuclear Center of Algiers

Email of corresponding author: merazgas@yahoo.fr, keffousa@yahoo.fr

A a-SiC thin films have been grown by magnetron sputtering process at DC power of 130 W followed by annealing under secondary vacuum in the range of 500,600,700,800°C in 1 houre . Structural characterization by FTIR and Raman analysis were performed. The Raman spectra have shown corresponding bands of SiC, Si and C for all the samples while FTIR characterization showed an increases of Si-C bonds intensity with the annealing temperature whereas the Si-H bonds decreases.
The optical properties of these films were analyzed by UV-Visible and ellipsometry. The variation of the optical gap and the thickness effected by the annealing was measured.

Thin Films in Photovoltaic Cells and Energy

PB125

Preparation and Characterization of Dye-sensitized TiO_2 Nanorod Solar Cells

Lijian Meng[1], Can Li[2] and M.P. dos Santos[3],

[1]*Instituo Superior de Engenharia do Porto/Instituto Politecnico do Porto Física Portugal*
[2]*State Key Laboratory of Catalysis, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, 457 Zhongshan Road, Dalian 116023,China.*
[3]*CeFITec, Universidade Nova de Lisboa/Departamento de Física, Universidade de Évora, Portugal*

Email of corresponding author: ljm@isep.ipp.pt

TiO_2 nanorods were prepared by dc reactive magnetron sputtering technique and applied to dye-sensitized titanium dioxide solar cells (DSSCs). The length of the TiO_2 nanorods is varied from 1 μm to 6 μm. The scanning electron microscopy images show that the nanorods are perpendicular to the substrate. Bothe the X-ray diffraction(XRD) patterns and Raman scattering results show that the nanorods have an anatase phase and no other phase has been observed. The (101) and the (220) diffraction peaks have been observed for the nanorods. The (101) diffraction peak intensity keeps constant with the nanorods length. However the intensity of the (220) diffraction peak is increased almost lineament with the increasing of the nanorods length. These nanorods are used as the working electrode in DSSCs and the effect of the nanorods length on the conversion efficiency has been studied. An optimum photoelectric conversion efficiency of 4,8% is achieved for 4 μm length nanorods.

Thin Films in Photovoltaic Cells and Energy

PB126

Plasmonic effect of Au NPs on CSS CdS/CdTe solar cell characteristics

Nicolae Spalatu[1], Natalia Maticiuc[1], Atanas Katerski[1], Malle Krunks[1], Valdek Mikli[1] and Jaan Hiie[1]

[1]*Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, Estonia*

Email of corresponding author: nickspalatu@gmail.com

Thin film photovoltaics currently is a topic of interest for the scientific community working in the field of solar cell technology. In order to improve light trapping of CdTe thin-film solar cells, a coupling with designed plasmonic nanostructures can be performed. The resulting increased absorption is believed to be a result of the enhanced electric field and forward-scattering upon excitation of the surface plasmon resonance (SPR), combined to favorable redistributions of light field in the device mediated by the CdTe layer.

The simulation results [1] suggest a technological feasibility of placing nanoparticles on the CdTe before back contacting. In [2] we studied incorporation of gold nanoparticles (Au NPs) into the CdTe thin films deposited by close spaced sublimation (CSS) and demonstrated applicability of chemical spray pyrolysis of $HAuCl_4$ ethanol solution and sputtering of metallic

Au for introduction of surface plasmon resonance on a CdTe thin film. The CdTe films show SPR effect and enhanced light absorption in the visible range of spectrum.

In this presentation we provide results of investigation of placing nanoparticles on the CdTe and then covering them by Te and Ni as back contacts to achieve enhanced efficiencies of the CdS/CdTe solar cells.

[1] Repän, T.; Pikker, S.; Dolgov, L.; Loot, A.; Hiie, J.; Krunks, M.; Sildos, I. (2014). Increased efficiency inside the CdTe solar cell absorber caused by plasmonic metal nanoparticles. Energy Procedia, 44, 229 - 233.

[2] Maticiuc, N.; Spalatu, N.; Katerski, A.; Hiie, J.; Mikli, V.; Krunks, M.; Dolgov, L.; Sildos, I. (2014). Incorporation of Plasmonic Au Nanoparticles inside the CdTe Thin Film Absorber. (To be published)

Thin Films in Photovoltaic Cells and Energy

PB127

Micro diffraction and Structural Characterization of Nanocrystalline $Cu_2ZnSnSe_4$ Thin Films: Identification Phase Formation Cu1.8Se

A. Dussan[1] and Heiddy P. Quiroz[1]

[1]*Universidad Nacional de Colombia, Department of Physics, Group Nano-Structured Materials, Cra. 30 No. 45-03 Lab. 121C, Ciudad Universitaria, Bogotá, Colombia*

Email of corresponding author: adussanc@unal.edu.co

This work presents a study the structural characterization and microdiffraction patterns of $Cu_2ZnSnSe_4$ (CZTSe) thin films by X-ray diffraction (XRD) and microdiffraction (XRMD) measurements. Samples were deposited varying both mass (MX) and substrate temperature (T_s) at which the Cu and ZnSe composites were evaporated. CZTSe samples were deposited by co-evaporation method in three stages. From X-ray diffraction (XRD) measurements, it was possible to establish, with increased T_s, the presence of binary phases associated to the quaternary composite during the material's growth process. From diffraction spectra were found crystalline structural, characteristic phases and sizes of the crystallites. A stannite-type structure in $Cu_2ZnSnSe_4$ thin films and sizes of the crystallites varying between 30 and 40 nm, were obtained. X-ray microdiffraction was used to investigate interface orientations and strain distributions when were varied deposition parameters. It was found that around the main peak, $2\Theta = 27.1°$, the $Cu_{1.8}Se$ and ZnSe binary phases predominate, which are formed during the subsequent material selenization stage. A Raman spectroscopy study revealed Raman shifts associated to the binary composites observed via XRD. Identification of the $Cu_{1.8}Se$ and ZnSe binary phases are reported as part of the CZTSe stannite structure.

Thin Films in Photovoltaic Cells and Energy

PB128

Controlling morphology, geometry, ordering, and crystalline structure of TiO_2 nanotube arrays by anodic oxidation

Farzad Nasirpouri, Naeimeh-Sadat Peighambardoust and Iman Yousefi

Faculty of Materials Engineering, Sahand University of Technology, Tabriz, Iran

Email of corresponding author: nasirpouri@sut.ac.ir

Titanium oxide (TiO_2) is particularly important due to its unique functional physical and chemical properties including high oxidative power, photocatalytic nature, photostability, and nontoxicity. Nanotubular form of TiO_2 has attracted much attention because of enhanced electron transport properties, flexibility of fabrication and tremendous applications such as dye-sensitized solar cells. Among various techniques for synthesis of nanotubes, anodic oxidation or anodization of Ti is a simple and low-cost method leading to self-organized nanotube arrays.
In this paper, the effect of controlling parameters of the anodic oxidation process including surface preparation, anodizing temperature and voltage, repetition of anodization on the surface morphology and nanotube geometry, i.e. pore wall thickness, pore diameter and tube length of titanium oxide and resulting crystalline structures was investigated. It is mentioned that the fabrication of highly ordered TiO_2 nanotube arrays using electropolishing and two-step anodic oxidation enhances the pore/tube ordering defined as ordered pore domians and consequently a linear growth rate of the ordered domian size is observed. The current-time curves showed that increasing of anodization voltage results in larger dielectric breakdown due to the larger electric field in the electrolyte and thereofore tube geometry significantly changes. Anodizing temperature also plays an extremely important role in the tube geometry as a lower the temperatures gives rise to smaller pore diameters with blocked pore openings. The mechanism of formation of an irregular porous layer that blocks the pore openings at low temperatures is exploited by a limited ionic mass transport assumption. This report brings to attention the desirable properties of the structurally oriented TiO_2 for dye-sensitized solar cell applications [1].

[1] N.-S. Peighambardoust, F. Nasirpouri / Surface & Coatings Technology 235 (2013) 727–734

Thin Films in Photovoltaic Cells and Energy

PB129

PYROSOL DEPOSITED AL-DOPED ZNO THIN FILMS FOR C-SI SOLAR CELLS

Alla Chebotareva[1], G.G.Untila[1], T.N. Kost[1] and A.S. Stepanov[1]

[1]*Lomonosov Moscow State University, SINP, Russia*

E-mail of Corresponding Author: GUntila@mics.msu.su

Transparent and conductive Al-doped ZnO (AZO) thin films were deposited by ultrasonic spray pyrolysis of film-forming solutions (FFS) on silicon and glass. The effect of Al concentration in the FFS in the range Al/Zn = 0-15 at% was systematically investigated to obtain AZO films suitable for application in c-Si solar cells. The goal of this work was develop transparent electrode for based on the AZO thin films, synthesized by ultrasonic spray pyrolysis (pyrosol) method. The pyrosol technique is a cost-effective improved version of spray pyrolysis. The main attention was focused on investigation of the morphological, electrical, optical, barrier, and passivating properties of the AZO films deposited on silicon substrates as well as on glass depending on the Al/Zn ratio in the FFS.

AZO thin films were prepared from FFS consisting of 0.19 M $Zn(CH_3COO)_2{\cdot}2H_2O$ + 0.01 M $ZnCl_2$ + X M $Al(C_5H_7O_2)_3$ + 2.6 M H_2O + 0.5 M CH_3COOH in methanol. The ratio between the Al and Zn atomic contents in the FFS was varied in the range of [Al]/[Zn] = 1–15 at%. AZO films were deposited on glass as well as onto (nn+)Cz-Si, (pp+)Cz-Si and (p+nn+)Cz-Si structures (with the thickness t = ~85 nm and ~225 nm). To compare optical losses in different AZO films, the effective absorption (Aeff) weighted over the distribution of photons in the solar radiation spectrum in the range of wavelengths 400–1100 nm in accordance with the standard ASTM G173-03 (AM 1.5G 1000W/m^2) was calculated for each AZO film on glass. The photovoltages Un, Up, and Uoc were measured, respectively, for AZO/(nn+)Cz-Si, AZO/(pp+)Cz-Si, and AZO/(p+nn+)Cz-Si structures.

For the first time, AZO films were synthesized and investigated by pyrosol method on a silicon substrate in order to further their use in crystalline silicon solar cells. It was found that from the point of view of a Si-based solar cell with diffusion layers, AZO films, synthesized by pyrosol method at a ratio of Al/Zn in the FFS ~3% in the best way combine (i) the best passivating properties; (ii) the smallest effective absorption of the sunlight; (iii) the best stability; and (iv) the smallest resistivity. Taking into account, that the value of Un for these films is more than two times greater than the Up value, they are more suitable for p+ surface of the (p+nn+)Cz-Si structure. "

Thin Films in Photovoltaic Cells and Energy

PB130

Thin Films of Inert Metal Nanowires for Electrochemical Applications

Ali Canlier, Duygu Tahaoglu[1], Mehmet Ozdemir[2], Unal Sen[1], Murat Citir[1] and Hakan Usta[1]

[1]*Abdullah Gül University, Depr. of Materials Science & Nanotechnology Eng., Turkey*
[2]*Meliksah University, ozdemir.mehmet@msn.com*

E-mail of Corresponding Author: ali.canlier@agu.edu.tr

Synthesis of long and thin nanowires of inert metals such as platinum and gold has been a challenge of nanomaterial researchers. In order to both exploit the surface chemistry of these metals as thin films and overcome the difficulty of synthesizing long and thin nanowires of those, we developed a multi-step solvothermal method to make inert metal/metal core/shell nanowires. Electrospraying the new metal nanowires with inert metal shell onto the desired substrate can yield a thin film of inert metal. these films can be used as an electrode for electrochemical applications as well as transparent electrode for display and solar cell applications. Ag/Au core/shell nanowires of ca. 13 micron long and 60 nm in diameter has been synthesized. Cu/Pt core/shell nanowires of ca. 20 micron long and 90 nm in diameter has been synthesized. Both works are still continuing for higher yields for large-scale production. Stability tests for use as electrodes in electrochemical cells and fuel cells are being carried out as well. Upcoming data will be presented later.

Thin Films in Photovoltaic Cells and Energy

PB131

Synthesis and characterization of Cu_2O/ZnO core-shell nanorod solar cell

Hsiang-Chen Wang[1], Hao-zhe Sun[1,2], Yi-Hong Lin[1,2], Cheng-Hsun Chu[1,2], Yung-Sheng Chen[1,2], Hsiang-Chen Wang[1,2], Che-Hao Liao[3], Li-Yin Chen[4], A. K. Chu[4], Raymond Chien-Chao Tsiang[1,5], and Chie-Tong Kuo[6]

[1]*National Chung Cheng University , Graduate Institute of Opto-Mechatronics, Taiwan*

E-mail of Corresponding Author: hcwang@ccu.edu.tw

This study demonstrated some nano-periodic structures p-Cu_2O/n-ZnO type heterojunction flexible solar cells. The first to generate the nano-structures on ITO / PET substrate by anodic aluminum oxide, nanoimprint and dual-beam interference techniques. Then the n-ZnO nanorod arrays / p-Cu_2O films were grown using hydrothermal method. The SEM, XRD, and TEM results show the analysis of the material properties of n-ZnO nanorod and p-Cu_2O films. We also use temperature dependence PL to measure their optical properties, and compare the differences between layers. Finally, the use of a sputtering Au electrodes were prepared to facilitate the completion of the production of solar cells. The I-V characteristics of solar cell devices were demonstrated for this step. This study prepared to find the best process parameters of p-Cu_2O/n-ZnO heterojunction solar cells and produce even higher than the current literature photoelectric conversion efficiency of 2%, respectively.

Thin Films in Photovoltaic Cells and Energy

PB132

GAS SENSING PROPERTIES OF THE ZnO FILMS

Mehmet Ertugrul[1], Demet Tatar[1], Zineb Benzaid[1]

[1]*Attaurk University, Electric&Electronics, Türkiye*

Email of corresponding author: ertugrul@atauni.edu.tr

Semiconducting metal oxides, such as SnO2, ZnO, and In2O3, are commonly employed in resistive gas sensors, exploiting the changes in the electrical conductivity or optical properties of these materials upon exposure to gaseous mixtures. Among these metal oxides, the utilization of ZnO in gas sensor applications has a long history; it was used in chemo-resistive sensors to detect several gases, such as H2, NH3, CH4, O2, ethanol and CO. The recent demonstration of gas sensors based on nanostructured metal oxides has further stimulated substantial efforts to explore novel ZnO nanostructures for high gas sensing performance. Nanostructured zinc oxides with different morphologies (such as nanoparticles, nanowires, nanorods) haves been extensively studied for gas sensor applications due to its favorable morphological, microstructural and electric properties.

In this study, the gas sensing properties of the ZnO films were investigated. ZnO films and nanostructures have been prepared by using spray pyrolysis and spray plasma techniques. Deposition temperature was 450oC. X-ray diffraction, Transmission Electron Microscopy and Scanning Electron Microscopy were used to study the microstructure and surface morphology of the films. The sensitivity of the films was studied in two steps: first of all as a function of their temperature for a fixed gas concentration and secondly as a function of concentration for a fixed temperature. All the films have shown faster response and recovery times at higher operating temperatures.

Thin Film Growth & Epitaxy

PB133

Structure, microstructure and magnetic properties of Ni75Fe25 films elaborated by evaporation from nanostructured powder

Amel KAIBI[1], A. Guittoum[2], R. Mustafa Öksüzoğlu[3], A.Murat Yağci[4], M.Boudissa[5] and M.Kechouane[6]

[1]*University of Science and Technology Houari Boumediene, USTHB physics, Algeria*
[2]*Nuclear Research Centre, Algeria*
[3]*University of Anadolu, Department of Materials Sciences and Engineering, İki Eylül Campus, Eskişehir,Turkey*
[4]*University of Anadolu, Faculty of Engineering, Eskişehir, Turkey*
[5]*ENMC laboratory,Physics department ,University of Sétif, Algeria*
[6]*Laboratory of Materials Physics,USTHB,Algeria,*

Email of corresponding author: kaibi_amel@yahoo.fr

We report on the structural, microstructural and magnetic properties of Ni75Fe25 permalloy (Py) thin films. Py thin films with different thicknesses were deposited by vacuum evaporation from nanocristalline powder onto Si (111) substrate. The thickness varies from 16 nm to 250 nm. From grazing X-ray diffraction spectra (GIXRD), we have shown the presence of a strong <200> texture for the lower thickness of 16 nm. For the intermediate thicknesses of 52 nm and 84 nm a strong <111> preferred orientation is developped. However, for the higher thicknesses, a polycristalline structure is present. The microstructure of Py films was investigated with atomic force microscopy (AFM). We have shown the existence of nanosized grains with a uniform distribution. The mean diameter of the grains increases from 27 nm to 40 nm when the thickness increases. The magnetization easy axis is found to be out of plane for the thinner sample. When the thickness increases, the direction of the magnetization seems to be situated between the perpendicular and parallel directions with respect to the plane of the film. We have found that the coercive filed, Hc//, decreases with increasing thickness with a minimum value of 1.96 Oe.

Nanostructured Growth

PB134

Influence of Al concentrations on the physical properties of transparent conducting Al-doped ZnO thin films

Savaş SÖNMEZOĞLU[1], Erdi AKMAN[1], Mahir GÜLEN[1], Seçkin AKIN[1], Aytaç GÜLTEKİN[2], Hüsnü Emrah ÜNALAN[3] and Raşit TURAN[4]

[1]*Department of Materials Science and Engineering, Karamanoğlu Mehmetbey University, Karaman, Turkey*
[2]*Department of Energy Systems Engineering, Karamanoğlu Mehmetbey University, Karaman, Turkey*
[3]*Department of Metallurgical and Materials Engineering, METU, Ankara, Turkey*
[4]*Center for Solar Energy Research and Application, and Department of Physics, METU, Ankara, Turkey*

Email of corresponding author: svssonmezoglu@kmu.edu.tr

Aluminum–doped zinc oxide (Al:ZnO, AZO) is a promising material for transparent conducting films used as a front contact layer on chalcopyrite CuInGaSe2 (CIGS)–based thin-film solar cells. In this report, pure ZnO and AZO films at various concentrations (1%, 3%, 5%, 7%, and 10%) were prepared via the sol-gel technique. Their microstructure and crystal growth were characterized as a function of doping concentration. The XRD analysis results revealed that the structural properties of the films possessed a hexagonal crystalline structure with a preferential orientation according to the direction (002) plane. Nanostructured particles have been observed from the surface analysis. The obtained films exhibit direct band gap transition with the band gap values lying in the range between 3.31 and 3.39 eV. The blue shift is observed in the absorption edge as the Al concentrations increased. Furthermore, the AZO films indicate a high transparency in the visible region with an average value of above 80%. The obtained results reveal that Al-3wt.% is the optimum concentration to achieve the best crystallization quality, minimum film resistivity (approximately 5×10-5 Ω.cm), and strong ultraviolet emission. These transparent and conductive AZO films may open a new avenue for optoelectronic and photonic device applications in the near future.

Keywords: Transparent conducting oxides, Aluminum–doped zinc oxide, Sol-gel technique.

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Thin Films in Photovoltaic Cells and Energy

PB135

Influence of Substrate Temperature on the Structural, Optical and Morphological Properties of RF-Sputtered AZO Thin Films-Based UV Sensors

Nihan Akın[1], Buse Cömert[1], Meltem Dönmez[1], Halil İbrahim Efkere[1], Mehmet Çakmak[1] and Süleyman Özçelik[1]

[1]*Gazi University, Physics, Türkiye*

Email of corresponding author: nihanakinn@gmail.com

200 and 300 nm thick Al-doped zinc oxide (AZO) thin films were deposited onto n-type silicon (n-Si) and glass substrates by radio frequency (RF) magnetron sputtering method at 100 oC, 200 oC and 300 oC. Structural, optical and morphological properties of the films were investigated by high-resolution x-ray diffractometer (HRXRD), UV–Vis spectrometer and atomic force microscope (AFM), as a function of the substrate temperature. All the obtained films had a highly preferred orientation along [002] direction of the c-axis perpendicular to the substrates and extremely flat and uniform surfaces at nanoscale. The optical band gap of the films varied in the range of 3.37 - 3.51 eV. The RF-sputtered AZO thin films-based sensor structures were developed on the samples which have the highest band gap. Current-voltage (I-V) analysis of the sensors were investigated to understand the UV sensing. It is clear from the analysis that the developed sensors are photo-conductive type and sensitive in the UV region of the electromagnetic spectrum.

Thin Film Growth & Epitaxy

PB136

Fabrication and Characterization of Ferromagnetic-Superconducting Hybrid Films

Erhan Ongun[1], M.Kuru[1], E.Yazıcı[1] and A.E.Ozmetin[1]

[1]*Meliksah University, Materials Science and Mechanical Engineering, Turkey*

E-mail of Corresponding Author: eongun@meliksah.edu.tr

In the science and applications of thin-films, the magnetism and superconductivity are known to be great examples of mutually exclusive states. As reported [1-3], hybrid films combining these two exclusive states at microscale exhibit exotic superconducting characteristics.

This study reports on a microfabricated-magnet and superconductor (Permalloy/$Pb_{82}Bi_{18}$) hybrid film structures which were sequentially grown by sputtering and thermal vapor deposition techniques. Superconducting and normal conducting current paths were formed parallel and perpendicular to the magnetic stripes, providing directional dependency on the current flow.

By changing the orientation of the magnetic stripes with respect to the superconducting film, the exclusive transport characteristics of the hybrid film structure were investigated. The structural properties were observed and analysed using the SEM and XRD techniques.

Keywords: Magnet-Superconductor Hybrid Film-Structures, Superconductivity, combined-PVD techniques, low-temperature DC resistivity measurement.

References

[1] A. E. Ozmetin, M. K. Yapici, J. Zou, I. F. Lyuksyutov, and D. G. Naugle, “Micro-magnet superconducting hybrid structures with directional current dependence for persistent current switching” Applied Physics Letters 95, 022506 (2009).
[2] A. E. Ozmetin, E. Yazici, K. Kim, K. D. D. Rathnayaka, I. F. Lyuksyutov and D. G. Naugle, “Hysteresis of the Phase Diagram in the Ferromagnet-Superconductor Hybrids"" Int. J. Mod. Phys. B Vol. 27, Iss. 15 (2013).
[3] A. E. Ozmetin “A Method for Simulating the Superconducting Properties in Ferromagnetic – Superconducting Hybrid Systems"" ACES, The 29th International Review of Progress in Applied Computational Electromagnetics, Monterey, CA, USA. Volume: Modeling and Simulation in Electromagnetic Engineering, Year: 2013.

Superconducting Thin Films

PB137

Fabrication and Characterization of MgB_2 Films Grown by RF Magnetron-Sputtering Technique

Erhan Ongun[1], M.Kuru[1], E.Yazıcı[1], A.E.Ozmetin[1] and O.Şahin[2]

[1]*Melikşah University Materials Science and Mechanical Engineering, Turkey*
[2]*Mustafa Kemal University, Micro/Nanomechanic Characterization Lab., Turkey*

Email of corresponding author: eongun@meliksah.edu.tr

MgB_2 is a new, simple, and binary superconductor having a record high T_c for a non-oxide compound [1]. High-quality thin films, Josephson Junctions [2], and circuits made of MgB_2 are of importance for future superconducting-electronic applications [3]. To date, several groups have reported on MgB_2 thin films made using various deposition techniques [4-7].
In this study, we report fabrication and characterization of MgB_2 films grown by RF magnetron sputtering technique. A home-made sputtering target, composed of a mixture of pure Mg and B powders, was used. As expected, the fabrication of high-quality MgB_2 films proved to be complicated because of large differences in vapour pressure between B and Mg, and Mg oxidizes easily. Several measures were implemented to avoid oxidation of Mg during deposition.
The transport properties of the MgB_2 films were investigated using low-temperature DC resistivity measurements. Structural and mechanical properties were investigated using the SEM, XRD, and nanoindentation techniques.

References

[1] J. Nagamatsu, N. Nakagawa, T. Muranaka, Y. Zenitani, and J. Akimitsu, "Superconductivity at 39 K in magnesium diboride," Nature, vol. 410, no. 6824, pp. 63–64, 2001.
[2] H.Shimakage, K.Tsujimoto, and Z.Wang, "All-MgB2 tunnel junctions with aluminum nitride barriers", Applied Physics Letters 86, 072512 (2005).
[3] A.Saito, A.Kawakami, H.Shimakage and Z.Wang, "As-grown MgB2 thin films deposited on Al2O3 substrates with different crystal planes", Supercond.Sci.Technology. 15:1325-1329 (2002).
[4] W. N. Kang, H. J. Kim, E. M. Choi, C. U. Jung, and S. I. Lee, "MgB2 superconducting thin films with a transition temperature of 39 K", Science, vol. 292, no. 5521, pp. 1521–1523, 2001.
[5] S. H. Moon, J. H. Yun, H. N. Lee et al., "High critical current densities in superconducting MgB2 thin films," Applied Physics Letters, vol. 79, no. 15, pp. 2429–2431, 2001.
[6] Rowell, "Magnesium diboride: superior thin films," NatureMaterials, vol. 1, no. 1, pp. 5–6, 2002.
[7] S.Fabretti, P.Thomas, M.Meinert, I.-M.Imort, A.Thomas, J. Supercond. and Novel Magn., 26:1879-1882 (2013).

Keywords: MgB2 thin-films and superconducting electronics, RF Magnetron Sputtering, low-temperature DC resistivity measurement, nanoindentation.

Superconducting Thin Films

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Testhermoelectric	Prof. Dr. Raşit Ahiska, Director	Research area is new generation thermoelectric systems.	info@testhermoelectric.com	http://testhermoelectric.com/
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