Nanotech MEET Tunisia 2014

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24 - 26 April 2014
Royal Hotel Hammamet, Tunisia

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Dr. Imen Hafaid,	Tunisia
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Oral Presentations Program: Nanotech MEET Tunisia 2014

	Thursday 24th April 2014 Advanced Materials, Fabrication, Characterization & Tools Nefertiti Conference Room (Conference Centre 1st Floor)	
7.00-9.15	**Registration- Welcome coffee**	
9.15-9.45	**Opening Session Dr. Malika Ardhaoui/Prof. Adnane Abdelghani, Tunisia Prof. Slim Ben Saoud, Director of the INSAT, Tunisia**	
Plenary talk 9.45-10.30	**Dr. Jorge M. Garcia-** Director of the Instituto de Microelectronica de Madrid, CSIC, Spain **MBE growth of Quantum nanostructures for optoelectronics** *(Page 23)*	**Dr. Jorge M. Garcia**
10.30-11.15	**Coffee break**	
	Advanced Materials, Fabrication, Characterization & Tools Nefertiti Conference Room (Conference Centre 1st Floor)	
	Chairs : Prof Khaled Karrai and Prof Axel Lorke	
11.15-11.45	D.S.Yang, M.Y. Song, E.J. Bae, J.D. Park and **J. Sung Yu** Department of Advanced materials Chemistry, Korea University, **Republic of Korea.** Synthesis of Nitrogen-Doped Porous Carbon Nanofibers: Effect of Their Texural Properties on Oxygen Reduction Reaction *(Page 24)*	**Prof Jong-Sung Yu**
11.45- 12.00	**T. Touam** Laboratoire des Semi-conducteurs- Université Badji Mokhtar- **Algeria** Synthesis and characterizations of sol-gel Ag-doped ZnO nanostructured thin films for optoelectronic applications *(Page 25)*	**Dr Tahar Touam**
12.00-12.15	**M. Božič**, V. Vivod, D. Jaušovec, R. Vogrinčič, and V. Kokol University of Maribor, Institute for Engineering Materials and Design, **Slovenia.** Biocatalytical Modifications of NanoCellulose Surface and potential Applications *(Page 26)*	**Dr Mojca Božič**
12.15-12.30	**H.Abuhimd** and M. A. Dar National Nanotechnology Center, King Abdulaziz City for Science and Technology and Center of Excellence for Research in Engineering Materials, Advanced Manufacturing Institute, King Saud University, **Saudi Arabia** Few Layer Graphene on Copper Substrate Developed By Atmospheric Chemical Vapor Deposition *(Page 27)*	**Dr Hatem Abuhimd**
12.15-12.30	M. Ezzdini, **W. Rouis**, S. Rekaya, B. Azeza, L. Sfaxi, R. M'ghaieth and H. Maaref University of Monastir, Laboratory of Micro-Optoelectronics and Nanostructures (Imon), Faculty of Sciences of Monastir, and Sousse University, high School of Science and Technology of Hammam Soussse, **Tunisia** Growth and optical characterization of vertically stacked and electronically coupled InAs/InGaAs/GaAs QDs hetero-structures intermediate-band solar cells *(Page 28)*	**Ms Wiem Rouis**
12.30-12.45	**M. A. AbdelKawy**, A. El-Shazly and Y. El Shazly Chemical and Petrochemical Engineering Dept., Egypt-Japan University of Science and Technology (E-JUST) and Chemical Engineering Dept., Faculty of Engineering, Alexandria University, Alexandria, **Egypt** Production of Pure Nano-Iron by using ball milling machine, chemical batch reactor and K-M Micro reactor *(Page 29)*	**Mr Mohamed Ahmed AbdelKawy**
12.45-14.00	**Lunch break - Poster Session 1 - Exhibition**	
	Chairs: Prof. Adnane Abdelghani/ Prof. Sihem Jaziri	
Plenary talk 14.00- 14.45	**Prof Adnen Mlayah-** Centre d'Elaboration de Matériaux et d'Etudes Structurales CEMES-CNRS, Paul Sabatier University, **France.** **Plasmonics boosts Nanotechnology** *(Page 30)*	**Prof Adnen Mlayah**
14.45-15.30	**Prof Khaled Karrai-** Attocube Systems AG- München- **Germany** **Innovative cryogenics for high resolution scanning probe microscopy** *(Page 31)*	**Prof Khaled Karrai**
15.30- 15.45	**Y. Shilyaeva,** V. Bardushkin, M. Silibin, V. Yakovlev, A. Shulyat'ev and S. Gavrilov National Research University of Electronic Technology, Bld. 5, Pas. 4806, Zelenograd, Moscow, **Russia**	**Ms Yulia Shilyaeva**

	Synthesis and Thermal Characterization of Metal Filled Alumina Composites with Different Concentrations of Nanowires ***(Page 32)***	
15.45- 16.00	**J. Selmi**, R. Bedira and A.Gharsallah Laboratoire de physique de la Matière Molle et Modélisation Electromagnétique, Faculté des Sciences de Tunis, **Tunisia**	**Dr Jamila Selmi**
	Scattering by Single Wall carbon nanotubes using WCIP method ***(Page 33)***	
15.15-15.30	**S.Parsons**, R.Murphy, J.Lee, G.Sims and V.Gopee University of Surrey, Centre of Environmental Strategy, Guildford, Surrey, United Kingdom and National Physical Laboratory (NPL), Hampton Road, Teddington, Middlesex, **United Kingdom**	**Ms Sophie Parsons**
	Uncertainty Communication in the Environmental Life Cycle Assessment (LCA) of Carbon Nanotubes (CNTs) ***(Page 35)***	
15.30-15.45	**W. Heni**, L. Vonna and H. Haidara Institut de Science des Matériaux de Mulhouse, Université de Haute Alsace, CNRS-UMR 7361 **France**	**Mr Wajdi Heni**
	Mechanical stability of nanoparticle-based coatings ***(Page 36)***	
15.45-16.00	**Y.Yamada**, M. Miura, K. Tajima, M. Okada, and K. Yoshimura National Institute of Advanced Industrial Science and Technology, Nagoya, **Japan**	**Dr Yasusei Yamada**
	Pd Distribution of Switchable Mirrors Using Mg–Y Alloy Thin Films ***(Page 37)***	
16.00-16.15	**Coffee Break - Poster Session 1 - Exhibition**	
16.15-16.30	**A. Rached**, A. Bhouri and J. L. Lazzari Laboratoire d'Electronique et Microélectronique, Faculté des Sciences de Monastir, 5019 Monastir, **Tunisia** and Centre Interdisciplinaire de Nanoscience de Marseille (CINaM), UMR 7325 CNRS – Aix-Marseille Université, **France**	**Mrs Amani Rached**
	Resonant Tunneling Transport in Al0.5G0.5N/InxGa1-xN/Al0.5G0.5N/In0.1Ga0.9N quantum structures ***(Page 38)***	
16.30-16.45	**N. Ismail,** A. Kalboussi, S. Lenfant and D. Vuillaume INSAT, University of Carthage and Laboratory of Microelectronic and Instrumentation, Faculty of Sciences of Monastir, University of Monastir, **Tunisia** and IEMN-CNRS, **France.**	**Dr Naoufel Ismail**
	Enhanced Performance of Optoelectronic Memory Devices Based on Carbon Nanotube Transistors ***(Page 39)***	
16.45-17.00	**E. Ismar**, A.S. Sarac Istanbul Technical University, Department of NanoScience and NanoEngineering, Istanbul, **Turkey**	**Ms Ezgi ISMAR**
	Synthesis and Characterization of PAN-co-polymers as Carbon Nano Fiber Precursor ***(Page 40)***	
17.00-17.15	**A. Daboussi**, L. Mandhour and S. Jaziri Laboratoire de Physique de la matière Condensée, Faculté des Sciences de Tunis and Laboratoire de Physique des Matériaux, Faculté des Sciences de Bizerte, **Tunisia.**	**Ms Ameni Daboussi**
	Minimal conductivity in ballistic bilayer graphene with a twist ***(Page 41)***	
17.15-17.30	A. Mami, I. Mellouki and N. Yacoubi U.R. Photopyroelectric, IPEIN- Nabeul, **Tunisia**	**Mrs Amel Mami**
	Thermo-electrical properties of polymer materials For Electro-Pyro-Electric Technique (EPE) ***(Page 42)***	
17.30-17.45	**B .Dridi Rezgui**, X. Paquez, Y. Leconte and B. Bessaïs Laboratoire de Photovoltaïque, Centre des Recherches et des Technologies de l'Energie, Technopole de Borj-Cédria, **Tunisia** and Laboratoire Francis Perrin, CEA/DSM/IRAMIS/SPAM - CNRS URA 2453, **France.**	**Dr Béchir Dridi Rezgui**
	Optical and structural characteristics of nanocrystalline silicon films for third generation solar cells	
17.45-19.00	**Poster Session 1 – Exhibition**	

	Thursday 24th April 2014 **Advanced Materials, Fabrication, Characterization & Tools** **Nefertiti Conference Room (Conference Centre 1st Floor)**	
7.00-9.15	**Registration- Welcome coffee**	
9.15-9.45	**Opening Session** **Dr. Malika Ardhaoui and Prof.Adnane Abdelghani, Tunisia** **Prof. Slim Ben Saoud, Director of the INSAT, Tunisia**	
Plenary talk 9.45-10.30	**Dr. Jorge M. Garcia-** Director of the Instituto de Microelectronica de Madrid, CSIC, **Spain** **MBE growth of Quantum nanostructures for optoelectronics**	**Dr. Jorge M. Garcia**
10.30-11.15	**Coffee break**	
	Advanced Materials, Fabrication, Characterization & Tools **Conference Room Cesar (Conference Centre Ground Floor)**	
	Chairs : Prof. Rachida Sridi and Dr Michael Stöcker	
11.15-11.30	**B. Marinkovic** Department of Materials Engineering, Pontifical Catholic University, **Brazil.** TiO2 based nanopowders and coatings with high photocatalytic activity for NO gas degradation developed from low cost precursors ***(Page 43)***	**Prof Bojan Marinkovic**
11.30-11.45	**F. Hammami** and Y. Kulkarni University of Houston, Department of Mechanical Engineering, Houston, Texas, **USA** Interplay of Intrinsic and Extrinsic Size Effects in Twinned Nanopillars ***(Page 44)***	**Mrs Farah Hammami**
11.45- 12.15	E. Anagnostopoulou, M. Pousthomis, K. Aït-Atmane, W. Fang, J.-Y. Piquemal, L.-M. Lacroix, F. Ott and **G.Viau** Université de Toulouse, LPCNO, UMR 5215 INSA-CNRS-UPS, University Paris-Diderot, ITODYS and Lab. Léon Brillouin UMR 12 CEA/CNRS Centre d'Etudes de Saclay, **France.** From High Aspect Ratio Nanoparticles Synthesis to Nano-Structured Permanent Magnets ***(Page 45)***	**Prof Guillaume Viau**
12.15-12.45	**V. Levchenko**, I. Buyanovsky, Z. Ignatieva and V.Matveenko Department of Colloid Chemistry, Lomonosov Moscow State University and Department of tribology, Blagonravov Mechanical Engineering Research Institute, Moscow, **Russia.** Nanostructural Carbon Polymer Coatings – Orientants and their Influence on Oils Lube Ability ***(Page 46)***	**Prof Vladimir Levchenko**
12.45-14.00	**Lunch Break - Poster Session 1 - Exhibition**	
	Chairs: : Prof. Larbi Sfaxi and Prof. Samia Abdi-ben Nasrallah	
Plenary talk 14.00- 14.45	**Prof Adnen Mlayah-** Centre d'Elaboration de Matériaux et d'Etudes Structurales CEMES-CNRS, Paul Sabatier University, **France.** **Plasmonics boosts Nanotechnology**	**Prof Adnen Mlayah**
14.45-15.30	**Prof Khaled Karrai-** Attocube Systems AG- München- **Germany** **Innovative cryogenics for high resolution scanning probe microscopy**	**Prof Khaled Karrai**
The 2 above Keynote Speakers Talks are to be in the Nefertiti Conference Room (Conference Centre 1st Floor)		
15.30-15.45	**N. Zeiri,** S.Abdi-Ben Nasrallah and M. Said Laboratoire de la Matière Condensée et des Nanosciences (LMCN) Département de Physique, Faculté des Sciences de Monastir, **Tunisia** Electric field effects on the linear and nonlinear intersubband optical properties in asymmetric quantum wells ***(Page 47)***	**Mr Nebil Zeiri**
15.45- 16.00	**A. Chehaidar** and H. Jedidi Département de Physique, Faculté des Sciences de Sfax, Université de Sfax, **Tunisia** Theoretical Study of the Optical Properties of Si/Ge, Ge/Si core/shell and Si1-xGex alloy nanoparticles ***(Page 48)***	**Prof Abdallah Chehaidar**

15.15-15.30	**I. Shehadi** and A. Khalil Department of Chemistry, University of Sharjah and Department of Chemistry, University Arab Emirats University, Al Ain, **United Arab Emirates.** Quality Structure activity relationships study for selected metal oxide/ mixed metal oxide catalysts *(Page 49)*	**Dr Ihsan Shehadi**
15.30-15.45	**N. Kizildag**, N. Ucar, I. Karacan and A.Onen Textile Engineering Department and Chemistry Department Istanbul Technical University and Erciyes University, Textile Engineering Department, Kayseri, **Turkey**. PAN/CNT/AgNP composite nanowebs: Effect of CNT functionalization and Ag+ reduction on properties of composite nanofiber webs *(Page 50)*	**Mrs Nuray Kizildag**
15.45-16.00	**Dr Eduardo Carrasco** and J. Perruisseau-Carrier Adaptive MicroNano Wave Systems, Ecole Polytechnique Fédérale de Lausanne (EPFL), **Switzerland** Dynamic Spatial Manipulation on Infrared Light Using Arrays of Plasmonic Graphene Nanoantennas *(Page 51)*	**Dr Eduardo Carrasco**
16.00-16.15	**Coffee Break - Poster Session 1 - Exhibition**	
16.15-16.30	**M.R. Alenezi**, A.S. Alshammari, T. H. Alzanki, S.J. Henley and S. R. P. Silva Nanoelectronics Center, Advanced Technology Institute, University of Surrey, **United Kigndom**, College of Technological Studies, PAAET, **Kuwait** and Department of Physics, College of Science, University of Hail, **Saudi Arabia** Bottom-Up Fabrication of High performance Nanostructured Photoetectors *(Page 52)*	**Dr Mohammad R. Alenezi**
16.30-16.45	**M. Hamdi** and A.Abdelghani Nanotechnology Laboratory, National Institute of applied Science and technology,Carthage university, **Tunisia** Design and Computational Analysis of an ultra-sensitive gaz sensor based on functionnalised carbon nanotube *(Page 53)*	**Dr Mustapha Hamdi**
16.45-17.00	A.Themri, **H. Baccar**, I. Hafaid, E. Llobet and A. Abdelghani Carthage University, Nanotechnology Laboratory, INSAT, Tunis, Tunisia and MINOS-EMaS, Universitat Rovira i Virgili, Tarragona, **Spain** Rhodium-decorated MWCNTs for chemical vapors detection *(Page 54)*	**Dr Hamdi Baccar**
17.00-17.15	**M. Dridi** and George C. Schatz Department of Chemistry, Northwestern University, Evanston, Illinois 60208, **USA.** Theory of plasmon enhanced lasers: Coupling QM to EM at the rate constant level *(Page 55)*	**Dr Montacer Dridi**
17.15- 17.30	**A. Makhlouf**, D. Frihi, H. Satha, A. Layachi & S. Gherib - Silicates, Polymers and Nano- Composites (LSPN) laboratory Guelma University- **Algeria** Calorimetric Study and optimization of crystallinity rate for the composite: isotactic polypropylene / micro- talc (iPP / µ -talc) *(Page 56)*	**Mr Azzedine Makhlouf**
17.30-17.45	**W. Naffouti**, A. Mehdi and N. Kamoun Laboratoire de Physique de la Matière Condensée, Faculté des Sciences de Tunis El Manar, **Tunisia** and Institut Charles Gerhardt - UMR5253, Chimie Moléculaire et Organisation du Solide, Université MontpellierII, **France.** Effect of heat treatment on physical properties of Titanium dioxide *(Page 57)*	**Ms Wafa Naffouti**
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Friday 25th April 2014 Nanotech in Life Sciences & Medicine/ Nanotechnology safety Nefertiti Conference Room (Conference Centre 1st Floor)		
	Chairs: Prof Giancarlo Franzese and Prof Iran Alemzadeh	
Plenary talk 9.00-9.45	**Prof Didier Letourneur-** Cardiovascular Bio-engineering - INSERM U1148 - LVTS. Bichat Hospital, University Paris 7 - Denis Diderot and Institut Galilée, University Paris 13 - **France** **Polysaccharide Scaffolds for Cardiovascular Tissue Engineering** ***(Page 59)***	**Prof Didier Letourneur**
9.45-10.15	**G. Franzese** Universitat de Barcelona, Departament de Fisica Fonamental, Barcelona, **Spain** The nanoparticles protein corona: How to extract a predictive molecular mode from the experiments. ***(Page 60)***	**Prof Giancarlo Franzese**
10.15-10.45	**Coffee Break - Poster Session 2 - Exhibition**	
10.45-11.00	**W. Messina**, Una Crowley and Eric Moore Tyndall National Institute and Chemistry Department, University College Cork, **Ireland** Fabrication of gold nanopillars on gold interdigitated impedance electrodes for biological applications ***(Page 61)***	**Mr Walter Messina**
11.00- 11.15	**I. Balti**, P. Chevallier, M. A. Fortin, C. Menager, A. Michel, B. Viana, N. Jouini and F. Chaubet Laboratoire de bio-ingénierie des polymères cardiovasculaires, Inserm U698 and Laboratoire de Sciences des Procédés et des Matériaux, LSPM, CNRS UPR 3407, Institut Galilée Institut Galilée, Université Paris 13, Physicochimie des Electrolytes, Colloïdes et Sciences Analytiques (PECSA) UMR 7195 UPMC - CNRS -ESPCI Université Pierre et Marie Curie, Paris and Ecole Nationale Supérieure de chimie de Paris, **France** and Centre de Recherche Hôpital St François d'Assise – CHU de Québec, **Canada.** Nanohybrid based on Zn(Fe)O pullulan grafted nanoparticles as potential luminescent and magnetic bimodal imaging probes: synthesis, characterization, modification and cytoxicity study ***(Page 62)***	**Dr Imen Balti**
11.15-11.30	**A. Laouini** , G. T. Vladisavljevic, K. Shroen, H. Fessi and C. Charcosset Laboratoire d'Automatique et de Génie des Procédés, Lyon University, **France**, Department of Chemical Engineering, Loughborough University, **United Kingdom** and Laboratory of Process Engineering, Waginengen University, **The Netherlands** Vitamin E Encapsulation Within Pharmaceutical Drug-Carriers Prepared Using Membrane Contactors ***(Page 63)***	**Dr Abdallah Laouini**
11.30-11.45	**R. Jaafar** Nanosurf AG, Liestal, **Switzerland** FluidFM: A micromanipulator with force control for single cell adhesion or injection experiments ***(Page 64)***	**Dr Rached Jaafar**
11.45- 12.00	A. Heydari, **I. Alemzadeh,** M. Vossoughi and H. Ostadi Department of Chemical and Petroleum Engineering and Institute for Biotechnology and Environment (IBE), Sharif University of Technology, Tehran and Department of Chemical Engineering, University of Mohaghegh Ardabili, Ardabil, **Iran** Enzymatic Degradability of Corn Starch Nanocomposites ***(Page 65)***	**Prof Iran Alemzadeh**
12.00-12.15	M. Feilizadeh, **M. Vossoughi** and I. Alemzadeh Department of Chemical and Petroleum Engineering and Institute for Nano-science and Nano-technology, Sharif University of Technology, Tehran, **Iran** Photocatalytic disinfection by a visible light-activated co-doped TiO2 ***(Page 66)***	**Prof Manouchehr Vossoughi**
12.15-12.30	**B. Tangour** Research Unity of Theoretical Chemistry and Reactivity, Université de Tunis El Manar, **Tunisia** Encapsulation into nanotubes ***(Page 67)***	**Prof Bahoueddine Tangour**
12.30-12.45	**S. Trabelsi**, A. Aschi, T. Othman and A. Gharbi	

	Laboratoire de Physique de la Matière Molle et Modélisation Electromagnétique, Faculté des Sciences de Tunis, **Tunisia.**	**Mr Saber Trabelsi**
	Dynamical behavior and rheological properties of complexes particles formed by small globular protein and polyelectrolyte long-chain *(Page 68)*	
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Plenary talk 14.00- 14.45	**Prof. Kenneth A. Dawson-** University College Dublin- **Ireland**	**Prof. Kenneth A. Dawson**
	Nano-materials for drug delivery	
	Chairs: Prof. Adnane Abdelghani and Prof. Samia Abdi-ben Nasrallah	
14.45- 15.00	**O. Tagit** and N. Hildebrandt Nano Bio Photonics, Institut d'Electronique Fondamentale, Université Paris-Sud, **France**	**Dr Oya Tagit**
	Semiconductor Nanorods as Acceptors in Förster Reso-nance Energy Transfer-Based Immunoassays *(Page 69)*	
15.00- 15.15	**H. Baccar** Nanotechnology Laboratory, INSAT, Tunis, **Tunisia**	**Dr Hamdi Baccar**
	Bacteriophage sensors integrated in a microfluidic cell for pathogens detection *(Page 70)*	
15.15-15.30	**S. Leboukh**, H. Gouzi, Y. Harek and A. Ziouche Laboratoire de Chimie Organique, Substances Naturelles et Analyse (COSNA), Département de Chimie, Université Abou Bekr Belkaid, Tlemcen, Welding and NDT (CSC), Algiers and Université Amar Telidji, Faculté des Sciences, **Algeria.**	**Ms Saida. Leboukh**
	Development of enzyme-based biosensor for environmental monitoring *(Page 71)*	
15.30-15.45	H. Chammem, **I. Hafaid**, L. Mora, O. Meilhac and A. Abdelghani Nanotechnology Laboratory- National Institute of Applied Science and Technology- **Tunisia**, Cardiovascular Bio-engineering - INSERM U1148 - LVTS. Bichat Hospital, University Paris 7 - Denis Diderot and Institut Galilée, University Paris 13 - **France**	**Dr Imen Hafaid**
	Electrochemical sensor based on functionalized magnetic beads for C - reactive protein Immunosensor *(Page 72)*	
15.45-16.00	**I. Yalcin**, J. Horakova and T. Gok Sadikoglu Istanbul Technical University, Textile Technologies and Design Faculty, Department of Textile Engineering, Istanbul, **Turkey** and Technical University of Liberec, Faculty of Textile Engineering, Department of Nonwovens and Nanofibrous materials, Liberec, **Czech Republic.**	**Ms Ipek Yalcin**
	The Use of Different Solvent Types for Electrospinning of Polycaprolactone Tubular Scaffolds *(Page 73)*	
16.00-16.15	**Coffee break- Poster Session 2 - Exhibition**	
16.15-16.30	**L. Benterrouche**, N. K. Chaouche, S. Sahli, S. Benhassine, M. T. Benabbas and A. Benhamouda Laboratory of Microsystems and Instrumentation and Laboratory of Mycology, Biotechnology and Microbial Activity, Constantine 1University,Constantine, **Algeria**	**Mr Lyes Benterrouche**
	Sterilization of polymers surface contaminated by Bacillus bacteria using atmospheric dielectric barrier discharge plasma *(Page 74)*	
16.30-17.45	**N. Ben Hafaid**, N. Bellakhal and S. Hamza National Institute of Applied Sciences and Technology and iomaterials and Biomechanics Laboratory, National Institute M.T. Kassab of Orthopedic, Tunis, **Tunisia**.	**Ms Nouha ben Hafaied**
	Physical and chemical characterization of the Hydroxyapatite and nacre used for medical application	
18.00-19.15	**Poster Session 2 – Exhibition**	

Friday 25th April 2014 Materials for Energy and Environment / Nano-scale Electronics for Energy & Environment Conference Room Cesar (Conference Centre Ground Floor)		
	Chairs: Prof. Ridha Ben Mrad and Prof. Larbi Sfaxi	
Plenary talk 9.00-9.45	**Prof. Jean-Pierre Joly** Director of the National Institute of Solar Energy (INES), France **Key issues for High efficiency Silicon Solar Cells** ***(Page 76)***	**Prof. Jean-Pierre Joly**
9.45-10.00	**H. Farjallah**, **H. Ketata** and M.H. Ben Ghozlen Materials Physics Laboratory, Sfax university, Faculty of Sciences of Sfax and Preparatory Engineering Institute, Sfax university **Tunisia** Influence of anisotropy on transmission spectrum and band gaps of elastic plate waves in photonic plate with defect ***(Page 77)***	**Mrs Hajer Farjallah**
10.00-10.15	M. Troudi, **S. Chatbouri**, Nabil Sghaeir, Adel Kalboussi, Dominique Drouin, Vincent Aimez and Adelkader Souifi Laboratoire Nanotechnologies et Nanosystèmes (UMI-LN2 3463) INSA de Lyon, **France**, Institut Interdisciplinaire d'Innovation Technologique- Université de Sherbrooke, **Canada** and Laboratoire de Micro´electronique et Instrumentation- Université de Monastir/ Institut Préparatoire aux Etudes d'Ingenieurs de Nabeul(IPEIN), **Tunisia** Analysis of trap centers at the tunnel oxide in single electron photodetector (photo-SET) ***(Page 78)***	**Mr Samir Chatbouri**
10.15-10.30	**Coffee Break - Poster Session 2 - Exhibition**	
10.15-10.30	**S. Ghanem**, A.Telia and C.Boukous Laboratory of Microsystems and instrumentation (LMI), Department of electronic, University of Constantine 1, **Algeria** Humidity sensing based on sol-gel grown ZnO nanostructure ***(Page 79)***	**Mr Salah Ghanem**
11.30-11.45	**A. Touati**, S. Chatbouri and A. Kalboussi Faculty of Science of Monastir, Physics Department, Microelectronic Laboratory, University of Monastir, **Tunisia** Single-electron photodetector based only on Single-electron devices ***(Page 80)***	**Mr Amine. Touati**
11.45-12.00	M.R. Alenezi and **T.H. Alzanki** College of Technological Studies- **Kuwait** High Performance Gas sensor Based on Brush-like Hierarchical ZnO Nanostructures ***(Page 81)***	**Dr Talal H. Alzanki**
12.00- 12.15	**K. Abderrazek** , N. Frini Srasra, E. Srasra , M. Seffen ,A. Uheida and M. Muhammet National research center of materials sciences, Technopark of Borj Cedria, Laboratory of research in energy and materials, high school of sciences and technologies of Hammam Sousse, **Tunisia** and Functional Materials Division, Royal Institute of Technology, Stockholm, **Sweden** [Zn-Al] LDH and Polymer-[Zn-Al] LDH composites: synthesis, characterization and application for water depollution ***(Page 82)***	**Mrs Kaouther Abderrazek**
12.15-12.30	**P. Mines**, J. Byun, Y. Hwang, H. Patel, H. Andersen and C. Yavuz, Technical University of Denmark, Department of Environmental Engineering, Kongens, **Denmark** and Korea Advanced Institute of Science and Technology, Graduate School of EEWS, **Korea Republic** Nano-Sized Zero Valent Iron and Covalent Organic Polymer Composites for Azo Dye Remediation ***(Page 83)***	**Mr Paul Mines**
12.30-12.45	W. Makni, **M. Najari** and H. Samet Laboratory of Micro-Electro Thermal Systems (METS), National School of Engineering of Sfax and Department Of Physics, Faculty of Sciences of Gabes, **Tunisia** Simulation study of an Operational Amplifier with non-Ideal CNTFET ***(Page 84)***	**Dr Montasar. Najari**
12.45-14.00	**Lunch Break - Poster Session 2 - Exhibition**	
Plenary talk 14.00- 14.45	**Dr Michael Stöcker-** SINTEF Materials and Chemistry**- Norway** **Advanced Materials for Water Treatment and Bio-refining** ***(Page 86)***	**Dr Michael Stöcker**
	Chairs: Dr Jorge M. Garcia and Prof. Adel Kalboussi	
14.45- 15.00	**W. Rouis,** S. Rekaya, M. Ezzdini, B. Azeza, L. Sfaxi, R. M'ghaieth and H. Maaref	

	University of Monastir, Laboratory of Micro-Optoelectronics and Nanostructures (Imon)- Faculty of Sciences of Monastir and high School of Science and Technology of Hammam Sousse, **Tunisia** Optical properties of Si-delta doping on multi-stacked InAs/InGaAs/GaAs intermediate-band solar cells ***(Page 87)***	**Ms Wiem Rouis**
15.00- 15.15	**H. Hamdi**, R. De La Torre-Roche, J. Hawthorne and J. C. White Water Research and Technology Center, University of Carthage, **Tunisia** and Department of Analytical Chemistry, the Connecticut Agricultural Experiment Station, **USA** Impact of non-functionalized and amino-functionalized multiwall carbon nanotubes on pesticide uptake by lettuce (Lactuca sativa L.) ***(Page 88)***	**Dr Helmi Hamdi**
15.15-15.30	**M. Haggui,** B. Reinhold and P. Fumagalli Freie Universität Berlin, Institut für Experimentalphysik and Helmholtz-Zentrum Berlin für Materialien und Energie, Berlin, **Germany** Spatial Resolved Measurements of the Local Efficiency in CIGS Thin Film Based Solar Cell ***(Page 89)***	**Dr Mohamed. Haggui**
15.30-15.45	**K. Jabeur**, G. Prenat and G. Di Pendina SPINTEC Lab, CEA/INAC, CNRS, UJF, G-INP, Grenoble, **France** Spin Orbit Torque (SOT) nanodevices for ultra-energy efficient and non-volatile applications ***(Page 90)***	**Mr Kotb Jabeur**
15.45-16.00	**H. Sezgin**, I. Yalcin, T. Gok Sadikoglu, G. Ozcan and O. B. Berkalp Istanbul Technical University, Textile Technologies and Design Faculty, Textile Engineering Department, Istanbul, **Turkey** Design of a UV-Protected Nonwoven Fabric with Anti-mosquito Property ***(Page 91)***	**Ms Hande Sezgin**
16.00-16.15	**Coffee Break - Poster Session 2 - Exhibition**	
16.15-16.30	**K. Zaafouri**, L.A. Fernandez Guelfo , C.J. Álvarez-Gallego and I.L. Romeo Garcia, K. Aboudi, J. Fernández Rodriguez, S. Sanxhez Villasclaras, I.Olivares Merino, L.Bergaoui and M. Hamdi Laboratoire d'Ecologie et Technologie Microbienne and Unité de Recherche d'Elaboration des Nanomateriaux et leurs Applications URENMA, Institut National des Sciences Appliquées et de Technologie, **Tunisia**, Laboratory of biological treatment of wastes, Department of Chemical Engineering and Food Technology, Faculty of Science. University of Cadiz and Department of Chemical, Environmental and Materials Engineering, University of Jaén, Campus Las Lagunillas, **Spain.** Characterization of Dry Fibers of Optunia ficus-indica Cladodes' as Lignocellulosic Feedstocks for Biorefineries ***(Page 92)***	**Mrs Kaouther Zaafouri**
16.30-16.45	**A. Jaballah**, D. Mezghani and A. Mami Laboratory of Analyze and control of systems,Department of Electric Engineering, National School of Engineering of Tunis and Electronic Laboratory, Department of Physics, Faculty of Sciences of Tunis, **Tunisia** FPGA-based real time implementation of a controller algorithm for water pumping system powered by a wind/photovoltaic hybrid power System ***(Page 93)***	**Mr Akram Jaballah**
16.45-17.00	**T. Ben Amor** and M. Ben Amor Laboratoire de Traitement des Eaux Naturelles. Centre de Recherches et Technologies des Eaux, Technopole de Borj-Cédria, **Tunisia** Defluoridation of drinking water using functionalized SBA-15 type ordered mesoporous silica ***(Page 94)***	**Dr Taissire. Ben Amor**
17.00-17.15	**M. T. Benabbas**, S. Sahli, N. Kacem Chaouche, L. Benterrouche and M. Kara Ali Laboratory of Microsystems and Instrumentation, Electronic department, Faculty of Sciences and Technology and Laboratory of Mycology, Biotechnology and Microbial Activity, Constantine 1 University, **Algeria.** Investigating effects of an argon-based non-thermal atmos-pheric pressure plasma jet on inactivation of E-Coli ***(Page 95)***	**Mr Mohamed Tahar Benabbas**
17.15-17.30	**S. Etteieb,** A. Kawachi, J. Han, J. Tarhouni and H. Isoda Water Science and Technology Laboratory (LSTE)- National Agronomic Institute of Tunisia INAT- Tunisia, School of Life and Environmental Science, Univ. of Tsukuba, Japan and Alliance for Research on North Africa, Univ. of Tsukuba, Japan	**Mrs Selma Etteieb**

	Cytotoxic effects of treated effluents and industrial wastewater discharges on mammalian cell lines ***(Page 96)***	
17.30-17.45	**N. Hechmi**, N. Ben Aissa, H. Abdenacceur and N. Jedidi Laboratory of Wastewater Treatment. Water Research and Technologies Centre (CERTE), Technopole Borj- Cedria and National Agronomic Institute of Tunisia, **Tunisia.**	**Dr Nejla Hechmi**
	Bioremediation of Pesticide Contaminated Soils: microbiological methods for feasibility assessment and monitoring ***(Page 97)***	
17.45-18.00	**A.A. Abdelkarim**, A. S. G. Khalil, T. A. Gad-Allah, M.I. Badawy and Mathias Ulbricht Technical Chemistry II, University of Duisburg-Essen, Essen, **Germany**, Water Pollution Research Department, National Research Center, Egypt Nanotechnology Center, Physics Department, Faculty of Science, Fayoum University, Arab Academy of Science, Technology and Maritime Transport, Smart Village Campus, Giza, **Egypt**	**Mr Ahmed A. Abdelkarim**
	Removal of Organic Pollutants Using Commercial Nanofiltration and Reverse Osmosis Membranes ***(Page 98)***	
18.00-19.15	**Poster Session 2– Exhibition**	

Saturday 26th April 2014 Materials for Energy and Environment / Nanoscale Electronics, Energy & Environment Nefertiti Conference Room (Conference Centre 1st Floor)		
	Chairs: Prof. Jean-Pierre Joly and Prof. Samia Abdi-Ben Nasrallah	
Plenary talk 9.00-10.00	**Prof. Claude Cohen Tannoudji (Nobel Prize Physics)-** Collège de France**- France** **Manipulating atoms with light**	**Prof Claude Tannoudji**
10.00-10.20	**Coffee break- Poster Session 3 - Exhibition**	
Plenary talk 10.20-11.05	**Prof. Axel Lorke-** Faculty of Physics and CENIDE, University Duisburg-Essen**- Germany** **Nanoparticles for Energy Applications** *(Page 99)*	**Prof. Axel Lorke**
Plenary talk 11.05-11.35	**Prof. Ridha Ben Mrad,** Department of Mechanical and Industrial Engineering, The University of Toronto**- Canada** Development of Large Stroke Microelectrostatic Actuators and Piezo Nanofibers Based Energy Harvesters with Applications *(Page 100)*	**Prof. Ridha Ben Mrad**
Plenary talk 11.35-12:05	**Prof. Vasco Teixeira-** University of Minho**- Portugal** **Nanoscale-based Concepts for Innovative and Eco-Sustainable Constructive Materials: Challenges and Opportunities for Energy and Environment Applications**	**Prof Vasco Teixeira**
12.05-12.30	**G. Griffini**, L. Brambilla, C. Castiglioni, M. Del Zoppo, M. Levi and S. Turri Department of Chemistry, Materials and Chemical Engineering “Giulio Natta” of Politecnico di Milano, Milano, **Italy** Luminescent solar concentrators based on molecular cocrystals as novel fluorescent materials *(Page 101)*	**Dr Gianmarco Griffini**
12.30-12.45	**P. Gómez-Romero** Catalan Institute of Nanoscience and Nanotechnology, ICN2(CSIC-ICN) Campus UAB, Barcelona, **Spain** Hybrid energy storage: Merging the Chemistries of Batteries and Supercapacitors *(Page 102)*	**Prof Pedro Gómez-Romero**
12.30-14.00	**Lunch break- Poster Session 3- Exhibition**	
14.00-15.30	**Poster Session 3– Exhibition**	

Posters sessions - Nanotech MEET Tunisia 2014

NB: All poster sessions are located in the Conference Centre G Floor (Cleopatre Conference Room) in the same area as the Exhibition and the Coffee Breaks areas.

Board N°	Session 1: Nano-materials synthesis and characterization (24^{th} April 2014)	
1	Synthesis and structural characterization of nanocrystalline LaNi4.7Al0.3 alloy prepared by mechanical alloying **M. Mhadhbi** and M. Abdellaoui, National Institute of Research and Physic-Chemistry Analysis- Technopole of Sidi Thabet- Tunisia.	**Dr Mohsen Mhadhbi**
2	Chemical Vapor Deposition Synthesis of Highly Aligned Single Walled Carbon Nanotubes on ST-cut Quartz Substrates: Effect of Gas Flow Rates **E.S. Sadki-** Physics Department, United Arab Emirates University, Al Ain, **United Arab Emirates**	**Dr ElHadi. S. Sadki**
3	Microstructure properties of Fe-doped ZnO nanostructures prepared by mechanical alloying. **S. Oudjertli.,** R. Bensalem, S Alleg and J.J. sunol Laboratoire de Magnétisme et Spectroscopie des Solides, Département de Physique Université de Annaba, **Algeria** and Dep. de Fisica, Universitat de Girona, **Spain**	**Mr Salah Oudjertli**
4	Structural, Morphological, Optical, and Waveguiding Properties of Sol-Gel Nano-structured TiO2 Thin Films **M. Atoui** , T. Touam, I. Hadjoub, A. Chelouche, B. Boudine, A. Fischer, A. Boudrioua and A. Doghmane Laboratoire des Semi-conducteurs, Université Badji Mokhtar-Annaba, Laboratoire de Génie de l'Environnement, Faculté de Technologie, Université de Bejaia and Laboratoire de cristallographie, Université Constantine, **Algeria** and Laboratoire de Physique des Lasers, Université Paris 13, **France**	**Mr Mohamed Atoui**
5	Facile Synthesis of Monodisperse Triangular Gold Nanoparticles Based on a Polyol Process: Plasmonic and SERS Properties **A. Mezni**, A. Fkiri, A. Mlayah, Y. Abid and L. S. Smiri Unité de recherche "Synthèse et Structure de Nanomatériaux" UR11ES30, Faculté des Sciences de Bizerte and Laboratoire de Physique Appliquée (LPA), Faculté des Sciences, Université de Sfax, **Tunisia** and Centre d'Elaboration de Matériaux et d'Etudes Structurales, CNRS-Université de Toulouse, **France**	**Mr Amine Mezni**
6	Synthesis of ZnO Aerogels Nanopowders Using a Modified Sol-Gel Route: Effect of Sol Concentration on Structural and Morphological Properties M. Meddouri, D. Djouadi, **A. Chelouche**, T. Touam and B. Boudine Laboratoire de Génie de l'Environnement (LGE), Université de Bejaia, Laboratoire des Semi-conducteurs, Université Badji Mokhtar and Laboratoire de cristallographie, Université Constantine 1, **Algeria**	**Dr Azeddine Chelouche**
7	Effect of Co-Solvent on Structural and Morphological Properties of ZnO Aerogels Prepared by a Modified Sol-Gel Process M. Meddouri, **D. Djouadi**, A. Chelouche, T. Touam and A. Chergui Laboratoire de Génie de l'Environnement (LGE), Université de Bejaia, Laboratoire des Semi-conducteurs, Université Badji Mokhtar and Département de Physique, Faculté des Sciences, Université Ferhat Abbas Sétif, **Algeria.**	**Mr Djamel. Djouadi**
8	Heating rates and template concentrations effect on the optical and photocatalytic properties of TiO2 nanoparticles. **K. Atamnia**, H. Satha and A. Chemseddine. Département de Génie des Procédés, université de Jijel, Laboratoire des Silicates, des Polymères et des Nanocomposites, université de Guelma, **Algeria** and Helmholtz-Zentrum Berlin für Materialien und Energie, **Germany**	**Mr Kamel Atamnia**
9	Textural and structural characterization of EMIMAc silica ionogels and their corresponding aerogels **N. Bengourna**, F.Despetis, L.Bonnet, R.Courson, P.Solignac, H.Satha and N.Olivi-Tran	**Mrs Bengourna nadjette**

	Université 08 mai 1945, Laboratoire des Silicates, polymères et des Nanocomposites, **Algeria** and Laboratoire Charles Coulomb CNRS UMR 5221, Université Montpellier and Laboratoire PHASE, Université Paul Sabatier, **France**	
10	Nano-powder and nano-porous surface elaborated by Plasma Enhanced Chemical Vapor Deposition from Hexamethyldisiloxane precursor **I. Nouicer,** S.Sahli, M. Kihel, A. Bellel, P. Raynaud and Y. Segui Laboratoire Microsystèmes et Instrumentation (LMI), Faculté des Sciences de la Technologie and Laboratoire d'Etude des Matériaux Electroniques pour Applications Médicales (LEMEMED), Faculté des Sciences de la Technologie, **Algeria** and Laboratoire Plasma et Conversion d'Energie (LAPLACE)- CNRS, Université Paul Sabatier, **France**.	**Mr Ilyes Nouicer**
11	Study and simulation of electrical parameters for biomedical ISFET sensor **B. Kaghouche**, F. Mansour and I. Nouicer LEMEAMED Laboratory, Department of Electronics, Constantine 1 University and Université Mentouri de Constantine, Laboratoire de Microsystèmes et Instrumentation (LMI), Faculté des Sciences de l'Ingénieur, **Algeria**	**Mr Ilyes Nouicer**
12	Synthesis, characterization and optical properties of ZnxCd1-xS quantum dots **A. Yakoubi,** Tahar Ben Chaabane and Schneider Unité de Recherche Synthèse et Structure de Nanomatériaux UR 11 ES 30. Université de Carthage. Faculté des Sciences de Bizerte, **Tunisia** and Laboratoire Réactions et Génie des Procédés (LRGP), UMR 7274, CNRS, Université de Lorraine, **France.**	**Ms Afef Yakoubi**
13	Microwave Synthesis of Magnetic Nanoparticles **B. Grindi**, E. Anagnostopoulou, K. Aït Atmane, Z. Beji, A. Ben Ali, J.-Y. Piquemal, L.-M. Lacroix and G. Viau Unité de Recherche Synthèse et Structure de Matériaux Inorganiques, Faculté des Sciences de Bizerte, **Tunisia** and Université de Toulouse, LPCNO, UMR 5215 INSA-CNRS/ University Paris-Diderot, ITODYS UMR 7086, **France**	**Mr Bilel Grindi**
14	Combustion synthesis, characterization and optical properties investigation of LaErO3 nano-oxide **A. Siaï**, K. Horchani-Naifer and M. Ferid Laboratoire de Physico-Chimie des Matériaux Minéraux et leurs Applications, Centre National des Recherches en Sciences des Matériaux, Technopole de Borj Cedria, **Tunisia**	**Dr Amira Siaï**
15	Synthesis and characterizations of zinc oxide nanoparticles with different morphologies **B. Chouchene** and T. Ben Chaabane Unité de Recherche Synthèse et Structure de Nanomatériaux UR 11 ES 30. Université de Carthage. Faculté des Sciences de Bizerte, **Tunisia**	**Mr. Bilel Chouchene**
16	Green synthesis of ZnO nanoparticles Using a co-precipitation method **S. Akir**, R. Boukherroub and A. Dakhlaoui-Omrani Laboratoire de Physico-Chimie des Matériaux Minéraux et leurs Applications, Centre National des Recherches en Sciences des Matériaux, Technopole de Bordj Cedria, **Tunisia** and Institut de Recherche Interdisciplinaire (IRI), **France**	**Prof Amel Dakhlaoui-Omrani**
17	Effect of Silica Concentration on Negative Differential Resistance Phase in Carbon-silica Nanocomposites S. Gouadria, **H. Dahman**, A. Alyamani, N. Bouguila and L. El Mir Laboratory of Physics of Materials and Nanomaterial's applied at Environment (LaPhyMNE), Gabès University, **Tunisia** and National Nanotechnology Research Centre, KACST/ Department of Physics, College of Sciences,Al Imam Mohammad Ibn Saud Islamic University (IMSIU), **Kingdom of Saudi Arabia**	**Dr Hassen Dahman**
18	Reduction of graphene oxide using a natural and low-cost polymer **F. Khili**, R. Boukherroub and A. DakhlaouiOmrani Laboratoire de Physico-Chimie des Matériaux Minéraux et leurs Applications, Centre National des Recherches en Sciences des Matériaux, Technopole de Bordj Cedria, **Tunisia** and Institut de Recherche Interdisciplinaire (IRI), **France**	**Ms Faouzia Khili**
19	Elaboration of Fe, Co and Fe-Co thin films by the PVD technique **M. Boudissa,** M. Benkerri, F. Zekkar and N. Menni	**Prof Mokhtar Boudissa**

	ENMC Laboratory, University F. Abbas and Insitut d'Optique et de Mecanique de Precision, Universite Setif 1, **Algeria**	
20	Polyol-made cobalt substituted Ni-Zn ferrites nanoparticles: synthetic optimization, and structural and microstructural study **H. Huili**, L. Ben Tahar and L.S. Smiri Université de Carthage, Unité de Recherche ''Synthèse et Structure de Nanomateriaux'' (UR11ES30), Faculté des Sciences de Bizerte, **Tunisia**	**Mr Hichem Huili**
21	Optimization of Si and Ag Nanocrystal Hybrid Systems Fabricated by Ion Beam Synthesis **A. Haj Salem**, M. Carrada, R. Carles and G. Ben Assayag CEMES-CNRS, Université de Toulouse, **France**	**Mrs Assia Haj Salem**
22	Optical characterization of the pyramid / porous / silane /Carbon nanotube structure. **H. Gammoudi**, S. Helali and R. Chtourou Photovoltaic Laboratory, Centre for Research and Energy Technologies CRTEn, **Tunisia**	**Mr Haythem. Gammoudi**
23	I-V curves investigation of the Ag2S thin films formed by SILAR method **O. Pyatilova**, S.A. Gavrilov, A.N. Belov, A.V.Zheleznyakova, R.Yu. Rozanov, P.I. Lazarenko and A.A. Raskin National Research University of Electronic Technology, Zelenograd, Moscow, **Russia**	**Ms Olga Pyatilova**
24	Effect of pyrolysis temperature on the properties of an organic-inorganic nanocomposite based on pyrogallol and formaldehyde **N. Ben Mansour**, I. Najeh, S. Mansouri and L. El Mir Laboratory of Physics of Materials and Nanomaterials Applied at Environment (LaPhyMNE), Gabes University, Faculty of Sciences in Gabes, **Tunisia** and Departement of Physics, College of Sciences Al-Imam Muhammad Ibn Saud University, **Kingdom of Saudi Arabia.**	**Mr Nabil Ben Mansour**
25	Growth and characterization of CuInS2 thin films by low cost CSVT method from nanoparticles synthesized by solvo-thermal route **J. Benbelgacem**, A. Ibn Marai, M. Nouiri, K. Djessas and Z. Ben Ayadi Laboratoire de Physique des Matériaux et des Nanomatériaux appliquée à l'Environnement, Université de Gabès, Faculté des Sciences de Gabès, **Tunisia** and Laboratoire Procédés, Matériaux et Energie Solaire (PROMES-CNRS), TECNOSUD/ Université de Perpignan, **France.**	**Dr Jihen Benbelgacem**
26	Structural, morphological and optical properties of non crystalline WOx thin films prepared in different oxygen environment **A. Arfaoui and** S. Touihri Unité de physique des dispositifs à semi-conducteurs Tunis ElManar University, **Tunisia**	**Dr Asma Arfaoui**
27	Synthesis and characterization of a new hybrid material: L-DOPA/Mn-oxide **A. Bejar**, S. Ben Chabeene, M. Jaber, J-F. Lambert and L. Bergaoui Laboratory of Chemistry of Materials and Catalysis, Faculty of Sciences of Tunis, **Tunisia**/ Department of Biological and Chemical Engineering, National Institute of Applied Sciences and Technology, INSAT, **Tunisia** and Laboratoire de Réactivité de Surface (UMR 7197 CNRS), UPMC Univ Paris 6, **France**	**Ms Amal Bejar**
28	Net emission of Carbon–Argon–Azote-Helium-Nickel-Cobalt thermal plasma **D.Salem**, R Hannachi and L Béji Laboratoire d'Energie et de Matériaux (LabEM), Institut Supérieur d'Informatiques et des techniques de communication, Université de Sousse, **Tunisia**	**Prof Donia Salem**
29	Synthesis of Iron Oxide thin films by Sol-Gel technique **F. Zekkar**, M. Benkerri, M. Boudissa and N. Menni ENMC Laboratory, University F. Abbas and Insitut d'Optique et de Mecanique de Precision, Universite Setif 1, **Algeria**	**Mrs Faouzia Zekkar**
30	**Elaboration and Characterization of a novel organic-inorganic hybrid perovskite quantum wells embedded in prous anodic alumina** **W. Zaghdoudi**, Y. Abid and R. Chtourou	**Mr Walid Zaghdoudi**

	Photovoltaic Laboratory Research and Technology Centre of Energy, Borj-Cedria Science and Technology Park, Faculty of science of Gafsa and Laboratoire de Physique appliqué (LPA), Faculty of Science of Sfax, **Tunisia.**	
31	Fibre Orientation and Its Influence on the Mechanical Properties of Glass fibre reinforced polyester composites **A. Taweel**, B. Alkabodib and H. Ala'ameryb Department of Physics, Rada'a , Al-baida'a University and Department of Mechanical Engineering ,Thamar University, **Yemen**.	**Dr. Abdulah Taweel**

Board N°	Session 2: Nanotech in Life Sciences & Medicine/ Nanotechnology safety (25th April 2014)	
1	Physical Characterisation of nanoparticles in aqueous and biological media **A. Sikora** and C. Minelli National Physical Laboratory, Middlesex, **United Kingdom**	**Dr Aneta Sikora**
2	Synthesis and functionalization of bioactive glasses for drug delivery system **N. Bchellaoui**, N. Letaief , J. Jlassi, Med Mami and Rachida Dorbez –Sridi Laboratory of physico-chemical of materials, faculty of sciences of Monastir, **Tunisia.**	**Mr Nizar Bchellaoui**
3	**Synthesis and characterization of nanohydroxyapatites using co-precipitation method** **S. Chabchoub** and A. Dakhlaoui Omrani Institut Préparatoire des Etudes Scientifiques et Techniques à la Marsa and Laboratoire de Physico-Chimie des Matériaux Minéraux et leurs Applications, Centre National des Recherches en Sciences des Matériaux, Technopole de Bordj Cedria, **Tunisia**	**Mrs Souad Chabchoub**
4	Preparation and in vitro evaluation of Artemisnin – Different Carriers Freeze Dried Powders **G. Elhassan**, Y. K. Hay, W.J. Woei, A. Javed, A. Javed ,R. Khan, K. Omer Alfaruq and J. Khan Department of Pharmaceutics Pharmaceutical-Chemistry, Unaizah College of Pharmacy,Qassim University,Qassim, **Kingdom Saudi Arabia**, Department of Pharmaceutical Technology, School of Pharmaceutical Sciences, Universiti Sains/ Mangement and science University,Selangoor, **Malaysia.** And Minstry of Health Khartoum State,Khartoum, **Sudan**	**Dr Gamal Elhassan**
5	Development of an electrochemical biosensor prototype for the detection of influenza virus Type A **A. Ben jaafar**, R. Boubaker Landolsi, K. Belgacem, I. Larbi, J. Nsiri, C. Tlili, A. J. Ghram and M. F. Diouani Institut Pasteur of Tunis, Laboratory of Epidemiology and Microbiology Veterinary/ High Institut of Biotechnologie Sidi Thabet (ISBST), Mannouba, Tunisia **Tunisia** and Center for Bioelectronics, Biosensors and Biochips (C3B), Clemson University Advanced Materials Center/ Department of Chemical and Biomolecular Engineering, Clemson University, **USA**	**Mrs Ameni Ben jaafar**
6	Wireless Sensors Networks For Medical Monitoring **J. Khaskhoussi,** R. Ouni and A. Mtibaa Laboratory EµE, Faculty of Sciences Monastir, **Tunisia** and College of Computer and Information Sciences (CCIS) University of King Saud (UKS), **Kingdom of Saudi Arabia**	**Mr Jihed Khaskhoussi**
7	Rapid sensitive and reproducible HPLC/UV-VIS Method for quantitative analysis of Polyphenols in different coffee samples. **K. Belguidoum**, H. Amira-Guebailia, Y. Boulmokh and O. Houache Laboratory of Applied Chemistry, 8 Mai 1945 Guelma University, Algeria and Petroleum & Chemical Engineering Department, **Sultanate of Oman**	**Ms Karima Belguidoum**
8	Optimal design and Management of thermal storage tanks for Multi-Energy District Boilers. **M. Labidi**, J. Eynard, O. Faugeroux and S. Grieu Cylergie, PROMES-CNRS, Rambla de la Thermodynamique, Tecnosud and University of Perpignan, **France**	**Ms Mouchira Labidi**

9	Synthesis and utilization of poly (dimethylmalic acid) derivatives copolyesters for warfarin controlled release system **I. Msolli**, R. M. Maaroufi, F. Chaubet and Christel Barbaud nserm, U1148, Laboratory for Vascular Translational Science, Institut Galilée, University Paris 13, **France** and Laboratory of Genetic, Biodiversity, and Bioresources Valorisation, Université de Monastir, Institut Supérieur de Biotechnologie de Monastir, **Tunisia**	**Ms Ines Msolli**
10	Quantitative analysis of caffeine in various coffee brands of the Algerian market by high performance liquid chromatography **Y. Boulmokh**, K. Belguidoum, H. Amira-Guebailia and O. Houache Laboratory of Applied Chemistry, 8 Mai 1945 Guelma University, **Algeria** and Petroleum & Chemical Engineering Department, Sultan Qaboos University, **Sultanate of Oman**	**Ms Yamina Boulmokh**

Board N°	**Session 2: Materials for Energy and Environment / Nano-scale Electronics, Energy & Environment (25th April 2014)**	
11	Pt-decorated MWCNTs and Pd-decorated MWCNTs for Volatile Organic compounds detection **H. Baccar**, A. Thamri, I. Hafaid, E. Llobet and A. Abdelghani Carthage University, Nanotechnology Laboratory, INSAT, Tunis, **Tunisia** and MINOS-EMaS, Universitat Rovira i Virgili, Avda, **Spain**	**Dr Hamdi Baccar**
12	Temperature effect on optical and electrical properties of ZnO nanoparticles synthesized by sol-gel method **K. Omri**, I. Najeh, R. Dhahri, J. El Ghoul and L. El Mir Laboratory of Physics of Materials and Nanomaterials Applied at Environment (LaPhyMNE), Gabes University, Faculty of Sciences in Gabes, Gabes, **Tunisia** and Al Imam Mohammad Ibn Saud Islamic University (IMSIU), College of Sciences, Department of Physics, **Kingdom of Saudi Arabia.**	**Mr Karim Omri**
13	Characterization of the GaAs-Based intermediate band solar cell with multistacked InAs/InGaAs Quantum dots **W. Rouis**, A. Sayari, M. Nouiri, M. Ezzedini, S. Rekaya, L. El Mir, L. Sfaxi and H. Maaref Laboratory of Micro-Optoélectronics and Nanostructures, University of sciences of Monastir/ Team Raman Spectroscopy, Department of Physics, Faculty of Sciences of Tunisia/Laboratory of Physics of Materials and Nanomaterials Applied at Environment (LaPhyMNE), Gabes University, Faculty of Sciences in Gabes/ Laboratoiry of Micro-Optoélectronics et des Nanostructures, University of Sousse, **Tunisia** and Al Imam Mohammad Ibn Saud Islamic University (IMSIU), College of Sciences, Department of Physics/ Department of Physics, Faculty of Science, King Abdulaziz University, **Kingdom of Saudi Arabia**	**Ms Wiem Rouis**
14	Photocatalytic degradation of 4-Nitrophénol with Cu doped Au@ZnO nanoparticles. **A. Fkiri**, B. Jamoussi and L. S. Smiri Unité de Recherche Synthèse et Structure de Nanomatériaux UR 11 ES30. Université de Carthage. Faculté des Sciences de Bizerte and Laboratoire de Chimie Analytique et Environnement. Institut Supérieur de l'Education et de Formation Continue, Université Virtuelle de Tunis, **Tunisia**	**Mr Anis Fkiri**
15	Synthesis of nano-silver/Polypropylene composite for biomedical applications **C. El Baher Dhafer**, Graceila Pavon- Djavid, A. Pellee and L. Smiri Research Unit: Synthesis and structure of nanomaterials, Faculty of Sciences of Bizerte, **Tunisia** and National Institut of Health and Medical Research INSERM 698 University of Paris 13, **France**.	**Ms Cyrine El Baher Dhafer**
16	Epitaxial pyroelectric thin films on silicon for thermal energy harvesting **R. Moalla,** L. Mazet, L. Louahadj, Q. Liu, J. Penuelas, B. Vilquin, G. Saint-Girons, C. Dubourdieu and R. Bachelet Institut des Nanotechnologies de Lyon, UMR CNRS 5270, Ecole Centrale Lyon, **France.**	**Ms Rahma Moalla**
17	Evaluation of physical parameters of localized states in nanoporous resin based on resorcinol-formaldehyde	**Dr Imededdine Najeh**

	I. Najeh, H. Dahmana , N. Ben Mansoura, A. Ahmed , L. El Mira, Laboratory of Physics of Materials and Nanomaterials Applied at Environment (LaPhyMNE), Gabes University, Faculty of Sciences in Gabes, **Tunisia** and Al-Imam Muhammad Ibn Saud University, College of Sciences, Departement of Physics, **Kingdom of Saudi Arabia**	
18	Design of new nanophotonic devices based on dielectric photonic bandgap heterostructures formed by the combination of periodic and quasi-periodic multilayer **Y. Bouazzi** and M. Kanzari Laboratoire de Photovoltaïque et Matériaux Semi-conducteurs (LPMS), Ecole Nationale d'Ingénieurs de Tunis, Université de Tunis El Manar, **Tunisia**	**Dr Yassine Bouazzi**
19	Surface Functionalization of Titanate Nanotubes with different Phenolic acids and their Photo-catalytic activity Darja Jaušovec, **Dr Mojca Božič**,1 Janez Kovač,2 Janez Štrancar,2 Vanja Kokol1 1University of Maribor, Institute for Engineering Materials and Design, Smetanova ul. 17, SI-2000 Maribor, Slovenia. vanja.kokol@um.si 2Institute Jozef Stefan, Laboratory of Biophysics, Jamova 39, SI-1000, Ljubljana, Slovenia	**Dr Mojca Božič**
20	Numerical modelling of V-groove quantum wire with application of coordinate transformation and finite difference method **A. Bouazra**, S. Abdi-Ben Nasrallah and M. Said Laboratoire de la Matière Condensée et des Nanosciences (LMCN), Département de Physique, Faculté des Sciences de Mo-nastir, 5019 Monastir, **Tunisia**	**Dr Adel Bouazra**
21	Dielectric properties of nickel doped zinc ferrite **B. Cherif**, E. Dhahri and K. Khirouni Laboratoire de Physique des Matériaux et des Nanomatériaux appliquée à l'Environnement, Faculté des Sciences de Gabès and Laboratoire de Physique appliquée, Faculté des Sciences, Université de Sfax, **Tunisia**.	**Ms Boutheina Cherif**
22	The study of the properties of silicon carbide layers with silicon nanocrystals. **R. Jemaï** , B. Rezgui, K. Zellama, K. Khirouni and S. Alaya. Laboratoire de Physique des Matériaux et des Nanomatériaux appliquée à l'Environnement, Faculté des Sciences de Gabès, Université de Gabès/ Laboratoire de Photovoltaique, Centre de Recherche et des Technologies, Bordj Cedria, Tunis, **Tunisia** and Laboratoire de Physique de la Matière condensée, Université de Picardie, Jules vernes, UFR des sciences d'Amiens, **France**	**Dr Raouia. Jemaï**
23	Effect of Nickel Concentration on Electrical Properties of Carbon-Silica-Nickel Nanocomposites H. Dahman, **S. Gouadria**, A. Alyamani and L. El mir Laboratory of Physics of Materials and nanomaterials applied at Environment (LaPhyMNE), Gabès University, **Tunisia** and National Nanotechnology Research Centre, KACST/ Al Imam Mohammad Ibn Saud Islamic University (IMSIU), **Kingdom of Saudi Arabia**	**Ms Soumaya. Gouadria**
24	Effect of solvent on the properties of ZnS films sputtered from nanoparticles for solar cells applications R. Mendil, **Z. Ben Ayadi**, M. Said, E. Hernandez and K. Djessas Laboratoire de Physique des Matériaux et des Nanomatériaux appliquée à l'Environnement, Université de Gabès, Faculté des Sciences de Gabès, **Tunisia,** Laboratoire Procédés, Matériaux et Énergie Solaire (PROMES-CNRS), TECNOSUD/ Université de Perpignan, **France** and Université de Djibouti, **Djibouti**.	**Prof Zouhaier Ben Ayadi**
25	Ab initio calculation of polarization, piezoelectric constants and elastic constants of InAs and InP semiconductors **C. Hajlaoui**, F. Raouafi, F. Ben Cheikh Laarbi and J-M. Jancu Faculté des sciences Tunis el Manar, laboratoire physico-chimie des microstructures et microsystèmes La Marsa, **Tunisia** and Université Européenne de Bretagne, INSA-RENNES, CNRS, UMR 6082, **France**	**Dr Chahira Hajlaoui**
26	Fractal Morphology of Lithium Iron Phosphate Particles for Use as Cathode in Lithium Ion Batteries. **Z. Cabán-Huertas**, O. Ayyad and P. Gómez-Romero 1Catalan Institute of Nanoscience and Nanotechnology, ICN2(CSIC-ICN) Campus UAB, Barcelona, **Spain**	**Ms Zahilia Cabán-Huertas**

27	Combustion Synthesis and Photoluminescence of Tb^{3+} doped $LaAlO_3$ nanophosphors A. Dhahri , **K. Horchani-Naifer** , A. Benedetti, F. Enrichi and M. Férid Laboratoire de Physico-chimie des Matériaux Minéraux et leurs Applications, Centre National des Recherches en Sciences des Matériaux, Technopole de Borj Cedria, **Tunisia** and Dipartimento di Scienze Molecolari e Nanosistemi, Università Ca' Foscari Venezia, **Italy**	**Dr Karima. Horchani-Naifer**
28	Fabrication of Nitrogen-Doped Nickel/Carbon Nanofibers as Non-Precious Catalyst for Alkaline Direct Methanol Fuel Cells **B. Thamer**, M. El-Newehy, N.. Barakat and,S. Al-Deyab Petrochemical Research Chair, Department of Chemistry, College of science, King Saud University, **Kingdom of Saudi Arabia** and Department of Organic Materials and Fiber Engineering, College of Engineering, Chonbuk National University, **South Korea**	**Mr Badr Thamer**
29	Stabilization of Negative Bias Illumination Stress Induced Instability on Electrical Characteristics of Amorphous Oxide Thin-Film Transistor Integrated with Plasmonic Filter **S. Chang**, Y. Seon Do, J-W. Kim, T. Kim, B-H. Choi, K. Cheol Choi and B-K Ju Department of Electrical Engineering, Korea University/ Department of Electrical Engineering, KAIST/ Electronic Materials and Module Team, Korea Institute of Ceramic Engineering and Technology, **Republic of Korea**	**Dr Seongpil Chang**
30	Band gap modifications of two-dimensional defected MoS_2 A.V. Krivosheev, V. L. Shaposhnikov, V.E. Borisenko, **J-L. Lazzari**, N.V. Skorodumova and B. K. Tay Belarusian State University of Informatics and Radioelectronics, **Belarus**, Centre Interdisciplinaire de Nanoscience de Marseille, CNRS – Aix-Marseille Université, Marseille, **France**, Royal Institute of Technology (KTH), **Sweden** and Nanyang Technological University, Singapore, **Singapore**	**Dr Jean-Louis Lazzari**
31	Evaluation of physical parameters of localized states in nanoporous resin based on resorcinol-formaldehyde I. Najeh, H. Dahman, N. Ben Mansour, A. Ahmed and L. El Mira Laboratory of Physics of Materials and Nanomaterials Applied at Environment (LaPhyMNE), Gabes University, Faculty of Sciences in Gabes, **Tunisia** and Al-Imam Muhammad Ibn Saud University, College of Sciences, Departement of Physics, **Kingdom of Saudi Arabia**	**Dr Imededdine Najeh**
32	MWCNTs decorated with $Mn_{0.8}Zn_{0.2}Fe_2O_4$ nanoparticles for removal of crystal-violet dye from aqueous solutions M.A. Gabal, E.A. Al-Harthy, **Dr Y. M. Al Angari** and M. Abdel Salam Chemistry department, Faculty of Science and Center of Excellence in Environmental Studies, King Abdulaziz University, **Kingdom of Saudi Arabia**	**Dr Yasser.M. Al Angari**
33	Substitution effect on structural, electrical and magnetic properties of $NiFe_{2-2x}Al_xCr_xO_4$ (x = 0-0.6) nano-crystalline ferrites via oxalate precursor route **M. Gabal**, A.Y. Obaid, M. Abdel salam and W.A. Bayoumy Chemistry department, Faculty of Science, King Abdulaziz University, **Kingdom of Saudi Arabia** and Chemistry Department, Faculty of Science, Benha University, **Egypt**	**Prof Mohamed Gabal**
34	Influence of sputtering power on the properties of thin layers of GZO for photovoltaic applications **H. Mahdhi**, Z. Ben Ayadi, J. L. Gauffier, K. Djessas and S.Alaya Laboratoire de Physique des Matériaux et des Nanomatériaux appliquée à l'Environnement, Faculté des Sciences de Gabès, **Tunisia.**	**Dr Hayet Mahdhi**
35	Effects of annealing temperatures on some physical properties of $CuInS_2$ sprayed films using Photothermal deflection **M. Znaidi**, I. Gaieda,D.Gherouel, M. Amloukb and N. Yacoubi Institut Préparatoire Aux Etudes d'Ingénieurs de Nabeul and Unité de Physique des Dispositifs à Semi-conducteurs, Faculté des Sciences de Tunis, **Tunisia**	**Mr. Mounir Znaidi**
36	Immune cells of *Mytilus galloprovincialis* and Nanotoxicity: Investigate exposure to ionic forms compared to nanosized forms of Titanium dioxide (TiO_2) and Nickel (Ni) **Y. Bouallegui**, R. Ben Younes and R. Oueslati	**Mr Younes Bouallegui**

	Unit of immunology-microbiology environmental and cancerogensis IMEC, University of Carthage, Sciences Faculty of Bizerta, Zarzouna 7021, Tunisia	

Board N°	Session 3: Materials for Energy and Environment / Nano-scale Electronics, Energy & Environment 26th April 2014	
1	Modeling Peaks Over a Threshold of El-Ham Basin River Using R, Algeria **F. Belagoune**, D. Boutoutaou and K. Rahmani University of Ouargla and,University of Batna, **Algeria**	**Mr Fares Belagoune**
2	Hydrogen produced by steam reforming for use steel. **M. Kahalerras**, M. T. Abedghars, Z. Zarour and S. Boulekroune. Welding and NDT Research center (CSC) / Unit for Applied Steel and Metals. URASM /CSC-Annaba, **Algeria**.	**Mr Mounir Kahalerras**
3	Absorption amelioration in organic solar cells using trilayer anode **H; Djedjiga** and MS. Belkaid Laboratory of Advanced Technologies of Electrical Engineering (LATAGE), Faculty of Electrical and Computer Engineering, Mouloud Mammeri University (UMMTO), **Algeria.**	**Mr Hatem Djedjiga**
4	Modeling and Simulation of Radial Piezoelectric Transducer **S. Rouabah**, A.Chaabi and T.Mordjana Departement of Electronique, Laboratory of Hyperfrequencies and Semi-conductor (LHS), University Constantine 1, **Algeria**	**Ms Sawsen Rouabah**
5	Electrochemical preparation process of Mg-La alloys for solid hydrogen storage **M. Sahli**, K. Chetehouna, F. Faubert, N. Bellel and N. Gascoin Laboratoire de Physique Energétique, Université de Constantine 1, Algeria and INSA Centre Val de Loire, Univ. Orléans, PRISME/ Univ. Orléans, GREMI, UMR 7343, **France**	**Mr Mounir. Sahli**
6	Effect of Nickel doping on the electrical properties of Molybdenum doped ZnO thin film. **T. Larbi**, Ouni, A. Boukachem and M. Amlouk. Unité de physique des dispositifs a semi-conducteurs, Faculté des sciences de Tunis, **Tunisia.**	**Mr Tarek Larbi**
7	Detection of adulteration of extra virgin olive oil with pomace olive oil by Fourier transform infrared spectroscopy **S. Nigri** and R. Oumeddour Département des sciences de la matière, Faculté des MISM, and Laboratoire d'Analyses Industrielles et Génie des Matériaux, Université de Guelma, **Algeria**.	**Dr Soraya Nigri**
8	Cyclic voltammetry for the study of the effect of a plant ex-tract as a brightener for nickel deposits **H. Belbah**, H. Amira-guebailia andM.A. Affoune Laboratory of Applied Chemistry and Laboratory of Industrial Analyses and Materials Engineering, 8 Mai 1945 Guelma University, **Algeria**	**Mrs Hayet Belbah**
9	Effect of Phase Change Materials (PCMs) on the hydration reaction and kinetic of PCM-mortars **Ms Sarra Drissi**, Anissa Eddhahak2, Sabine Caré3, Jamel Neji1 Université Tunis El Manar- Laboratoire de Matériaux, d'Optimisation et d'Energie pour la Durabilité, LAMOED- Ecole Nationale d'Ingénieurs de Tunis, **Tunisia,** Université Paris-Est - Institut de recherche en constructibilité/ Université Paris-Est, Laboratoire Navier (UMR CNRS - IFSTTAR - ENPC), IFSTTAR, **France**	**Ms Sarra Drissi**
10	The unification of the four cosmic forces - Energy attraction **Dr. Mostafa Korany**, Ministry of Scientific Research, **Egypt**	**Dr. Mostafa Korany**
11	Kinetic study of oxidation of phenol by tyrosinase d'agaricus bisporus **S. Leboukh**, H. Gouzic, A. Namaned and A. Hellale Laboratoire d'Electrochimie et Chimie Analytique, Département de Chimie, Faculté des Sciences, Université Abou Bekr Belkaid, Welding and NDT (CSC), Laboratoire de Chimie Organique, Substances Naturelles et Analyse (COSNA), Département de	**Ms Saida Leboukh**

	Chimie,Faculté des Sciences, Université Abou Bekr Belkaid and Laboratoire des Sciences et Techniques de l'Environnement, Ecole Nationale Polytechnique, El Harrach, **Algeria**	
12	Substrate type effect on the electrical behavior of ZnO:In/PS/Si(n/p) solar cell structures **H. Belaid**, M. Nouiri, Z. Ben Ayadi, K. Djessas and L. El Mir Laboratory of Physics of Materials and Nanomaterials Applied at Environment (LaPhyMNE), Gabes University, Faculty of Sciences in Gabes, **Tunisia**, Laboratoire de Mathématiques et Physique des Systèmes (MEPS), Université de Perpignan, **France** and Al Imam Mohammad Ibn Saud Islamic University (IMSIU), College of Sciences, **Kingdom of Saudi Arabia**	**Mrs Houda Belaid**
13	An energy analysis of a combined refrigeration cycle **K. Megdouli**, M. Elakhdar, E. Nehdi and L. Kairouani Unité de Recherche Energétique et Environnement, Ecole Nationale d'Ingénieurs de Tunis, **Tunisia**	**Ms Karima Megdouli**
14	Complex impedance diagram of Si by Electro-PyroElectric (E.P.E.) technique **N. Bennaji**, I. Mellouki and N. Yacoubi U.R. Photopyroelectric, IPEIN, **Tunisia**	**Mrs Najoua. Bennaji**
15	Analysis of Zn, Cd, As, Cu, Pb and Fe in snails shells as bioindicators and soil samples near traffic road by ICP-OES **A. M. Massadeh**, A. A. Alomary, I. F. Al-Momani, S. Mir, F. A. Momani, H. I. Haddad, Y. A. Hadad and A. M. Batieha Department of Medicinal Chemistry and Pharmacognosy, Faculty of Pharmacy/ Department of Applied Biological Sciences , Faculty of Science, Jordan University of Science and Technology/ Department of Chemistry, Faculty of Science, Yarmouk University, **Jordan**	**Prof Adnan M. Massadeh**
16	Effect of copper to indium atomic ratio on physical properties of Cu-In-S thin films for photovoltaic applications **N. Khemiri** and M. Kanzari, Laboratoire de Photovoltaïques et Matériaux de Semi-conducteurs- ENIT and Institut Préparatoire des Etudes d'Ingénieurs- Université de Tunis El Manar, **Tunisia**	**Dr Naoufel Khemiri**
17	Study and Characterization of porous copper oxide produced by electrochemical anodization for radiometric heat absorber **S. Ben Salem**, Z. Ben Achour, K. Thamri and O.Touayar Reaserch Team of «Métrologie des Rayonnements Optiques et Thermiques» Reaserch Laboratory Materials, Measurement and Applications : Institut National des Sciences Appliquées et de Technologie, **Tunisia**.	**Ms Sonia Ben Salem**
18	Thermal properties of GaSb by the new Electro-PyroElectric (E.P.E.) technique **I. Mellouki**, A. Mami, N. Bennaji and N. Yacoubi Institut Préparatoire aux Etudes d'Ingénieur de Tunis - IPEIT AND U.R. Photopyroelectric, IPEIN- **Tunisia**	**Mrs Imen. Mellouki**
19	Minority carrier lifetime and internal quantum efficiency improvement of gettered multicrystalline silicon based solar cells **L. Derbali** and H. Ezzaouia Photovoltaïc laboratory, Research and Technology Center of Energy, Technopôle de Borj-Cédria. BP 95 Hammam-Lif 2050, **Tunisia**	**Dr Derbali Lotfi**
20	Modeling and Simulation of AlGaAs/InGaAs Tandem Solar Cell **S. Slimani** and B. Djellouli University of Saida, Algeria,Department of Electronic, Faculty of Science and Faculty of Electrical and Computer Engineering Mouloud Mammeri University (UMMTO), **Algeria**	**Mrs Slimani Samia**

Nanotechnology Workshop
Nanotech MEET Tunisia 2014 Conferences and Exhibitions
24 – 26 April 2014, Royal Hotel, Hammamet - Tunisia

This Nanotechnology workshop consists in a series of short courses that will educate participants in a range of technologies through a 2 days Intensive Program. This course focuses on all the essential aspects in this rapidly growing field.
All courses are presented by leading experts in their fields of expertise. Participation includes Course Notes and a Networking coffee and Lunch with the instructors and experts.

Who Should Attend

These courses are a must for all beginners as well as experts interested in rapidly growing applications of Nano materials. They are suitable for: Graduate, Master and PhD students, Academic researchers, Managers, Practicing Engineers, Industrial Scientists and Decision/Policy Makers with some technical background.

Tutorials program

Day	Tutor	Timing	Tutorial title
24th April 2014	**Prof Adnen Mlayeh**, Paul Sabatier University and CNRS Toulouse **France**.	11.15- 12.30	Metal nanoparticles properties
		15.00- 16.30	Plasmonics for biomedical and energy applications
	Dr Renata Lewandowska, Raman Applications Manager HORIBA Scientific, **France**.	16.30-18.00	Tip- Enhanced Raman spectroscopy
25th April 2014	**Dr. Jorge M. Garcia**, Director of the Instituto deMicroelectronica de Madrid, CSIC, **Spain**.	10.30- 11.30	Graphene synthesis and properties
	Prof Michael Stocker, Chief Scientist at SINTEF Materials and Chemistry, **Norway**	11.30- 12.30	Nanomaterials and Water Purification: Opportunities and Challenges
	Prof. Axel Lorke, Faculty of Physics and CeNIDE, University of Duisburg-Essen-**Germany**	15:00- 16:00	Size Effects in Nanostructures
	Prof. Didier Letourneur, INSERM U 698, X. Bichat hospital, Paris University Paris Diderot and Paris Nord, **France**	16:00- 17:30	Nanomaterials for Bio-applications/ tissue engineering

NB :

- **Workshop courses will be done in the “Luxor” room.**
- **All the workshop participants are also invited to attend the plenary talks of the Nanotech MEET Tunisia 2014 held in parallel to this tutorial.**

Advanced Materials, Fabrication, Characterization & Tools

MBE growth of Quantum nanostructures for optoelectronics

Jorge M. García[1,2,*], Sheng Wang[2], Annette Plaut[3], Ulrich Wurstbauer[2], Aron Pinczuk,[1,2] Jose M. Ripalda[1], Daniel Granados[1], Benito Alen[1], Yolanda González[1], Luisa González[1]
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[3]University of Exeter, Exeter, UK.

Keywords: Self assembled nanostructures, QR, QD, QWR, MBE, Graphene

Molecular Beam Epitaxy (MBE) is a powerful technique for the fabrication of several self-assembled III-V nanostructures such as quantum rings, quantum dots, (Garcia 2013) and quantum wires that can cover a wide range of the spectrum from 0.98 μm to 1.6 μm (fig. 1).

The possibility of performing *in-situ*, *real-time*, measurements of accumulated stress ($\Sigma\sigma$) during growth of these nanostructures enables to achieve a deep understanding of the growth processes. For example, whereas quantum rings (QR) formation is crucially linked to the presence of liquid indium on the surface (Granados 2003), quantum wires (QWR) are produced (Garcia 2001) as an effective way of relaxing a large asymmetrical accumulated stress present on the sample (fig. 2).

This information allows to have powerful tools to finely tune the optoelectronic properties of these self-assembled nanostructures by controlling their size and shape.

Furthermore, the capability of tracking $\Sigma\sigma$ during growth is used to engineer strain compensated structures like multilayer quantum dot solar cells (Alonso-Alvarez 2011).

Recent progress (Fig. 3) in the growth of Graphene by MBE will also be discurssed (Garcia 2012).

References:

Garcia, J.M. et al. (2013), 0D Band Gap Engineering by MBE Quantum Rings: Fabrication and optical properties. Physics of Quantum Rings. Springer, Fomin, Vladimir, (Ed.). ISBN 978-3-642-39196-5

Granados, D. and Garcia, J.M., (2003), In(Ga)As self-assembled quantum ring formation by molecular beam epitaxy. *App. Phys. Lett.* 82, 2401-2403.

Garcia, J.M., et al. (2001), InAs/InP(001) quantum wire formation due to anisotropic stress relaxation: in situ stress measurements. *J. of Crys. Growth.*, 227, 975-979.

Alonso-Alvarez, D. et al. (2011). Strain Balanced Epitaxial Stacks of Quantum Dots and Quantum Posts, *Ad. Mat.*, 23, 5256-5261.

Garcia, J.M., et al. (2012), Graphene growth on h-BN by molecular beam epitaxy, *Sol. State Comm.*, 152-12, 975-978.

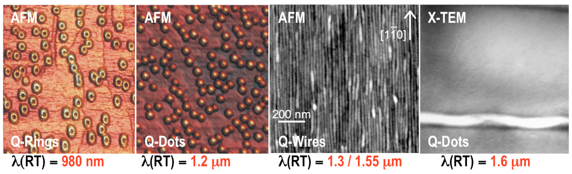

Figure 1: Various self-assembled nanostructures covering a wide range of the spectrum from 0.98 to 1.6 micron emission at RT.

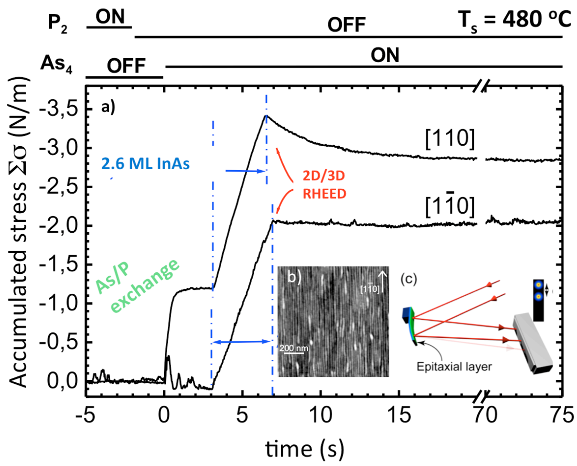

Figure 2: In-situ, real-time measurements of accumulated stress are crucial for a deep undertanding of the formation mechanisms.

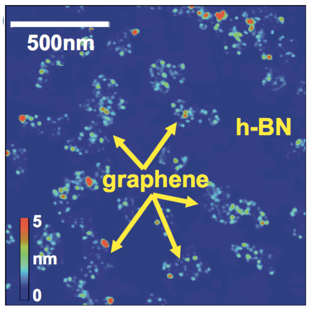

Figure 3:MBE growth of graphene nanodomains on h-BN.

Aknowlegments: N000140610138, FA9550-11-1-0010, DE-SC0001085, CHE-0641523, NYSTAR, CSIC-PIF200950I154,S2009ESP-1503, S2009ENE-1477 and AIC-B-2011-0806, MAT2011-26534.

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Synthesis of Nitrogen-Doped Porous Carbon Nanofibers: Effect of Their Texural Properties on Oxygen Reduction Reaction

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Abstract: Discovery of efficient catalytic materials for oxygen reduction reaction (ORR) plays an important role in the industrial development of fuel cells. Till date, the most efficient catalysts for ORR have been still platinum-based materials (Fang *et al*., 2009). However, these catalysts have not been practically applicable in industrial level because of high cost of platinum, its limited supply, and its sluggish ORR in cathode. Hence, in recent years research in this field focuses not only on non-precious-metals, but also metal-free doped-catalysts for ORR (Yu *et al.*, 2010). In particular, heteroatom-doping is an effective way to tune electric, chemical and catalytic properties of carbonaceous materials and thus plays a key role in the enhanced electrocatalytic performance of the heteroatom-doped carbon materials compared to their undoped counterparts (Yang *et al*., 2012). Nitrogen-doped carbons have been reported as a possible alternative to Pt-based catalysts for oxygen reduction (Yang *et al*., 2014).

In this work, we have prepared carbon nanofibers using electrospinning of PAN solution followed by carbonization. Later, the N-containing carbon fibers with porosity were prepared by co-spinning PAN with poly (ethylene oxide) (PEO) as a porogen, and the porosity was tuned by changing the concentration of PEO. The surface morphologies of these fibers are shown in Figure 1b – d. As we carbonize the polymer fibers, PEO decomposes completely, and the carbon fibers are formed from PAN. C-PAN fibers show virtually little porous nature on the surface of the fibers. As the concentration of the PEO increases, the porous nature also increases. In C-PEOPAN-21 (Figure 1d), the porosity is so high that the nature of the fiber form itself get destructed. The porosity can be tuned by changing the relative amount of PEO.

Some of key issues of oxygen reduction reaction (ORR) are addressed in terms of nitrogen content, porosity, and electrical conductivity in the N-containing carbon nanofibers. A medium porous sample prepared with 1:1 ratio of PEO to PAN by carbonization at 1000 ℃ is found to reveal best ORR performance, which is explained in terms of trade-offs between electrical conductivity, nitrogen content and surface properties.

Keywords: Nitrogen doping, porous carbon nanofibers, electrospinning, electrical conductivity, oxygen reduction reaction, fuel cell

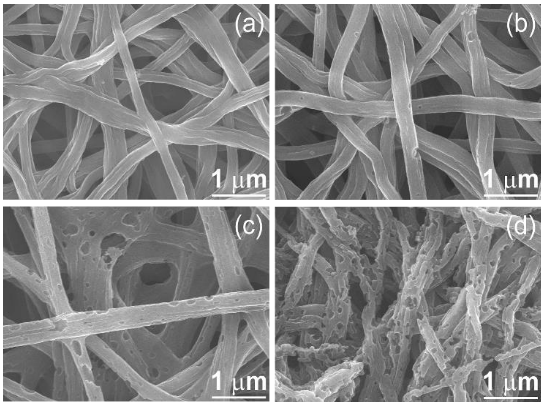

Figure 1. SEM images of carbon fibers prepared from precursor solutions of (a) pure PAN, (b) PEO/PAN in 1:2 ratio, (c) PEO/PAN in 1:1 ratio and (d) PEO/PAN in 2:1 ratio at 1000 ℃

References:

Fang, B., Chaudhari, N. K., Kim, M.-S., Kim, J. H., Yu, J.-S. (2009), Homogeneous deposition of platinum nanoparticles on carbon black for proton exchange membrane fuel cell, *J. Am. Chem. Soc.*, 131, 15330-15338.

Yu, J. -S., Kim, M. S., Kim, J. H. (2010), Combinatorial discovery of new methanol-tolerant non-noble metal cathode electrocatalysts for direct methanol fuel cells *Phys. Chem. Chem. Phys*., 12,15274-15281.

Yang, D.-S., Bhattacharjya, D., Inamdar, S., Park, J., Yu, J. -S. (2012), Phosphorus-Doped Ordered Mesoporous Carbons with Different Channel Lengths as Efficient Metal-Free Electrocatalysts for Oxygen Reduction Reaction in Alkaline Media *J. Am. Chem. Soc.*, 134, 16127-16130.

Yang, D.-S., Chaudhari, S., Rajesh, K. P., Yu, J.-S. (2014), Preparation of nitrogen-doped porous carbon nanofibers and the effect of porosity, conductivity, and nitrogen content on their oxygen reduction performance." *ChemCatChem*, 6, In Press.

Synthesis and characterizations of sol-gel Ag-doped ZnO nanostructured thin films for optoelectronic applications

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Abstract: Metal oxides thin films have been made by a variety of methods. Among them, the sol-gel route (Touam *et al*.; 2013, Djouadi *et al*.; 2012) has emerged as one of the most promising and widely used technique to produce thin, transparent and homogenous films of many compositions on silicon and glass. In this paper, we report the study of the physical and optical properties of undoped and silver-doped zinc oxide (ZnO) thin films synthesized by sol-gel method. Zinc acetate dihydrate, ethanol and monoethanolamine are used as precursor, solvent and stabilizer, respectively. In the case of doped films, silver nitrate is added to the precursor solution with an atomic percentage equal to 1, 2, 3, 4 and 5 at.% Ag. The multi thin layers are deposited by dip-coating onto glass substrates with a controlled withdrawal speed, and are transformed into ZnO upon annealing at 500 °C for 1 hour. The structural, morphological, optical and electrical properties of the thin films as a function of silver concentration have been investigated using X-Ray Diffraction (XRD), Scanning Electronic Microscopy (SEM), Atomic Force Microscopy (AFM), UV-visible spectrophotometer and four points probe technique. XRD spectra have shown that undoped thin film exhibit (101) orientation while doped ones display a strong c-axis orientation. SEM micrographs and AFM images have revealed that grain sizes and root mean squared roughness (R_{rms}) decrease with increasing silver up to 4% concentration, then increases for 5 at.% Ag . The UV-visible transmittance results (Figure 1) show a high transparency in the visible range which increases with increasing Ag percentage up to 4%, then decrease for ZnO:Ag 5%. The electrical measurement have revealed that the films resistivity decrease with increasing silver percentage (Figure 2). The electrical and optical results demonstrate that the ZnO thin films doped with 4 at.% Ag can be well adapted for optoelectronic applications.

Keywords: Ag-doped ZnO, sol-gel thin film, atomic force microscopy, electrical properties, UV-visible transmittance, optoelectronics applications.

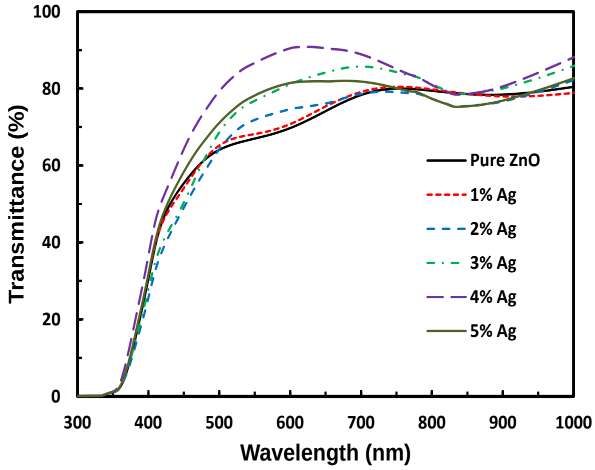

Figure 1: Transmittance spectra of Ag- doped ZnO thin films.

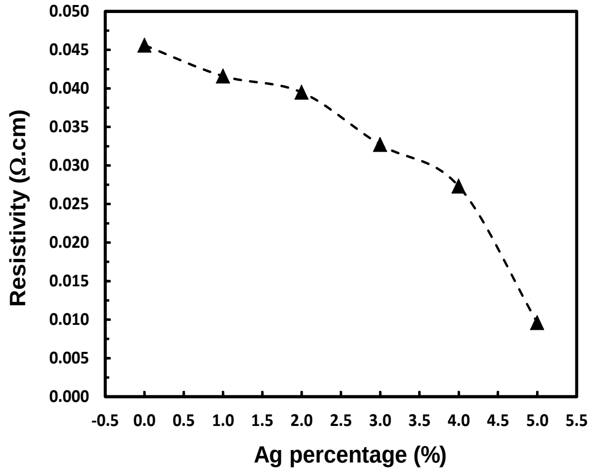

Figure 2: Transmittance spectra of Ag- doped ZnO thin films.

References:

Touam, T., Znaidi, L., Vrel, D., Kuznetsova, I. N., Brinza, O., Fischer, A., Boudrioua, A., (2013) Low loss sol-gel TiO_2 thin films for waveguiding applications, Coat. 3, 49-58.

Djouadi, D., Chelouche, A., Aksas, A., (2012) Amplification of the UV emission of ZnO: Al thin films prepared by sol-gel method, J. Mater. Environ. Sci., 3, 585-590.

Biocatalytical Modifications of NanoCellulose Surface and potential Applications

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Abstract: Cellulose nanofibers (CNFs) and nanocrystals have been receiving a great importance in the last decade due to their light weight, high aspect ratios as well as being renewable, sustainable and biodegradable nanomaterial. Moreover, the chemical structure of the cellulose molecule enables the creation of new functional groups or even introducing new molecules, which additionally governs the CNFs properties and broadens their application. Usually, chemical methods are applied, where mainly toxic reagents and organic/ionic solvents are used, leading also to partial or total disruption of the original material. Thus, preserving the integrity of the original morphology of CNFs, avoiding any polymorphic conversion and maintaining their native crystalline structure remain highly challenging (Habibi, 2014).

In the contribution, three recently developed bio-catalytically induced strategies for region-selective modification of CNF surfaces will be presented as substrate-specific, ecologically-friendly and not-aggressive alternative to chemical approaches (Figure 1), presenting also some of their functional properties and potential applications:

i) the oxidation of primary hydroxyl groups on the CNFs using laccase/TEMPO system in combination with different post-treatment step-s will be shown to enable the formation and tuning of aldehyde *vs.* carboxyl functional groups (Jaušovec, *submitted*), showing high and selective ion-adsorption ability being used in wastewater cleaning;

ii) the phosphorylation of CNFs using hexokinase-mediated reaction, showing flame-resistance, highly ion-adsorbing and hydroxyapatite-growth induced properties, being used in water purification, biocomposites and biomaterials development (Božič, *submitted*);

iii) the hydrophobization/acylation of CNFs using lipase in organic solvent performed with/without of $scCO_2$, showing protein adsorption *vs.* anti-adhesive ability being exploited in filters and biocomposites development.

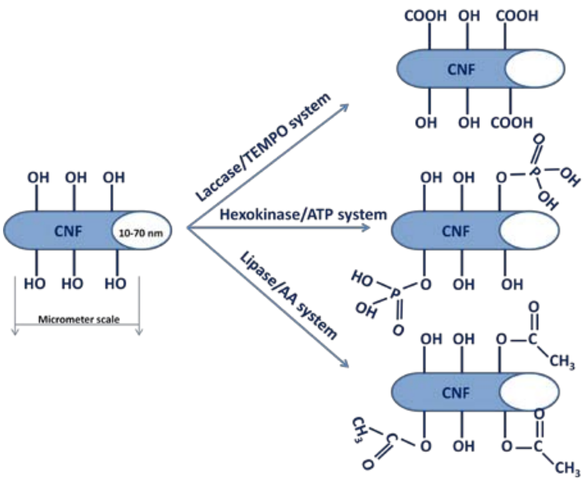

Figure 1: Schematic illustration of different biocatalytic strategies for modification of CNF surfaces, i.e. carboxylation, phosphorylation and acetylation.

Keywords: cellulose nanofibers, biocatalysis, carboxylation, phosphorylation, acetylation; applications.

Acknowledgment: The research leading to these results has been funded from the EU 7FP under the grant agreement NMP4-SL-2012-280519-NanoSelect (http://nanoselect.eu/). The authors are also grateful to Prof. Dr. Aji P. Methew from the Luleå University of Technology in Sweden for providing the CNFs.

References:

Habibi, Y. (2014) Key advances in the chemical modification of nanocelluloses, *Chem. Soc. Rev.*, Advance Article.

Jaušovec, D., Vogrinčnič, R., Kokol, V. Introduction of aldehyde *vs.* carboxylic groups to cellulose nanofibers using laccase/TEMPO mediated oxidation, and formation of hemiacetal linkages, *Carbohydr. Polym.*, submitted.

Božič, M., Liu, P., Mathew, A.P., Kokol, V. Enzymatic phosphorylation of cellulose nanofibers to new highly-ions adsorbing, flame-retardant and hydroxyapatite-growth induced natural nanoparticles, *Cellulose*, submitted.

Few Layer Graphene on Copper Substrate Developed By Atmospheric Chemical Vapor Deposition

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ABSTRACT

Advances in the graphene research has attracted the scientists because of its interesting and unique properties. Graphene is a two-dimensional material with high surface area, electrical conductivity, high flexibility, and better mechanical strength. It is alo providing single-atom-thick substrate for functional nanomaterials' growth [1-5]. Chemical vapor deposition (CVD) technique is one way to synthesize graphene on the metal substrates. The CVD method is inexpensive and resulting in high quality graphene on large area. The synthesiszed graphene can be coated on other appropriate substrates for specific application. In this research work, standard copper foil was used as a catalyst for the graphene growth [6].

In the graphene growth experimental procedure, we used 9 µm thick Cu foil (99.99%, MTI-USA) as the substrate. The Cu foil samples where cleaned ultrasonically in acetone, ethanol and double distilled water. The cleaned samples were loaded into the CVD system. To avoid oxidation of the loaded Cu samples at 950 C for 40 min, ambient gas atmosphere were maintained which involves hydrogen (H_2) (99.99%) and argon (Ar) (99.99%). Methane (CH4) (99.99%) precursor gas was flown for 10 min. The CVD system was cooled down to room temperature naturally. The resulted product was characterized by X ray diffraction (XRD), Scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy (AFM) and Raman microscopy. The SEM results show that the grain size of the resulting graphene obtained was found to 70 microns (Fig. 1).

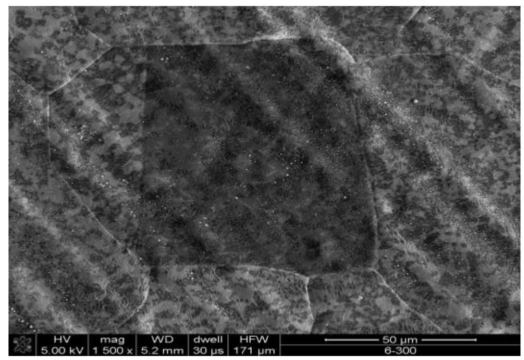

Fig. 1. A representative SEM image of the

Acknowledgement

The authors would like to acknowledge King Abdulaziz City for Science and Technology for funding this work.

References:

1. S. Garaj, W. Hubbard, A. Reina, J. Kong et. al., Nature 467 (2010) 190.
2. S. Stankovich, D.A. Dikin, G.H.B. Dommett et. al., Nature 442 (2006) 282.
3. A.K. Geim, Graphene: Status and Prospects, Science 324 (2009) 1530.
4. X.S. Li, W.W. Cai et. al, Science 324 (2009)1312.
5. J.R. Miller, R.A. Outlaw, B.C. Holloway, Science 329 (2010) 1637.
6. Z. G. Wang, Y. F. Chen, P.J. Li et. al., Vacuum 86 (2012) 895-898

Growth and optical characterization of vertically stacked and electronically coupled InAs/InGaAs/GaAs QDs hetero-structures intermediate-band solar cells

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Abstract: We report optical and spectral response characteristics of GaAs p-i-n solar cells containing vertically multi-staked and electronic coupled InAs/InGaAs/GaAs quantum dot (QDs) heterostructures (Figure 1). The samples were grown by Solid-Source Molecular Beam Epitaxy (SS-MBE) and investigated via photoluminescence (PL) and photocurrent (PC). Distinctive double-emission peaks are observed in the PL spectra of the samples. From the excitation power-dependent and temperature-dependent PL measurements, these emission peaks are associated to the ground-state transition from InAs QDs with two different size populations. In addition, a significant energy red-shift in the PL spectra was observed as the number of the QDs layer was increased . This red shift can be attributed to the combination of many effects, such as: the increase in the sizes of InAs QDs caused by strain field coupling and/or the formation of a mini-band caused by the electronic coupling in the vertical direction. Moreover, solar cells containing quantum dots show a broader photo-response spectrum at longer wavelength into the near-infrared range extending up to 1250 nm. In addition, the spectral response increases as the number of stacking layer increase.

Keywords: InAs/InGaAs/GaAs**,** molecular beam epitaxy, vertical coupled quantum dots intermediate band solar cells

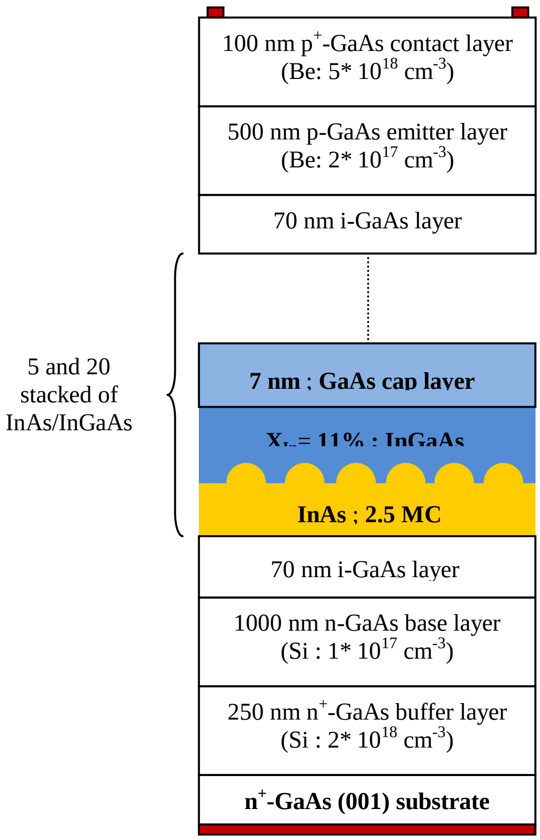

Figure 1: Schematic layer structure of samples

Production of Pure Nano-Iron by using ball milling machine, chemical batch reactor and K-M Micro reactor

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Abstract

In this study, pure nano iron was formed by two techniques: top to down and bottom up technique .top to down including production of nano iron by using ball mill machine and bottom up including two methods batch and K-M micro reactor. Different techniques were used for investigation and characterization of the produced nano iron particles such as SEM, XRD, UV, TEM and PSD. The produced Nano particle using micro mixer showed better characteristics than those produced using batch reactor and ball mill in different aspects such as homogeneity of the produced particles, particle size distribution and size, as 10nm particle size were obtained. The results showed that 10 nm core diameter were obtained using Micro mixer as compared to 200 nm and 1200 nm core diameter using batch reactor and ball mill respectively.

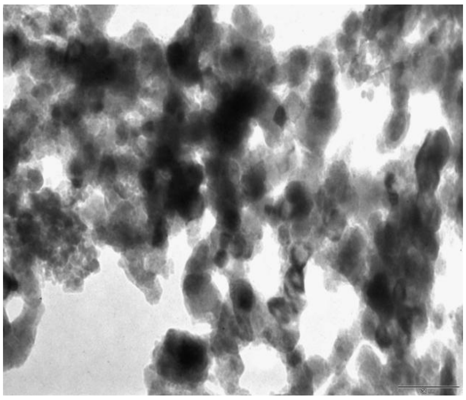
References

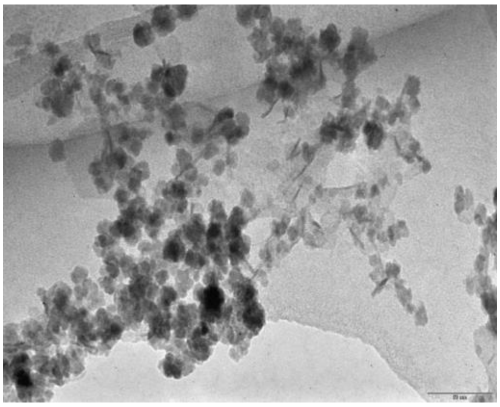
[1] H.Nagasawa, N. Aoki, K.Mae, Design of a New Micromixer for Instant Mixing Based on the Collision of Micro Segments, Chemical Engineering Technology, 28, p. 324-330, (2005).

[2] M.Allabaksh, B.Mandal, M.Kesaral, et al, Preparation of Stable Zero Valent Iron Nanoparticles using Different Chelating Agents, Journal of Chemical and Pharmaceutical Research, 2(5), p.67-74 (2010).

[3] Y.Li,Z.Jin,T.Li,Z.Xiu, One-step Synthesis and Characterization of Core-Shell Fe @SiO_2 @ Nanocomposite for Cr(VI) Reduction , Science of Total Environment ,Elsevier,p.260-266 (2012).

Figures





TEM images of Nano iron by using K-M Micro reactor

Plasmonics boosts Nanotechnology

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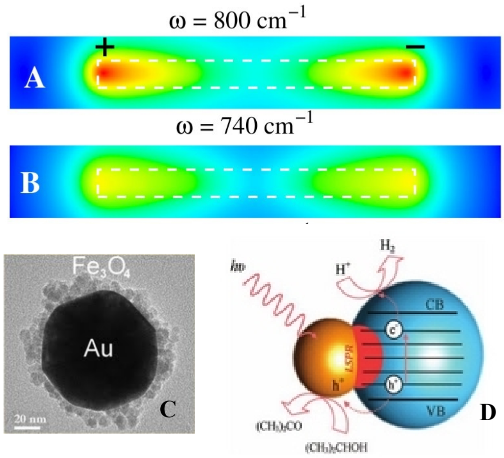
Abstract: Electron-electron interactions in metals, combined with dielectric surface discontinuity, are responsible for the appearance of strongly localized collective electronic excitations, the so-called surface plasmons. Surface plasmons have been predicted by Ritchie [1], in the theoretical framework of the hydrodynamical Bloch equations, and proven experimentally by Powell and Swan [2] using electron energy loss spectroscopy. Since then, owing to the strong progress in top-down surface patterning techniques (focused ion beam milling, e-beam lithography) and chemistry-based bottom-up synthesis routes, there has been a rise of theoretical and experimental studies of the optical properties of metal nanoparticles [3]. The interest lies in the fact that surface plasmons open a way to the engineering of the light confinement, guidance, absorption and scattering with an unprecedented degree of precision and integration. As a matter of fact, with the same metal, for instance gold, light absorption can be tuned from the green region of the visible spectrum to the far infrared simply by changing the size and/or the shape of the metal nanoparticle, as well as its environment [4]. Moreover, because of the localized nature of the surface plasmons, light can be confined to a volume as small as a few nanometer cube, thus strongly enhancing the local electromagnetic field intensity. These basic idea have let to a new way of thinking optics. Plasmonics is a branch of nano-optics that focuses on the light-matter interaction in metal nanoparticles and nanostructures [3].

In this talk, I will first introduce the fundamental aspects of plasmonics, and describe a variety of experimental techniques that allowed to gain a deep understanding of the physics of surface plasmons. Then, I will discuss how research in plasmonics could be translated into technological applications. Healthcare and lifesciences are the main application sectors of nanotechnology which is incorporated into medical products and also into treatments of fatal diseases. In particular, metal nanoparticles can efficiently absorb and scatter light and are therefore excellent candidates for cell-imaging-based diagnosis and treatment using the photo-thermal conversion of electromagnetic energy into heat. A strategic sector, for the world-wide economies, is the production, the storage and the distribution of energy. In particular, the jump from the Carbon era to the Hydrogen era is a challenging task, currently addressed in several research labs. Hybrid metal/semiconductor nanoparticles may help to bridge the gap for the efficient and low-coast production of hydrogen. I will discuss, current research devoted to the synthesis of nanoparticles with high quantum efficiency and photocatalytic properties. I will finally give some concluding remarks.



(A, B) Electric field distribution in a plasmonic-phononic hybrid system for far-infrared light havesting (after reference 5). **(C)** plasmonic-magnetic Au-Fe3O4 hybrid nanoparticles (collaboration with Pr. Leila Smiri, Bizerte Faculty of Science, after reference 6). **(D)** Plasmonic-semiconductor hybrid Au-TiO2 nanoparticles for photocatalytic water splitting, collaboration with Pr. Ming Yong Han, IMRE Singapore, After reference 7).

References:

[1] Ritchie R.H., *Plasma losses by fast electrons in thin films,* Physical Review B 106 (1957)
[2] Powell J.C. and Swan J.B., *Origin of the electron energy losses in aluminum*, Physical Review B 115, (1959)
[3] Ch. Girard, *Near-Fields in Nanostructures,* Rep. Prog. Phys. 68, 1883 (2005)
[4] Bohren and Huffman, *absorption and scattering of light by small particles*, Wiley GmbH (2004)
[5] R. Marty, A. Mlayah, A. Arbouet, Ch. Girard and S. Tripathy, *Plasphonics : local hybridization of plasmons and phonons,* Optics Express 21, 4551 (2013)
[6] A. Mezni, I. Balti, A. Mlayah, N. Jouini, and L. Samia Smiri, *Hybrid Au–Fe3O4 Nanoparticles: Plasmonic, Surface Enhanced Raman Scattering, and Phase Transition Properties*, J. Phys. Chem. C, 117 (31) (2013)
[7] Z. W. Seh, S. Liu, M. Low, S. Y. Zhang, Z. Liu, A. Mlayah and M.-Y. Han, *Janus Au-TiO2 Photocatalysts with Strong Localization of Plasmonic Near-Fields for Efficient Visible-Light Hydrogen Generation*, Advanced Materials 24, 2310 (2012)

Innovative cryogenics for high resolution scanning probe microscopy

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Abstract: Scientific research at large and nanoscience in particular has enormously benefited from the use cryogenics since the first liquefaction of helium [1] by Kamerling Honnes and his team in 1910. Much of the semiconductor and laser technology we are profiting from today was first investigated at low temperatures. Novel materials show exotic magnetic phases that have the potential to be central to high density information storage and processing, Quantum information technology is testing its concepts for the future on solid state systems that are cooled at low enough temperatures to insure the quantum coherence of entanglement and superposition of states. Single molecule optical spectroscopy developed in that late nineteen eighties was only possible at cryogenic temperatures. Even in biology, fields such as cryobiology are developing rapidly. Here cryogenics is required to freeze viral development in cell nuclei in order to study them under electron as well as fluorescence microscopy and this in such a way that the structures rich in water do not change appreciably through the cooling process. A key word search in google scholar shows that number of publications involving directly and indirectly research under cryogenic environment has been growing at a rate of about 30% a year during the past five decades and keep growing. Yet, until very recently nanoscience laboratories using cryogenic temperature below 77 K generally not only required having experts and trained technical staff to operate the dedicated cryostats, but also demanded muh logistic and administrative efforts, security training and finances just to operate such type of equipment. In short, these systems are not at all "press-button". Alternatives already exist in various forms. They have in common that they operate in closed cycle, very much like a kitchen refrigerator, but with extremely demanding specification in terms of ultimate cooling. These systems are also called "dry cryostat" because they do not necessitate the transfer of liquid cryogens from a delivery tank. These closed-cycle cryostat alternatives made their way slowly in the labs but remain at large unattractive for most in nanoscience applications such as in high resolution scanning probe microscopies of various type. This is because their operation is accompanied by mechanical vibrations in the tens of micrometer amplitude range due to the very action of cooling. Even if one accepted the inherent limitation of vibrations, these type of equipment are far from being user friendly, in fact they are very noisy, they necessitate separate vacuum pumps and gas handling procedures, making them everything but a "press-button" type of instrument.
In this presentation I will review results of years of instrumental developments in our research labs in attocube that enabled us to pioneer high resolution scanning probe microscopy in ultra-low vibration closed-cycle cryostats. Applications involving magnetic force microscopy on magnetic materials as well as confocal optical spectroscopy of quantum dots and graphene will be presented. Also the latest development in miniaturized positioning sensing interferometry for sample accurate positioning and position control in extreme environment will ber eluded.

Keywords: cryogenics, scanning probe microscopy, closed cycle cryostat, dry cryogenics, confocal microscopy, Raman magneto-spectroscopy, magnetic force microscopy, vortex imaging, lithography at cryogenic temperatures, interferometric precision positioning.

References:

Heike Kamerling Honnes
"*Investigations into the properties of substances at low temperatures, which have led, amongst other things, to the preparation of liquid helium*"
Nobel Lecture, December 11, 1913

Synthesis and Thermal Characterization of Metal Filled Alumina Composites with Different Concentrations of Nanowires

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Abstract: The development of methods predicting the properties of nanostructured materials is one of the main challenges of modern materials science. Nanowires have attracted a great deal of research interest in recent years because of their unique properties, which are different from that of their parent counterpart [1]. A great number of different metal [2], semiconductor [3], and organic [4] nanowire arrays have been successfully fabricated and investigated. The arrays of low-melting-point metal nanowires are interesting first of all in terms of the subsequent preparation of semiconductor nanostructures under higher temperatures. Therefore, it is necessary to study their thermal characteristics, in particular temperature stability ranges.

The aim of current study was to prepare and characterize the metal filled alumina composites and to investigate the effect of concentration of reinforcement on thermal behavior.

We have synthesized ordered indium, tin, and zinc nanowire arrays by electrochemical deposition within the nanochannels of anodic aluminum oxide (AAO) membranes with different porosity. Fig. 1 shows a schematic representation of the structure of synthesized materials. Crystalline structure of the nanowires has been investigated using X-ray diffraction and scanning electron microscopy analyses. Thermal behavior of prepared metal filled anodic alumina composites has been analyzed by differential scanning calorimetry (DSC) under argon atmosphere.

The results have been discussed in terms of the local thermoelastic characteristics of filamentary metal filled alumina composites. In this work, we have assessed the average stress induced by the thermal expansion mismatch between the components of composites. The problem of determining the bulk density of the energy of deformation in composites with threadlike metal nanocrystals in a matrix of anodic aluminum oxide has been solved with allowance for the difference between the thermal coefficients of the linear extension of elements of heterogeneity. Model calculations have been performed for composites with indium, tin, and zinc nanowires.

Keywords: anodic aluminum oxide, metallic nanowires, filamentary composites, differential scanning calorimetry, melting, thermoelastic characteristics, energy of deformation.

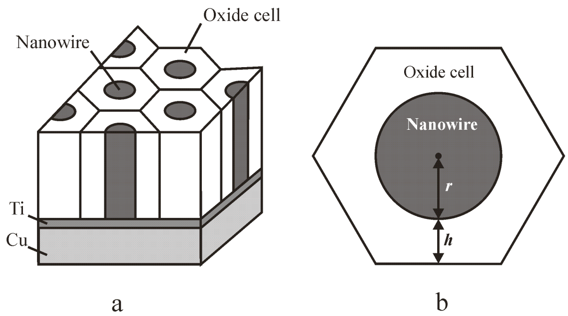

Figure 1: Schematic representation of the structure of the material: (a) several volume elements, (b) cross section of a volume element.

Acknowledgements. This research was partially supported by the European FP7 project PIRSES-GA-2011-295273-NANEL.

References:

[1] Sarkar, J., Khan, C.G., Basumallick, A. (2007), Nanowires: properties, applications and synthesis via porous anodic aluminium oxide template, *Bull. Mater. Sci.,* 30 (3), 271-290.

[2] Zhang, Z., Dai, S., Blom, D.A., and Shen, J. (2002), Synthesis of ordered metallic nanowires inside ordered mesoporous materials through electroless deposition, *Chem. Mater.,* 14 (3), 965-968.

[3] Law, M., Goldberger, J., Yang, P. (2004), Semiconductor nanowires and nanotubes, *Annu. Rev. Mater. Res.,* 32, 83-122.

[4] Dai, L., Reneker, D.H. (2003), Polymer nanowires and nanofibers. In: Wang, Z.L., editor. Nanowires and nanobelts: materials, properties and devices. Vol. 2. Springer Publishing, 269-288

SCATTERING BY Single Wall CARBON NANOTUBES USING WCIP METHOD

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Abstract: The problem of scattering of an incident plane wave by carbon nanotubes has attracted considerable attention of scientific community, certainly for their remarquable physics proprietes.
In this work, the Wave Concept Iterative Process (WCIP) has been applied to analyse the electromagnetic scattering problems of single wall carbon nanotubes in free space.

Using the Wave Concept Iterative Process (WCIP) to resolved a problem of scattering wave by CNTs (Iijima, I, 1991) is regarded as a challenge, because since its discovery WCIP is used to analyse microwaves circuits (Gharsallah, A.Gharbi, A. Baudrand, H. 2001), and applied to reach scattering problems by conductors bodies (Selmi,J. Bedira, R. Baudrand,H. 2010)
The principle of the WCIP is the expressions of boundary and closing conditions in terms of waves, incident $\vec{\mathbf{A}}$ and reflected $\vec{\mathbf{B}}$, a system of equations relates both the incident and reflected waves is deduced from these conditions. This system is resolved by an iterative process. The resolution is achieved when a good precision is reached on the required value.

$$\vec{\mathbf{A}} = \frac{1}{2\sqrt{\mathbf{Z}_0}}\left(\vec{\mathbf{E}} + \mathbf{Z}_0\left(\vec{\mathbf{H}} \wedge \vec{\mathbf{n}}\right)\right) \qquad (1a)$$

$$\vec{\mathbf{B}} = \frac{1}{2\sqrt{\mathbf{Z}_0}}\left(\vec{\mathbf{E}} - \mathbf{Z}_0\left(\vec{\mathbf{H}} \wedge \vec{\mathbf{n}}\right)\right) \qquad + (1b)$$

with $\mathbf{Z}_o$ is an arbitrary impedance parameter, chosen as the free space impedance.

$$Z_o = \sqrt{\frac{\mu_0}{\varepsilon_0}} = 120\pi\Omega \qquad (2)$$

$\vec{\mathbf{E}}$ and $\vec{\mathbf{H}}$ are the tangential components of electric and magnetic fields, respectively.

In this work single- wall CNT (SWCNT) is the studed, because the material has many unique proprietes.

The CNT is formed by rolling up the honeycomb lattice structure of graphene such that the circumference of the tube coincides with the chiral vector c = ma_1+ na_2 (Mikki, S.,M, Kishk, . A . 2007), here m and n are two integers that completely determine the structure and the properties of the CNT (Figure1).
Single Wall CNT (SWCNT) is the result of the structure if one layer is used to form a tube (Figure2).
CNTs with the structure (n, 0) are called zig-zag CNT because the pattern created along the circumference of the tube resembles a zig-zag motion. The structure (n, n) is called armchair. Tubes that have n = m are called chiral. The radius of the CNT is given by (Mikki, S.,M, Kishk, . A . 2007).
The general theory can be used to construct the response of the CNT to any kind of source excitation. Terefore, the electromagnetic field impinging on the CNT takes the simple form of plane wave.
The current density on CNT are calculated (Figure 3) and compared with exact solution .

Keywords: carbone nanotubes, Wave concept Iterative Process, Electromagnetic scattering.

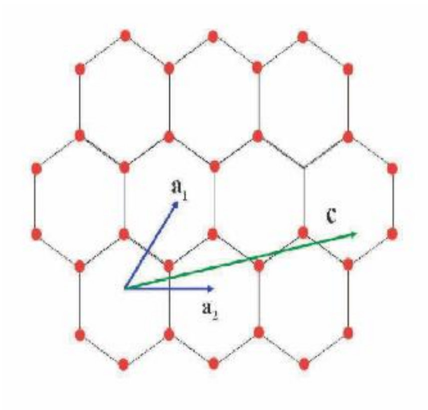

Figure 1: Figure illustrating the honeycomb lattice structure of graphene

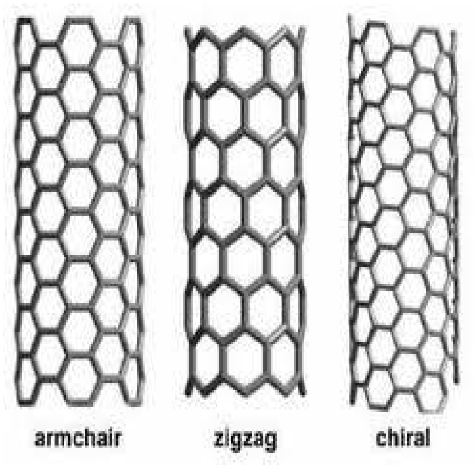

Figure 2: Figure illustrating differents SWCNT

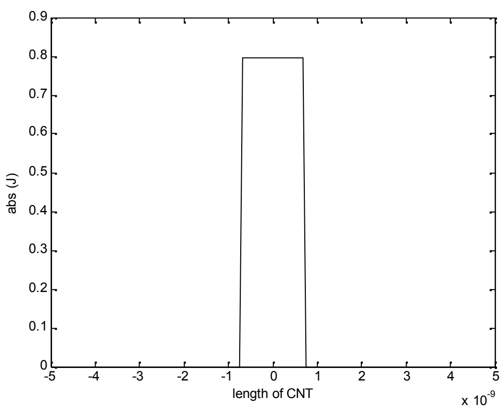

Figure 3: Figure illustrating the courant on CNT surface

References:

Iijima, I, 1991*Nature London 354, 56.*

A. Gharsallah, A.Gharbi and H. Baudrand, "Efficient analysis of multiport passive circuits using the iterative technique", *Electromagnetics, vol. 21, pp. 73-84, 2001.*

Selmi,J. Bedira, R. Gharsallah, A. Baudrand,H. (2010), Iterative solution of electromagnetic sattering by arbitrary shaped cylinders. *Aplied Computationel Electromagnetics Society.*

Mikki, S.,M, Kishk, . A . (2007), of optical scattering by carbon nanotubes. *Microwave & Optical Technology Letters, Vol. 49, No. 10, 2360–2364, October .*

Uncertainty Communication in the Environmental Life Cycle Assessment (LCA) of Carbon Nanotubes (CNTs)

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Abstract: Amidst the great technological progress being made in the field of nanotechnology we are confronted potentially by both conventional and novel environmental challenges and oportunities. Many gaps exist in the present state of knowledge and experience with nanomaterials, and understanding and managing such uncertainty is key to ensuring properly informed decision-making based on LCAs. As environmental regulation increases, it is important to handle correctly the quantitative data needed for LCAs and to assign appropriate confidence to the interpretation of the resulting environmental impact profiles and benefits of nanotechnology. Traditionally used for more established technology systems, environmental LCA is now being applied to nanomaterials by policy-makers, researchers and industry. However, the aleatory (variability) and epistemic (system process) uncertainties in LCAs of nanomaterials need to be properly accounted for and communicated in the analysis, else the results risk being misinterpreted, misguiding decision-making processes and leading to significant effects for industry, research and policy-making.
Here, we review current life cycle assessment literature for carbon nanotubes, and identify the key sources of uncertainty which need to be taken into consideration. These include: the potential for non-equivalency between mass and toxicity (requiring inventory and impact models to be adjusted); the use of proxy data to bridge inventory data gaps; and the often very wide ranges in material performance, process energy and product lifetimes quoted. Neglecting these uncertainties has a considerable impact on our ability to make representative and informed environmental life cycle assessments and subsequent decisions.

Keywords: life cycle assessment, LCA, uncertainty, carbon nanotubes, systems analysis, environmental impact, energy, decision-making

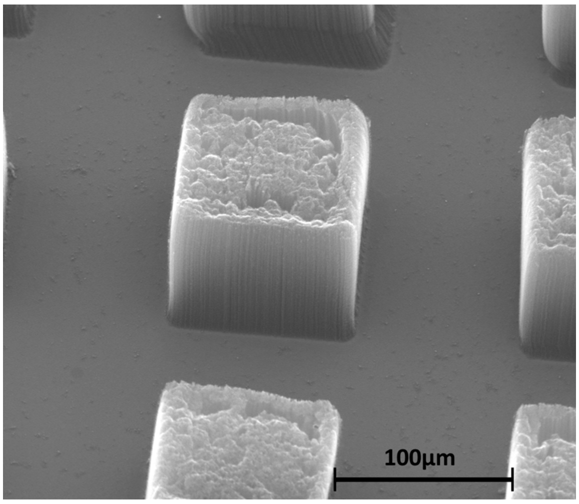

Figure 1: Vertically aligned CNT array synthesized by PTCVD on a Si/SiO_2 substrate

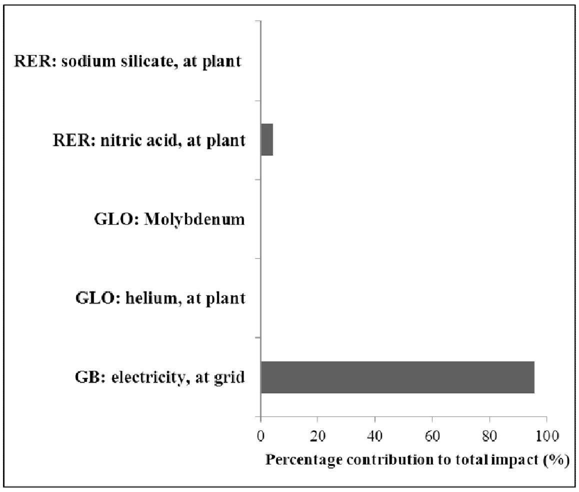

Figure 2: Contribution (%) of material and energy inputs to total Global Warming Potential GWP_{100}) (kg CO_2-equiv) for CNT production.

Mechanical stability of nanoparticle-based coatings

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Abstract: Thin films of nanoparticles (NPs) show functional properties that make them useful for numerous applications. The poor mechanical stability of most of these systems remains however a major drawback for their industrial use. The weak adhesive interactions between the NPs, and between the NPs and the substrate lead indeed to fragile coatings that may loss their functionalities upon friction, scratch … Additionally, the failure of such coatings can lead to dispersion of the NPs in the environment. Different approaches were proposed in order to improve the mechanical stability of NPs-based coatings such as calcination or hydrothermal treatments, atomic layer deposition and covalent chemical bonding.

The mechanical properties of such thin NPs-based coatings are however extremely difficult to accede with the technique commonly in use, and are thus rarely discussed in the literature. In only few cases indeed elastic modulus and hardness were retrieved form nanoindentation measurements or macroscopic wear behaviour from abrasion under mechanical shear (Dafinone *et al.*, 2011; Gemici *et al.*, 2008; Yaghoubi *et al.*, 2010).

In this work ultrasonic cavitation is used as an alternative test (Pigerre *et al.*, 2005; Vallat *et al.*, 1996) to study the adhesion and cohesion of thin NPs-based coatings. The coatings are multilayers of spherical silica nanoparticles with nominal diameters of 17 nm, 30 nm and 50 nm, deposited on silicon substrates following a layer-by-layer procedure. The mechanical stability of these coatings is discussed as a function of the NPs size, and the nature of the NPs/NPs and NPs/substrate interactions. Size effect of the NPs on the macroscopic scale mechanical stability of the coating is demonstrated here for the first time, based on this technique.

Keywords: nanoparticle-based coatings, mechanical stability, adhesion, cohesion, cavitation, ultrasonic cavitation

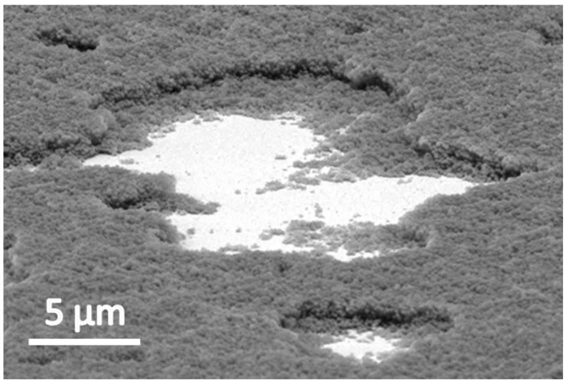

Figure 1: Scanning electron microscope image showing the cavitation damages induced in a nanoparticle-based coating (10 layers of 180 large silica nanoparticles)

References:

Dafinone, M. I., Feng, G., Brugarolas, T.,Tettey, K. E., Lee, D. (2011) Mechanical Reinforcement of Nanoparticle Thin Films Using Atomic Layer Deposition. *ACS nano*, 5, 5078–5087.

Gemici, Z., Shimomura, H., Cohen, R. E., Rubner, M. F. (2008), Hydrothermal Treatment of Nanoparticle Thin Films for Enhanced Mechanical Durability. *Langmuir*, 24, 2168–2177.

Pigerre, J., Rodriguez, P., Mehinto, T., Mansot, J., Roos, C. (2005) Development of an ultrasonics-based flash test used for fast qualification of the mechanical resistance of industrial organic coatings Part II: comparative results. *Progress in Organic Coatings*, 54, 377–383.

Vallat, M.-F., Haidara, H., Ziegler, P., Rey, D., Papirer, Y., Schultz, J. (1996), Adhesive behavior of aluminum layers evaporated on polyester films. *The proceedings of the 53rd international meeting of physical chemistry: Organic coatings*, 354, 14–22.

Yaghoubi, H.; Taghavinia, N.; Alamdari, E. K.; Volinsky, A. (2010) Nanomechanical properties of TiO_2 granular thin films. *ACS applied materials & interfaces*, 2, 2629–2636.

Pd Distribution of Switchable Mirrors Using Mg–Y Alloy Thin Films

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Abstract: Pd-capped magnesium-yttrium alloy switchable mirrors were found to have high switching durability of over 10,000 cycles between reflective and transparent states (Yamada *et al*.; 2013). However, the durability decreased considerably when the Pd thickness was decreased to improve the transmittance in the transparent state. Switchable mirrors with various Pd thickness were then prepared by a direct-current magnetron sputtering method, and the degradation in durability was studied by observing the distribution of each element of the switchable mirrors from the film surface to the substrate. X-ray photoemission spectroscopy (XPS) and transmission electron microscopy (TEM) showed that Pd with a short sputtering time (corresponding to layer thickness of ~3 nm) resulted in surface oxidation of Mg and Y, and no Pd at the surface. The deposited Pd was alloyed with the Mg-Y layer and after taking the sample out from the vacuum chamber a Pd-rich layer appeared between the surface oxides and the Mg-Y layers. With increasing deposition time, a Pd layer was formed on the oxide layer and the Pd layer thickness increased. The mirror with switching durability of over 10,000 cycles had a sufficiently thick Pd top layer of ~7 nm and a very thin oxide layer. This thick Pd layer is believed to be the reason for the high switching durability (Yamada *et al*.; 2014). A thin Ta intermediate layer was then inserted between the Mg-Y alloy layer and thinner Pd layers to inhibit alloying. Such a mirror capped by a Pd layer with a thickness of ~3 nm had a high switching durability of over 10,000 cycles, although a mirror without the Ta intermediate layer capped by a Pd layer with the same thickness never changed from the reflective to the transparent state. Owing to the decrease of the Pd thickness from ~7 to ~3 nm, the visible transmittance in the transparent state increased from 32% to 44% with high switching durability. The results of XPS and TEM showed that the inserted Ta layer fully inhibits alloying between the Pd and Mg-Y layers as shown in Fig. 1, and that the Pd existed at the surface region and scarcely diffused into the Ta and Mg-Y layers even after switching of 10,000 cycles. Because alloying is one of the main reasons for the reduction in durability with decreasing Pd thickness, the prevention of alloying is expected to cause

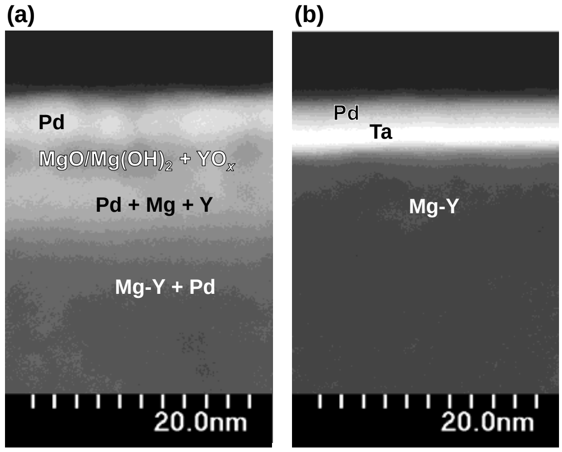

Figure 1: HAADF images of the cross sections for a mirror without Ta layer and with Pd deposited for the duration corresponding to a layer thickness of 7.5 nm (a) and a Ta inserted mirror (b).

high switching durability (Yamada *et al*.; to be submitted).

Keywords: switchable mirrors, Mg-Y alloys; switching durability, Ta intermediate layer, Pd distribution, XPS, STEM, Smart windows.

References:

Yamada, Y., Miura, M., Tajima, K., Okada, M., Yoshimura, K. (2013) Optical switching durability of switchable mirrors based on magnesium–yttrium alloy thin films, *Solar Energy Materials and Solar Cells* 117, 396-399.

Yamada, Y., Miura, M., Tajima, K., Okada, M., Yoshimura, K. (2014) Pd distribution of switchable mirrors based on Mg–Y alloy thin films, *Solar Energy Materials and Solar Cells* 120, 631–634.

Yamada, Y., Miura, M., Tajima, K., Okada, M., Yoshimura, K. Influence on optical properties and switching durability by introducing Ta intermediate layer in Mg-Y switchable mirrors, *Solar Energy Materials and Solar Cells* to be submitted.

Resonant Tunneling Transport in $Al_{0.5}G_{0.5}N/In_xGa_{1-x}N/Al_{0.5}G_{0.5}N/In_{0.1}Ga_{0.9}N$ quantum structures

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Abstract: In the last decade, GaN/Al(In,Ga)N heterostructures have received considerable attention in the nanoelectronics and nanophotonics research communities. In fact, III-nitride semiconductors are characterized by very large conduction band discontinuity (1.75 eV between GaN and AlN), which makes them promising for near-infrared intersubband optoelectronics. Furthermore, thanks to the high energy of their longitudinal optical phonon modes (92 meV in GaN), III-nitrides are excellent candidates for the fabrication of high temperature THz quantum cascade lasers (QCLs) [1-4]. All these key applications require the knowledge of vertical transport in III-nitride heterostructures. The basic device to study quantum transport is the double-barrier Resonant Tunneling Diode (RTD), which displays a negative differential resistance (NDR) associated to the constructive interference of the electron waves inside the central quantum well. The large NDR observed at Room Temperature in Al(Ga)N/GaN diodes has been interpreted as related to resonant tunneling but found to be sensitive to the internal electric field present in III-nitride compounds and to the depleted space charge GaN region on one side contact of the RTD structure (piezoelectric effect). In this work, we have investigated the vertical electron transport at room temperature in the pseudomorphic quantum stack $Al_{0.5}G_{0.5}N/In_xGa_{1-x}N/Al_{0.5}G_{0.5}N/In_{0.1}Ga_{0.9}N/GaN$ that is designed with a 6nm thick lateral $In_{0.1}Ga_{0.9}N/GaN$ n-type contact spacer. Using the transfer matrix formalism, we investigate the effect Indium composition in the $In_xGa_{1-x}N$ central well in order to optimize the resonant current peak-to-valley-ratio (PVR). Our self consistent calculations first show that this design can effectively minimize the depleted space charge region in the right-hand contact layer (insert of figure 1). For all In compositions, theoretical current-voltage characteristics reveal the presence of a sharp NDR due to the resonant tunneling between the Fermi level (E_F) and the quantum confined levels. Furthermore, we demonstrate that an appropriate choice of a 10% In composition achieves a peak current density of 5.72×10^5 A/cm^2 and a pronounced 564 PVR value which arises from the large decrease in the valley current. This makes this RTD design very interesting for power devices.

Keywords: Nitride materials, Piezoelectricity, Quantum wells, Resonant Tunneling Diodes, Negative Differential Resistance, Peak to Valley Ratio.

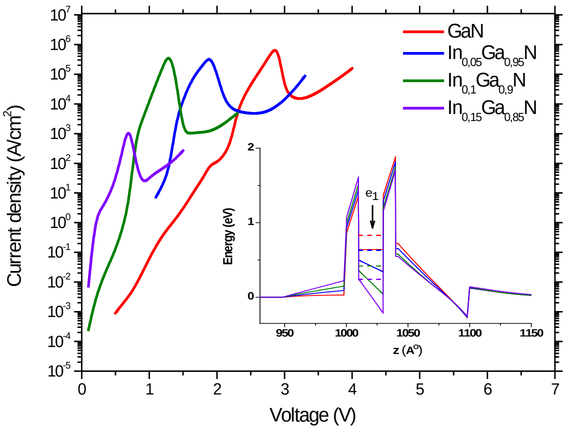

Figure 1: Theoretical current density vs. applied voltage characteristics for different In compositions in the n$^+$ (5.10^{18} cm^{-3})–GaN/5nm undoped GaN/1nm undoped $Al_{0.5}G_{0.5}N$ / 2nm undoped $In_xGa_{1-x}N$ / 1nm undoped $Al_{0.5}G_{0.5}N$ / n$^+$ (5.10^{18} cm^{-3}) 6nm $In_{0.1}Ga_{0.9}N$ / n$^+$ (5.10^{18} cm^{-3}) GaN quantum structures. The insert plots are the corresponding self consistent calculations of the conduction band edge at zero bias.

References:

[1] E. Bellotti, K. Driscoll, T. D. Moustakas, and R. Paiella, Appl. Phys. Lett 92, 101112 (2008).
[2] H. Machhadani, Y. Kotsar, S. Sakr, M. Tchernycheva, R. Colombelli, J. Mangeney, E. Bellet-Amalric, E. Sarigiannidou, E. Monroy, and F.H. Julien, Appl. Phys. Lett. 97, 191101 (2010).
[3] S. Sakr, E. Warde, M. Tchernycheva, L. Rigutti, N. Isac, and F. H. Julien, Appl. Phys. Lett 92, 142103 (2011).
[4] S. Sakr, Y. Kotsar, M. Tchernycheva, E. Warde, N. Isac, E. Monroy, and F. H. Julien, Appl. Phys. Express 5, 052203 (2012).

Enhanced Performance of Optoelectronic Memory Devices Based on Carbon Nanotube Transistors

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Abstract: Star et al. have demonstrated that carbon nanotube networks coated with polymers can act as memory devices (Star *et al.*, 2004). This approach has resulted in the development of a device named optically-gated CNTFET (OG-CNTFET) (Borghetti et al.,2006). Indeed, when the transistor is photoexcited, the photogenerated electrons in the polymer film are trapped at the polymer/SiO2 interface, in the vicinity of the nanotube. These trapped electrons act as an "optical gate" for the nanotube transistor and apply the equivalent of a very negative potential which induces the switch of the device from off state to on state regime. When the photoexcitation is turned off, the photogenerated electrons remain trapped and the device remains at the on state regime. Our purpose is to enhance the performance of this device by a chemical modification of the dielectric/polymer interface. We have fabricated three kinds of OG-CNTFET devices (Figure 1). A first device with carbon nanotubes deposited on Octadécyltrichlorosilane (OTS) molecular layer. A second device with carbon nanotubes deposited on the thermal oxide layer. A third device with carbon nanotubes deposited on an oxidized Undecenyltichlorosilane (UETS) molecular layer. We have observed that the first device doesn't present an hysteresis in the drain-source current versus gate-source voltage Ids-Vgs characteristic. This is attributed to the fact that the OTS molecules end with a CH3 chemical bond that doesn't allow electrons to be trapped around the carbon nanotubes. Furthermore, we have observed that the third device presents an hysteresis in the Ids-Vgs characteristic larger than the hysteresis corresponding to the second device. This phenomenon can be explained by the fact that the oxidized UETS molecules end with a COOH chemical bond increasing the trapping rate of electrons around the carbon nanotubes. We concluded that we can enhance the performance of the OG-CNTFET device operating as a memory by depositing the cabon nanotubes on an oxidized (UETS) molecular layer.

Keywords: Field-effect transistors (FETs), nanotechnology, carbon nanotubes, polymer, CNTFET, optoelectronics, traps.

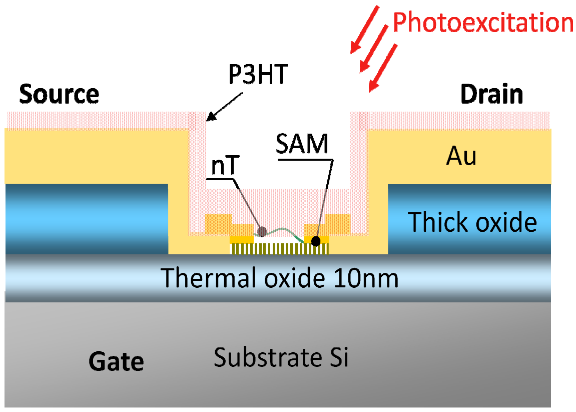

Figure 1: Figure illustrating the OG-CNTFET structure. A 10nm of oxide has thermally grown on a Si substrate. A thick oxide layer is deposited to isolate the source and drain contacts from the substrate. A molecular layer (SAM), representing the OTS or the oxidized UETS molecules, is grafted on the thermal oxide. The carbon nanotubes (nT) are then deposited on the molecular layer. Finally, the device is coated by a polymer film P3HT.

References:

Star, A., Lu, Y., Bradley, K., Grüner, G., (2004) Nanotube Optoelectronic Memory Device, *Nano. Lett.* , 4, 1587-1591.

Borghetti, J., Derycke, V., Lenfant, S., Chenevier, P., Filoramo, A., Goffman, M., Vuillaume, D., Bourgoin, J-P. (2006), Optoelectronic Switch and Memory Devices Based on Polymer-Functionalized Carbon Nanotube Transistors, *Adv. Mater.*, 18, 2535-2540.

Syntehisis and Characterization of PAN-co-polymers as Carbon Nano Fiber Precursor

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Abstract: Carbon nanofibers have a great interest due to their high aspect ratio and mechanical properties even with it is a time and energy consuming process. Carbon nanofibers mainly, can be pitch based or polyacrylonitrile (PAN) based (Edie 1998). In this study, different co-polymers of acrylonitrile was aimed to synthesis. In this perspective; acrylic acid and itaconic acid monomers were used. Instead of using homo polymer PAN, co-polymer of polyacrylonitrile have a positive effect to decrease cyclization reaction duration and temperature during oxidative stabilization process (Devasia et al. 2003). Acrylic acid (AA), itaconic acid (IA) and acrylonitrile (AN) were used as a precursor for polymerization reactions and copolymers were synthesized by using ammonium persulfate (APS) as an oxidant. Polymerization medium was water and dimethylformamide (DMF) mixture. Using a water:DMF mixture has a positive effect on the polymerization reaction (Bajaj, Paliwal, and Gupta 1993; Ouyang et al. 2008). Polyacrylonitrile-co-acrylic acid and Polyacrylonitrile-co-itaconic acid polymers were successfully synthesized with different feeding ratios. Synthesized co-polymers were investigated by Fourier Transform Infrared Spectroscopy-Attenuated Total Reflection (FTIR-ATR) spectroscopy and characteristic peaks for acrylonitrile unit, acrylic acid and itaconic acid units were seen. As indicated in the Figure 1, changing feeding ratios of acrylic acid unit has a linear relationship between CN/C=O peaks absorbance ratio. Thermal behavior was examined by using Differential Scanning Calorimeter (DSC) and Thermal Gravimetric Analyzer (TGA) and results showed that addition of monomers to acrylonitrile unit was reduced the Tg value of co-polymer PAN. Morphological behavior of carbon nanofibers was investigated by scanning electron microscope (SEM). Carbon nanofibers can be used in a various engineering fields.

Keywords: carbon nanofibre, PAN, AA, IA

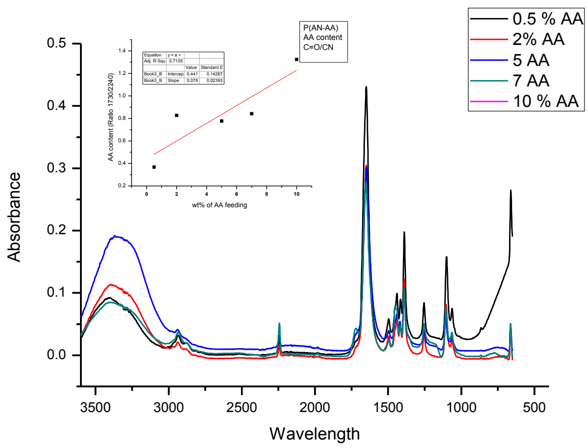

Figure 1: FTIR-ATR spectra of P(AN-AA) co-polymer for different feeding of wt% of AA and Correlation between FTIR-ATR absorbance ratio(CN/C=O peaks) with feeding wt% of AA

References:

Bajaj, P., D. K. Paliwal, and A. K. Gupta. 1993. ‘Acrylonitrile–acrylic Acids Copolymers. I. Synthesis and Characterization’. *Journal of Applied Polymer Science* 49 (5): 823–33.

Devasia, Renjith, C. P. Reghunadhan Nair, P. Sivadasan, B. K. Katherine, and K. N. Ninan. 2003. ‘Cyclization Reaction in Poly(acrylonitrile/itaconic Acid) Copolymer: An Isothermal Differential Scanning Calorimetry Kinetic Study’. *Journal of Applied Polymer Science* 88 (4): 915–20.

Edie, D.D. 1998. ‘The Effect of Processing on the Structure and Properties of Carbon Fibers’. *Carbon* 36 (4): 345–62.

Ouyang, Qin, Lu Cheng, Haojing Wang, and Kaixi Li. 2008. ‘Mechanism and Kinetics of the Stabilization Reactions of Itaconic Acid-Modified Polyacrylonitrile’. *Polymer Degradation and Stability* 93 (8): 1415–21.

Minimal conductivity in ballistic bilayer graphene with a twist

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Abstract:

Two graphene layers generally stack over the common AB or Bernal stacking configuration. Recently, it has been reported that several types of stacking defects can occur in natural and synthetic graphene bilayer systems. For instance, a chemical vapor deposition (CVD) growth of two graphene layers on metals and on the carbon face of the SiC substrates reveals natural stacking faults originating from a rotational mismatch by some twist angle between the two layers as compared to the perfect AB stacked bilayer. It has been reported that stacking defaults affect the band structure and turn each parabolic band crossing of a bilayer into pairs of Dirac cones. We have shown in a recent paper that, surprisingly, a stacking default (for example a twist) in a bilayer can result in perfect transmission at normal incidence as a result of Fabry-Pérot type resonances at zero-energy [1]. These constructive interferences only happen for a specific orientation of the Dirac cones with respect to the incident electron and for quantized values of their separation in reciprocal space.
Here we theoretically investigate how a rotational mismatch between the two graphene layers could affect an amazing property of graphene systems which is the finite minimal conductivity.
Starting from the two-band low-energy Hamiltonian, we report a calculation of the minimal conductivity in twisted bilayer graphene within two approach: the Landauer-Buttiker and Kubo-Greenwood. Then we discuss the effect of the stacking default and the orientation of the electrodes. A comparaison between the two formalism will be detailed.

Keywords: twisted bilayer graphene, Landauer-Buttiker approach, Kubo-Greenwood formula, minimal conductivity.

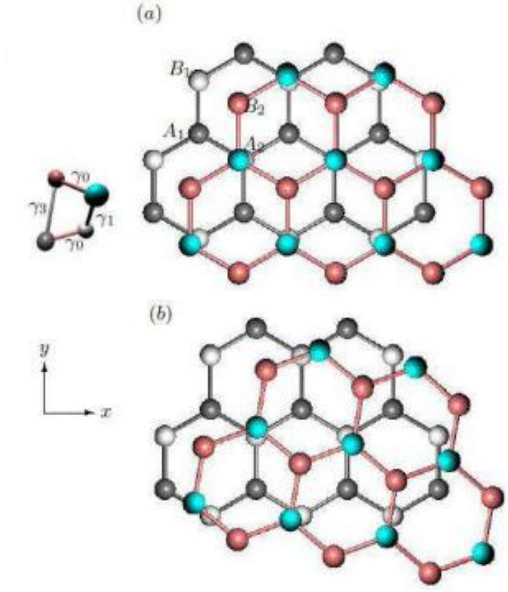

Figure 1: (Color online) Top view of a perfectly AB-stacked (Top: (a)) and rotationnaly faulted (Bottom: (b)) bilayer grapheme crystal. The top layers are shown in (Pink,Cyan) colors and the bottom layers are shown in (Gray,White) colors. Hopping parameters γ0,γ1 and γ3 are depicted in the top left panel.

References:

[1] Daboussi, A., Mandhour, L., Fuchs, J.N., Jaziri, S. (2014) , Tunable zero-energy transmission resonances in shifted graphene bilayer, *Phys. Rev. B,* Accepted

Thermo-electrical properties of polymer materials For Electro-Pyro-Electric Technique (EPE)

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Abstract: In this paper, we investigate thermally performance of polymers by both photothermal methods: photo-thermal deflection(Gaied *et al.*, 2010) and photo- pyroelectric technique (PPE) in back cnfiguration (Abdellaziz *et al.*, 2009).In addition to this, the electrical conductivity have been described using an impedance analyzer. The comparative study was performed on Sil-pad 900S layer, Sil-pad K10 layer and Mylar layer in order to involve it in the new so-called electro-pyroelectric (EPE) technique (Bennaji *et al.;* 2009, 2010), as good thermal conductor and an electrical insulator.

Keywords: thermally performance, polymers, photo-thermal deflection, photo- pyroelectric technique, electro-pyroelectric (EPE) technique.

References:

Gaied, I., Ghorbel, M. S., Yacoubi, N. (2010), Comparison between different Photothermal Deflection methods to determine thermal properties of bulk semiconductor samples. *J Phys Conf Ser*., 214 , 012110. .

Abdellaziz, I., Mellouki, I., Yacoubi N. (2009) Investigation of Thermal Properties of Bulk Zn Doped GaSb and Silicon by Photopyroelectric Technique. *Sensor Lett*, 7, 656–660.

Bennaji, N., Mellouki, I., Yacoubi, N. (2009), Thermal properties of metals using photopyroelectric technique: Electrical heating, *Sensor Lett.*, 7,716–720.

Bennaji, N., Mellouki, I., Yacoubi, N. (2010) Thermal properties of metals alloy by electrical pyroelectric method (EPE). *J Phys Conf Ser*., 214,012138.

TiO_2 based nanopowders and coatings with high photocatalytic activity for NO gas degradation developed from low cost precursors

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Abstract:. The process known as heterogeneous photocatalysis is based on the UV/Vis irradiation of semiconductors leading to photo-oxidation of inorganic and organic compounds and eventually to their complete mineralization. Among different semiconductors with photocatalytic potential, TiO_2-based materials are considered to be almost ideal photocatalysts since these are relatively inexpensive, chemically stable and superhydrophilic, while their photogenerated electrons and holes have high redox potential.
A great challenge is to improve activity and functionality of TiO_2-based photocatalysts through a simple and low-cost processing considering their efficient application for pollution remediation in both gaseous and aqueous environments. Photocatalytic materials can be applied in different forms such as powders, coatings or membranes, depending on the specific application.
The present research has two primary goals. The first one is the synthesis of TiO_2 powders, with high photocatalytic power for the degradation of high concentrations of NOx (~ 100 ppm), from low cost precursors and through a simple route. The second one is the development of highly adherent, supehidrophilic and photocatalytic coatings, starting from these TiO_2 powders.
Different low cost precursors were submitted to alkaline hydrothermal route in order to produce titanate nanotubes (Morgado Jr *et al.*, 2006), which were afretwards converted to anatase nanopowders through a simple calcination step.
Two as-synthesized nanopowders (labeled AM1 and AM2) obtained from the same low cost precursor, with a difference only in the calcination step, were thoroughly characterized by XRPD, TEM, DRS, BET, zeta potential measurements, XPS and EPR, while their phtocatalytic activity has been evaluated for degradation of 100 ppm of NO_x in a photocatalytic system using Photocatalytic Unit equipped with a gas chromatography/mass spectrometry (GC/MS) system. The as-developed TiO_2 nanopowders are significantly more powerful for the degradation of NOx in comparison to the benchmark P-25 (Degussa), while in parallel their partial deactivation time is slower (Figure 1).
The porous photocatalytic nanocoatings are developed over soda lime glass support through dip-coating and impregnation processing routes. The as-processed coatings obtained specifically by dip-coating are highly adherent and classified as 5B (the highest level of adherence) in accordance to ASTM D3359 – 09 Standard Test Methods for Measuring Adhesion by Tape Test, while showing superhidrophilic surface.

Keywords: TiO_2, low cost precursor, nanopowders, coatings, photocatalysis, NO_x, adherence.

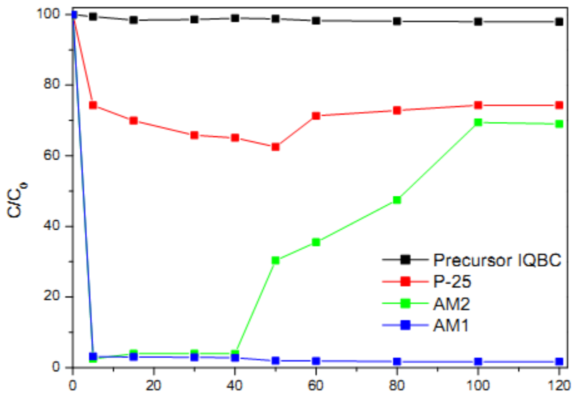

Figure 1: Photocatalytic degradation of 100 ppm of NO_x gas as a function of time presented by 4 different TiO_2 powders; AM1 and AM2 are nanopowders developed from a low cost precursor; P-25 is TiO_2 benchmark powder, while IQBC is a low cost precursor used for synthesis of AM1 and AM2.

References:

Morgado Jr, E., de Abreu, M. A., Pravia, O. R., Marinkovic, B. A., Jardim, P. M., Rizzo, F. C., Araújo, A. S, (2006) A study on the structure and thermal stability of titanate nanotubes as a function of sodium content, *Solid State Sciences,* 8, 888-900.

Interplay of Intrinsic and Extrinsic Size Effects in Twinned Nanopillars

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Abstract: It has long been known that mechanical properties scale dramatically with size, having important ramifications for the design of novel materials and technological development. One of the major reasons for this size effect is the radical transition in the deformation mechanisms that govern material response in nanostructured materials owing to a decreased specimen size as well as an increased density of interfaces. Recent research has shown that the presence of twin boundaries in fcc metals can lead to a special class of materials, known as nanotwinned metals, which exhibit even more remarkable properties compared to their nanocrystalline counterparts. Thus, nanotwinned structures have shown great potential as optimal motifs for strength, ductility, and stability with critical structural, biomedical and electronic applications.

In this talk, we will present our investigation of the interplay of extrinsic and intrinsic size effects in twinned nanopillars by way of molecular dynamics simulations of uniaxial compression. The extrinsic size effect refers to the effect of the diameter of the nanopillar while the intrinsic dimension is the twin boundary spacing within the nanopillar. Prior experimental and computational studies have revealed that both these effects lead to enhanced strengthening with decreasing size or spacing (Lu *et al*,. 2009, Jang *et al.*, 2012). The focus of our work is to study their coupled effect and discuss the possibility of an optimal combination of these extrinsic and intrinsic sizes for maximum strength as shown in Figure 1. This study will also provide us the opportunity to examine dislocations mechanisms endorsing strengthening and weakening of twinned nanopillars.

Keywords: Nanotwinned metals, Twin boundaries, Molecular Dynamics, Size Effects, Dislocation Starvation, Nano-materials Strength.

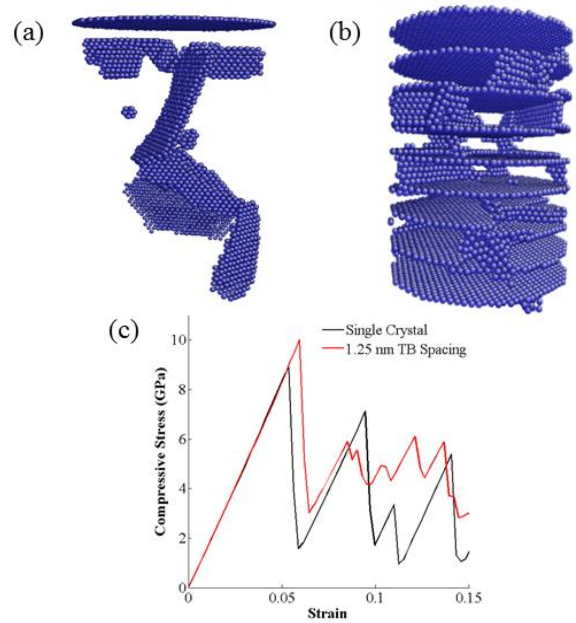

Figure 1: Dislocations configuration inside a Cu nanopillar subjected to compression, (a) without twin boundaries, (b) with twin boundaries at 1.25 nm spacing. (c) Stress-strain plot comparing these two cases (Hammami and Kulkarni, 2014).

References:

Hammami, F., Kulkarni, Y. (2014) Size effects in twinned nanopillars, submitted to *Nano Letters*.

Lu, K., Lu, L., Suresh, S. (2009) Strengthening materials by engineering coherent internal boundaries at the nanoscale, *Science* 324, 349.

Jang, D., Li, X., Gao, H., Greer, J. R. (2012) Deformation mechanisms in nanotwinned metal nanopillars, *Nature Nanotechnology* 7, 594-601.

From High Aspect Ratio Nanoparticles Synthesis to Nano-Structured Permanent Magnets

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Abstract: The high demand of permanent magnets due to their numerous applications is a reason of many researches. The bottom-up approach for nanostructured permanent magnets is an interesting alternative route to the classical rare-earth metallurgy (Poudyal *et al.*, 2013). This approach is developed thanks to the recent progresses in the magnetic nanoparticle synthesis by liquid phase methods which allow now a good control of particle size, shape and chemical composition. Our motivation is to develop a new generation of permanent magnets relying on the shape anisotropy of high aspect ratio magnetic nanoparticles. The polyol method allowed the preparation of cobalt nanorods and nanowires, monodisperse in size, with diameter and length in the range 10-30 nm and 50-300 nm, respectively (Soumare *et al.*, 2009). Coercive fields up to 0.7 T at 300 K were measured that result of the addition of shape and magnetocrystalline anisotropy. Recently, theoretical calculations described the role of the surfactants in the anisotropic growth of cobalt (Aït-Atmane *et al.*, 2014). Aiming to the production of a macroscopic magnetic material we developed the scale up of the polyol process for the synthesis of tens grams of cobalt nanorods. Since the key for a high energy product is the alignment of the nanorods packed with a high volume fraction (Panagiotopoulos *et al.*, 2013) we studied the possibility to obtain anisotropic textured materials with cobalt nanorods (Figure 1). In this communication we will present the challenges for the elaboration of permanent magnets by a bottom-up approach and our very recent results concerning the elaboration of anisotropic nanostructured materials and the assessment of their (BH)max.

Keywords: Nanomaterials, cobalt, shape anisotropy, permanent magnet.

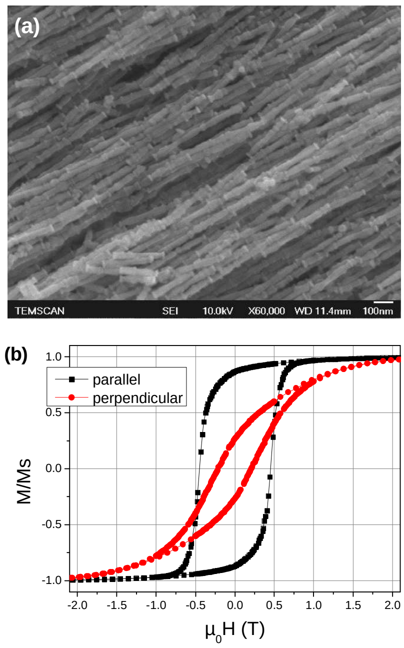

Figure 1: (a) SEM image of the cobalt nanorods aligned in an electromagnet (b) Magnetization curve $M/M_s(H)$ of a Co nanorods alignment measured with the applied field parallel and perpendicular to the alignment.

References:

Aït-Atmane, K. *et al.* (2014) Control of anisotropic growth of cobalt nanorods in liquid phase: from experiment to theory ... and back, *Nanoscale*, In Press.

Panagiotopoulos, I. *et al.* (2013), Packing fraction dependence of the coercivity and the energy product in nanowire based permanent magnets, *J. Appl.Phys.*, 114, 143902.

Poudyal N. and Liu, J. P. (2013) Advances in Nanostructured permanent magnets research, *J. Phys. D : Appl. Phys.* 46, 043001

Soumare, Y. *et al.* (2009), Kinetically controlled synthesis of cobalt nanorods with high magnetic coercivity, *Adv. Func. Mater.*, 19, 1971-1977.

Nanostructural Carbon Polymer Coatings – Orientants and Their Influence on Oils Lube Ability

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Abstract: In this report the results of pulsed carbon plasma condensation ($\rho = 10^{-13}$ cm $^{-3}$, ionization rate 35%,pulse duration $\tau = 400$ μsec, pulse frequency 1-3Hz). In the regime according AES spectroscopy the carbon coating-orientants with diamond short range order were obtained. The electric conductivity was $10^{-8} – 10^{-14}$Ohm^{-1}cm^{-1} at the deposition temperature 50°C. The maximum hardness was as high as 9800 HV when the energy of C^{+} ions was equal 60 eV. The DLC coating-orientants possess an excellent adhesion and could be deposited on any substrates such as the metals, dielectrics, ceramics etc. A new type of diamond like carbon coatings (DLC) namely nanostructural coatings-orientants is considered having at present time no analogues in triboengineering (Levchenko et al.; 2008, 2013). Efficiency of these nanocoatings results from the established by the authors' influence of the surface of these coatings on the level of structural ordering in the lube boundary layers adsorbed by the surface. It was found that the most perspective are mono- or polycrystalline coatings (M-carbon and P-carbon)j with the structure of two-dimensional linear-chained carbon. The level of orientating effect and coating characteristics depend on the parameters of coating synthesis, so it is possible to regulate them in the process of coating deposition.

Authors have made a number of theoretical and experimental studies directed to optimal synthesis parameters finding, coatings structure and tribological characteristics analyzing and establishing correlation between the mentioned factors (the triad "synthesis parameters- structure-performances"). It was shown the coatings under studies increasing the level of molecular ordering in boundary layers provide an evident reducing in friction coefficient and a widening of the temperature range of lube oils operation (Levchenko et al.;2013). On the contrary traditional DLC with amorphous structure have not such effect. Analysis of apparent activation energy of the process of boundary layer disrupture for steel specimens with polycrystalline nanocoatings - orientant had shown that this value exceeded essentially those obtained for the same specimens with amorphous carbon coating and without coating. A possibility of carbon coatings-orientants is considered for some practical triboengineering applications, namely for cutting fluids extrusion tread instrument. The M-carbon coating (thickness of 2 μk) was deposited by impulse condensation of carbon plasma on the worktop of shipless taps (burnishers) M8 x 1,25 made of high-speed steel. The test assembly was mounted on a vertical drill. The forces arising in the process of tread forming were registries by strain gauge transducer connected with computerized dynamometering system. Two commercial metal working fluids mineral oil - based (F1) and water-based (F2) were used. The results presented in Table 1 show that the taps coated by carbon M demonstrate minimal values of torsion torque for both types of working fluids and correspondingly better effectively as compared to chromium coating and uncoated high-speed steel.

Table 1. Torsion torque versus thread forming speed

Thread forming speed v, m/s	Torsion torque M, Nm					
	Uncoated steel		Chromium coating		M-Carbon coating	
	F1	F2	F1	F2	F1	F2
0.104	5.2	3.7	5.2	6,6	4.5 5	4,1
0.208	5.8	3.7	5.55	5,6	4.6	4,0
0,296	jam	3.7	5.55	5,6	5.0	3,5
0.417		12,2	5.55	6,48	5.5	3,45
0.583		jam	6.0	8,25	5.3	3,25

Coatings-orientants using allows simplifying the composition of oil materials by reducing amount of antifriction, antiwear additives, etc. As the coatings under study have high corrosion resistance, it is possible to use them in friction units operating in aggressive media.

Keywords: nanotribology, nanostructural carbon polymer coatings, coatings-orientants

References

Modern tribology: Results and perspectives. Ed. by K.V. Frolov. Moscow, publishing house LKI, 2008, 480p.

I.A. Buyanovskii, V.A. Levchenko, A.N. Bolshakov, V.N. Matveenko. Effect of Structure and Composition of Solid Carbon Coatings of Steel Parts on the Lubricating Properties of Synthetic Oil. // Friction and wear, 2013, V. 34, №. 5, p. 358-361

Electric field effects on the linear and nonlinear intersubband optical properties in asymmetric quantum wells

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Abstract: In this work, we have performed a theoretical study of the optical intensity and an applied electric field effects on the linear and nonlinear optical properties in asymmetric quantum wells. The calculations are performed within the framework of the effective mass approximation in the system based on (Cds/ZnSe)/BeTe at X-BeTe conduction band minimum. We have shown that results obtained in X minimum are better than those in Γ (N. Zeiri *et al.*; 2012, 2013). The linear and nonlinear optical absorption, linear refractive index change as well as the generation of second and third optical harmonics are calculated and discussed. The conclusion is that all these properties are notably affected by the applied external effects.

We find red and blue shifts of the resonant peaks, reduction or increasing of amplitudes, and modifications in the peak structure of second and third harmonic responses depending on the value of the external applied effect and on the transition (Figures 1,2). The increasing applied electric field strength alters the separation between energy levels, therefore the energy differences and the linear and nonlinear absorption peaks change in magnitude and position as the electric field value increases.

When applying an optical intensity I, From this figure, it can be clearly seen from Figure 1 that the peak of the total absorption coefficient decreases prominently with the increase of I, due to an increase of the negative contribution of the nonlinear absorption coefficient and there is no shift at the resonant peak position.

In addition, and due to the negative contribution of the third-order nonlinear term, we note a bleaching of the resonant peak of the total absorption coefficient at sufficiently high incident optical intensities (≈I = 1.25 MW/cm^2); the resonant peak is split up into two peaks.

Thus, the modulation of the absorption coefficients which can be suitable for good performance optical modulators and various infrared optical device applications can be easy obtained by tuning the optical intensity and the electric field strengths

Keywords: II-VI semiconductors, Intersubband transition, QWIP, Nonlinear optical properties, Absorption coefficient, Applied electric field effects.

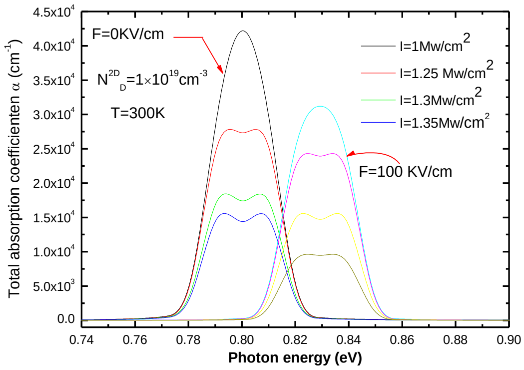

Figure 1: The total absorption coefficient α, for transition E_3-E_1 as a function of the photon energy for different values of optical intensity I: the peak of α decreases when the strength of the applied electric fied increases with a a blueshift; α decreases also when I increases. A bleacing is observed for I higher than 1.25 MW/cm^2.

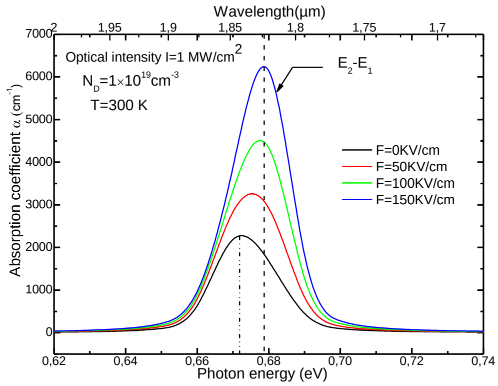

Figure 1: The intensity of absorption coefficient for transition E_2-E_1 increases when increasing the applied electric field with a modest blue shift of the peak position.

References:

Zeiri, N., Sfina, N., Abdi-Ben Nasrallah, S., Said, M. (2012) Intersubband resonant enhancement of the nonlinear optical properties in asymmetric (CdS/ZnSe) based quantum wells, *Superl. & Microst.*, 51, 587-596.

Zeiri, N., Sfina, N., Abdi-Ben Nasrallah, S., Said, M. (2013) Intersubband resonant enhancement of the nonlinear optical properties in asymmetric (CdS/ZnSe)/ X-BeTe based quantum wells, *Optical Materials*, 35, 875-880.

Theoretical Study of the Optical Properties of Si/Ge, Ge/Si core/shell and $Si_{1-x}Ge_x$ alloy nanoparticles

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Abstract: Semiconductor nanoparticles are good candidates for new optoelectronic, photovoltaic or sensing devices due to their exceptional ability to guide, scatter or absorb light, from ultraviolet to infrared. The occurrence of morphology-dependent optical resonances in nanostructures opens a route to overcome the intrinsic limitations of some materials (for instance the limited absorption of silicon in the visible-infrared spectrum due to its indirect band gap) and optimize their interaction with light.

The present wok is devoted to a detailed theoretical analysis of the optical properties of silicon-germanium spherical nanoparticles. Using the analytical Lorenz-Mie theory, we computed the absorption and the scattering efficiencies of light by $Si_{1-x}Ge_x$ alloy nanoparticle as well as Si/Ge and Ge/Si core/shell nanoparticles. A particular attention is devoted to the influence of nanoparticle diameter and Ge composition on their scattering and absorption cross sections.

Our results clearly show that the Ge composition provides an additional degree of freedom to tailor the optical response of the silicon-germanium nanostructures. Thus, resonant enhancement of absorption and/or scattering can be obtained in the visible-infrared range by a judicious choice of the Ge composition and the particle diameter. The optical properties of $Si_{1-x}Ge_x$ alloy nanoparticles are found to be composition-dependent; they evolve quasicontinuously from those of pure Si to those of pure Ge nanoaprticles with increasing alloy composition. The optical properties of Si/Ge and Ge/Si core/shell nanoparticles are found to be nearly insensitive to the Ge composition. The scattering and absorption properties of Si/Ge heterostructures, on the one hand, and the scattering properties of Ge/Si nanoparticles, on the other hand, show a close resemblance to those of pure Ge nanoparticle. The absorption properties of Ge/Si core/shell nanoparticle, however, differ slightly from those of pure Ge nanoparticle. More absorption resonances manifest themselves in Ge/Si nanoparticles. The additional resonances occur in the spectral range where the absorption by Ge nanoparticle is weak. More specifically, they appear in the Vis-NIR range.

Keywords: nanoparticles, silicon-germanium, optical properties, Mie theory, modeling

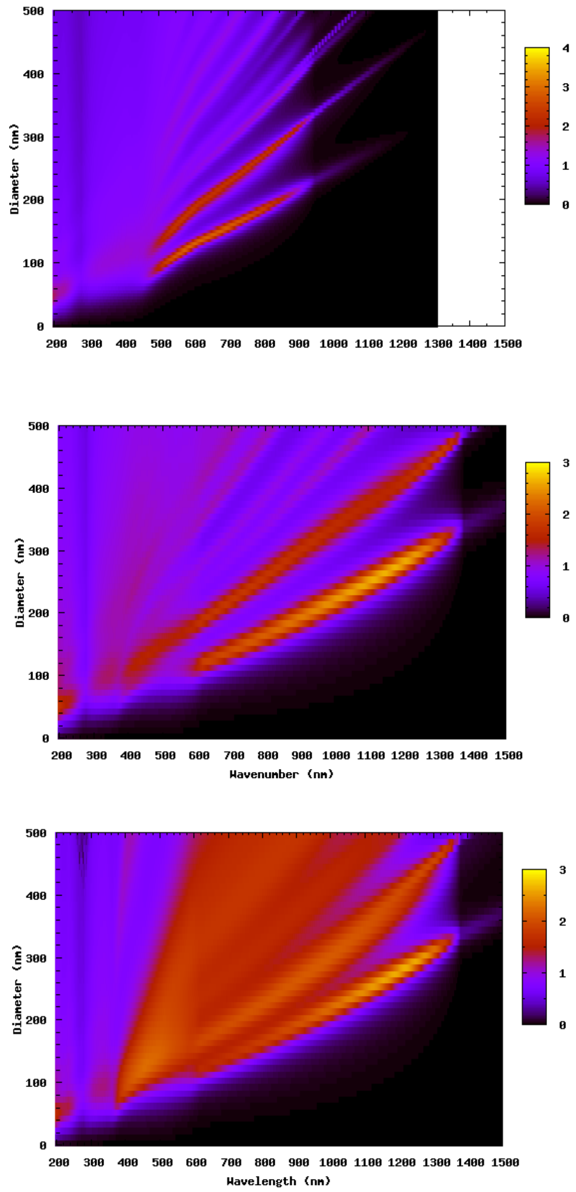

Figure 1: 2D color maps corresponding to the absorption efficiency of $Si_{1-x}Ge_x$ alloy nanoparticle, Si/Ge and Ge/Si core/shell nanoparticles. The Ge composition in the three cases is 0.5.

References:

C. F. Bohren and D. R. Huffman, Absorption and Scattering of Light by Small Particles (John Wiley & Sons, Inc., New York, 1998).

Quality Structure activity relationships study for selected metal oxide/ mixed metal oxide catalysts

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Abstract: Many mixed metal oxides are used as active catalysts in several industrially important reactions such as the conversion of methane to methanol and methanol to dimethyl ether on the surface of the catalysts. The conversion of methanol is used as a probe reaction to evaluate their acid-base and oxidation-reduction behavior. Experimentally, it was found that selected mixed oxides exhibited significant enhancement of their catalytic oxidation activity compared with their corresponding single metal oxides. The catalytic activity of the studied mixed oxides were correlated with their electronic structures. Hence, main principles of Density Functional Methods are utilized to design new effective and selective catalysts for the conversion of natural gas to transportable clean-burning liquid fuels and other valuable chemicals. It is strongly believed that transition metal- doped nanostructured metal oxides will exhibit unique activity and selectivity trends and, hence, will be commercially feasible. These catalysts are expected to display unique surface acid-base characteristics which can be, to some extent, controlled.

Several composites of mixed oxides containing another metal with (Al, V, Mn, Fe, Co, Cr and Cr) will be theoretically designed and investigated. A variety metals will be employed and compared including alkali and alkaline earth metals, metals in the first transition series, and other heavier transition metals. The effect of the doping metals will be established by studying the activity and selectivity of catalysts with different compositions and correlate that with experimentally determined results. A comparison between pure, supported and mixed oxides will be also established. Density Functional Methods will be applied to series of doped metal oxides catalysts to investigate the relationship between the doping of different metal in the metal oxide and the selectivity as well as the activity of proposed catalysts. Moreover, computational chemistry will be used to provide an insight into the proposed reactions mechanisms.

References:

Abbas Khaleel, Ihsan Shehadi, and Ali Al-Marzouqi, (2012) Unique textural properties of titanium-doped alumina via sol-gel synthesis under non-acidic conditions *Materials Letters* 68 11–13.

Abbas Khaleel, Ihsan Shehadi, and Ali Al-Marzouqi, *Fuel and Processing Technol*. 92 (2011) 1783–1789.

Abbas M. Khalil, Ihsan A. Shehadi and Mariam H. Al Shamsi, (2010) Structural and textural characterization of sol-gel prepared nanoscale titanium-chromium mixed *Journal of non-crystalline Solid*, 356,1282-1287.

Abbas M. Khalil, Ihsan A. Shehadi and Mariam H. Al Shamsi, (2010) Nanostructured chromium-iron mixed oxides: Physicochemical properties and catalytic activity , *Colloid and Surfaces A-Physiochemical and Engineering Aspects*, 355, 75–82.

PAN/CNT/AgNP composite nanowebs: Effect of CNT functionalization and Ag^+ reduction on properties of composite nanofiber webs

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Abstract: Silver (Ag), and carbon nanotubes (CNTs) have been increasingly incorporated into polymers with the aim of producing functional materials. Nanocomposites with silver nanoparticles are reported to acquire catalytic, optical, and especially antibacterial properties Through different methods of preparing a polymeric matrix containing silver nanoparticles, in situ reduction of metal ions have attracted much attention. Chemical reduction using aqueous solution of sodium borohydride, hydrazinium hydroxide, photoreduction, and heat treatment are some of the methods used for in situ reduction of silver nanoparticles (Mahapatra *et al.*, 2012; Sichani *et al.*, 2010). On the other hand, the combination of superior mechanical, thermal, and electronic properties makes CNTs an ideal candidate as an advanced filler material in nanocomposites. A significant challenge for getting maximum benefit of CNTs in polymer composites is to achieve a good dispersion. The functionalization of CNTs is an effective way for better dispersion and bonding of the CNTs within a polymer matrix. There are several approaches for functionalization of CNTs such as defect functionalization, covalent functionalization, and noncovalent functionalization (Coleman *et al.* 2006; Sahoo *et al.* 2009).

In this study, composite nanofibers from a solution of polyacrylonitrile (PAN), carbon nanotubes (CNTs) and silver nanoparticles (AgNPs) in dimethylsulfoxide were succesfully produced by electrospinning method (Figure 1). The use of amino-functionalized CNTs was investigated and compared to that of piristine CNTs. Chemical reduction using an aqueous solution of hydrazinium hydroxide was conducted for the in situ synthesis of silver nanoparticles and the effect of the reduction on the morphology, conductivity and mechanical properties of the nanowebs was also investigated. Scanning electron microscopy, conductivity meter and tensile tester were used for the characterization of the nanofibers.

Keywords: carbon nanotube, electrospinning, functionalization, nanofiber, nanocomposite, silver nanoparticles, silver reduction

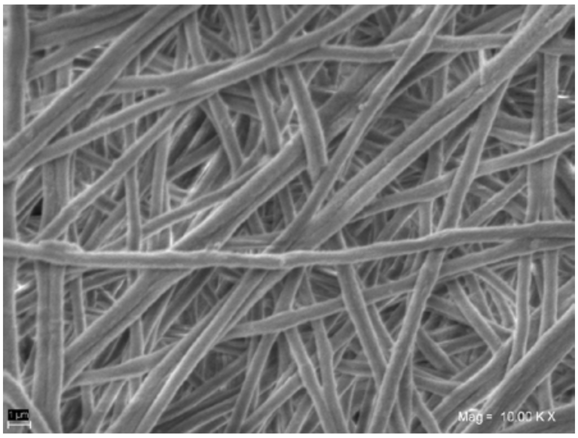

Figure 1: SEM image of the composite nanoweb containing %1 CNT-NH2 and %1 $AgNO_3$.

References:

Coleman, J.N., Khan, U., Gun'ko, Y.K. (2006), Mechanical Reinforcement of Polymers Using Carbon Nanotubes, *Adv. Mater.*, 18, 689–706.

Mahapatra, A., Garg, N., Nayak, B.P., Mishra, B.G., Hota, G. (2012) Studies on the Synthesis of Electrospun PAN-Ag Composite Nanofibers for Antibacterial Application, *J. Appl. Polym. Sci.*, 124, 1178–1185.

Sahoo, N.G., Chenga, H.K.F., Caia, J., Li, L., Chan, S.H., Zhaob, J., Yub, S. (2009) Improvement of mechanical and thermal properties of carbon nanotube composites through nanotube functionalization and processing methods, *Mater. Chem. Phys.*, 117, 313-320.

Sichani G.N., Morshed, M., Amirnasr, M., Abedi, D. (2010) In Situ Preparation, Electrospinning, and Characterization of Polyacrylonitrile Nanofibers Containing Silver Nanoparticles, *J. Appl. Polym. Sci.*, 116, 1021–1029.

Dynamic Spatial Manipulation on Infrared Light Using Arrays of Plasmonic Graphene Nanoantennas

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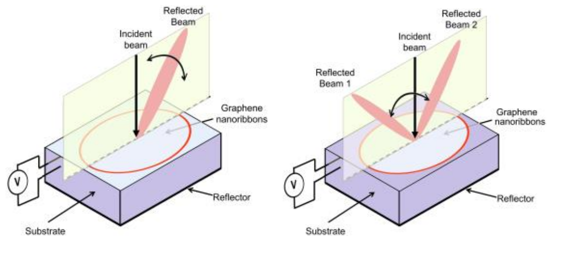
Abstract: Because of their unique electric and optic properties, plasmonic based structures made of graphene have recently acquired special relevance, especially in the spectral regions from low-THz to mid-Infrared. The applications for this kind of devices include low-range high-speed communications, sensing, chemistry, medicine, security, etc.

Graphene can be patterned in periodic or aperiodic strips of sub-wavelength size in the order of nanometers, known as nanoribbons. The operating principle of reflective type arrays is based on the fact that the phase of the reflected wave varies with the resonant width of the ribbon. After properly optimizing nanoribbons, the reflected wave can be dynamically controlled if an electrostatic biasing is applied. This biasing allows scanning the beam by varying the conductivity of graphene. Additionally the beam-shape and pointing direction can also accurately be manipulated. In this way, the incident beam can be splitted forming multibeams in reflection. Fig. 1 shows the two concepts: a beam which can be dynamically steered in reflection and a beam which is dynamically splitted forming two reflected beams.



(a) (b)

Figure 1: Graphene nanoantennas. (a) Dynamic beam-steering. (b) Dynamic beam-splitting.

In both cases it is assumed that a 27 THz Gaussian beam impinges normally on the surface of the array formed by 900 nanoribbons, separated 140nm. Fig. 2 shows the farfield radiation patterns for different cases. First a single-beam which is scanned from 15° to -40°, by dynamically varying the conductivity on each nanoribbon. The incident beam can be also splitted, as in the case of a diffraction grating, but without restriction on the spatial direction of each reflected beam. In the example the beam is divided in two beams towards the same direction of the previous single-beams. Finally, in Fig. 3 shows the plane of steering for a beam which is splitted in reflection towards different spatial directions in both symmetric and asymmetric beams.

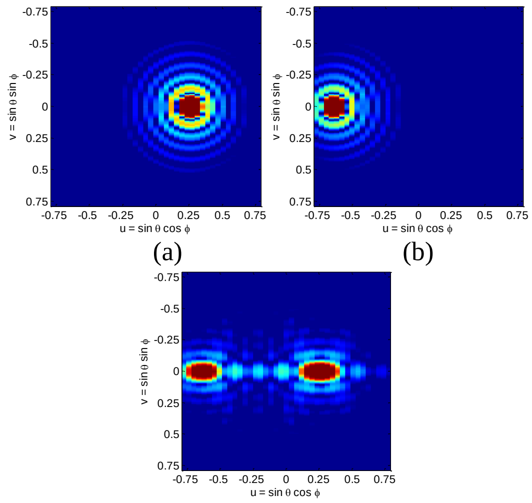


Figure 2: Farfield beams. (a) Single-beam towards θ=15°. (b) Single-beam towards θ=-40°. (c) Asymmetric splitting towards θ=-40° and θ=15°.

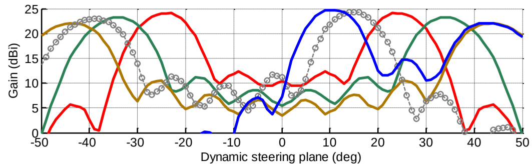


Figure 3: Splitted beams towards different spatial directions, including asymmetric splitting.

This work was supported by the Hasler Foundation (Project 11149), the Swiss National Science Foundation (Project 133583), and the European Union (Marie Curie IEF 300934 RASTREO).

Keywords: graphene nanoribbons, plasmonic, nanoantenna, reflective type array, beam bending, beam splitting, infrared metamaterials.

References:

Carrasco, E., Tamagnone, M., Perruisseau-Carrier, J., Tunable Graphene Reflective Cells for THz Reflectarrays and Generalized Law of Reflecion (2013) Appl. Phys. Lett., 102, 104103.

Low, T., Avouris, P., Graphene Plasmonics for Terahertz to Mid-Infrared Applications (2014) ACS NANO, 8 (2), pp 1086–1101.

Lee, S. H., et al., Switching terahertz waves with gate-controlled active graphene metamaterials (2012) Nature Materials 11, 936–941.

Bottom-Up Fabrication of High performance Nanostructured Photoetectors

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Abstract:
A controlled, seedless and site selective hydrothermal technique to fabricate high performance ZnO nanostructured photodetectors directly on chip is reported. We demonstrate that by controlling the nanowires growth process, via tuning the experimental parameters such as the concentration of reactants and the growth time, the device structure efficiency can be increased and significantly enhance its performance (sensitivity, detectability, response-time, and recovery-time). Using on-chip fabrication technique, bridging NWs (BNWs) photodetectors are fabricated on flexible and transparent substrates. The fabricated BNWs devices are then compared with other photodetectors having different device structures, NW array (NWA) and single NWs (SNWs) device. The BNWs photodetector demonstrates improved sensitivity, nanowatts detectability, and ultrafast response time and recovery time. The improvement in response time and recovery time is attributed to the unique NW-NW junction barrier dominating the charge transport in the BNWs devices and the direct contact between the ZnO nanowires and the Au electrode which are not available for the other devices. The enhanced photosensitivity and nanowatts detectability of the BNWs device are due to the reduction in dimensionality and ultrahigh surface-to-volume ratio compared to the other tested structures. This work paves the way toward low cost, large scale, low temperature, seedless and site-selective fabrication of high performance ZnO NW sensors on flexible and transparent substrates.[1,2]

Keywords: ZnO, hydrothermal synthesis, photodetectors, nanowires, seedless synthesis, bottom up.

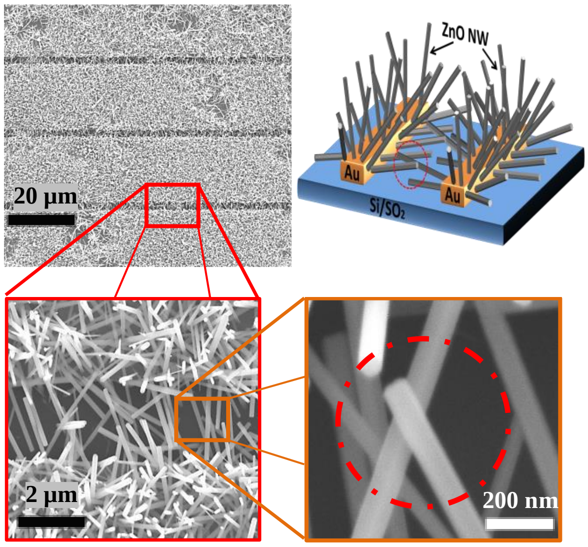

Figure 1: SEM images at different magnifications and schematic diagram of the bridging nanowires photodetectors.

References:

1. M. R. Alenezi, S. J. Henley, N. G. Emerson, S. R. P. Silva, *Nanoscale*, **2014**,*6*, 235–247.
2. M. R. Alenezi, A. S. Alshammari, K. D. G. I. Jayawardena, M. J. Beliatis, S. J. Henley, S. R. P. Silva *J. Phys. Chem. C*, **2013**, *117*, 17850–17858.

Design and Computational Analysis of an ultra sensitive gaz sensor based on functionnalised carbon nanotube

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Abstract: Developments in the field of nano-biodevices coupling nanostructures and biological components are of great interest in gaz and vapour nanosensor [1]. As the fundamentals of gaz/bionano-sensor interaction processes are still poorly understood in the design of these devices, design methodology and multiscale dynamics modeling approaches are necessary at the fabrication pre-project stage [2,3]. This paper proposes the caracterizatoin and optimization of carbon nanotube based ultra-nanosensor design gaz detection applications.

The design of ultra nanosensor is parametrized using a quantum level approach and characterized by using molecular dynamics.

First, a co-prototyping methodology that integrated principles for multiscale approach is presented. Then, we focus in the determination of plages of sensitivity and saturation limits by calculating the total non-bonded energies between bio-nanosensor and diffrents Acetone vapor conectrations. Also we determine the eventual absorption of Acetone molecules inside the functionalized cnt therefore we can characterize the hysteresis phenomena.

Based on the analysis of the simulation results, an optimized nanosensor with ultra-sensitive capabilities is simulated and analyzed for application as a gas/vapor detector.

Keywords: Vapor detection. functionalized carbon nanotubes Molecular dynamics, quantum mechanics, hysteresis phenomena, sensors saturation.

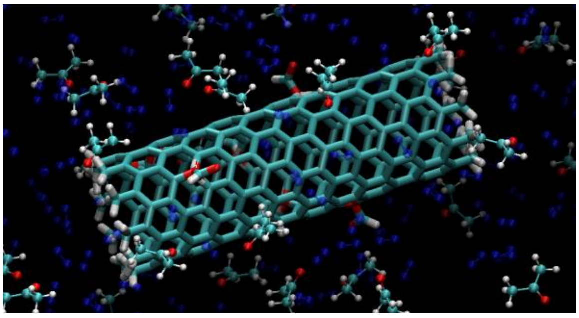

Figure 1: Structure of oorganic functionalized carbon nanotubes CNT decorated by COOH peptides, surrounded by 2 percent Acetone and 98 percent Azote.

References:

I.Hfaiedh, Pierrick Clément, H.Baccar,Eduard Llobet, A.Abdelghani (2013), Functionalised mutli-waaled carbon annaotubes for chemical vapour detection. Int. J.Nanotechnology, Vol. 10, Nos, 5/6/7.

Hamdi, M. ; Ferreira, A. , Computational study of superparamagnetic nanocapsules crossing the blood-brain barrier: A robotics approach, (2012) Intelligent Robots and Systems (IROS), IEEE/RSJ International Conference on.

Mustapha Hamdi (2009), Computational design and multiscale modeling of a nanoactuator using DNA actuation, IOP Nanotechnology 20 485501

Rhodium-decorated MWCNTs for chemical vapors detection

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Abstract: Nowadays, the detection of organic pollutants, heavy metals and toxic gases represent a major issue in several areas especially industrial, military and the environment. The rapid development of microelectronics technology has facilitated the design of miniature systems called sensors. Sensors are devices that detect or measure physical or chemical quantities, providing instant feedback on the environment. For several years, gas sensors have attracted the interest of intensive research because of the demand for sensitive, rapid and stable devices for environmental monitoring and regulatory controls in the industry. To respond to this request, nanotechnologies are used, providing new materials and a huge potential to build highly sensitive and portable sensors with low energy consumption. One class of such materials are carbon nanotubes (CNTs) discovered in 1991 by Iijima [1]. The effect of the adsorption of gas molecules on the electronic properties of carbon nanotubes (CNTs) has been studied extensively. Detection of gas at room temperature has been demonstrated for many organic vapors (ethanol, methanol, acetone ...) and many aromatic vapors (benzene, toluene ...) [2]. However, the nanotubes do not show a high reactivity to many gases of interest, and their sensitivity is not gas-selective. Recent research has demonstrated the possibility of fixing metal or nanoparticles to CNTs to open the way for the development of new hybrid materials combining unique physical and chemical properties of carbon nanotubes and other materials [3,4].

In this paper, we describe a new approach for the development of a gas sensor based on carbon nanotubes coated with Rhodium for organic and aromatic vapors. Various organic vapors (ethanol, methanol and acetone) and various aromatic vapors (toluene, benzene, xylene) were tested. The developed sensor shows two different kinetics and different response time for both vapors. For organic vapors, the kinetics shows chemisorptions behavior, although with aromatic vapors, the kinetics shows a physisorption behavior. Also, the developed sensor has better sensitivity for organic vapors than for aromatic vapors. The sensor response deviation was below 10% after two months which shows a higher MCNTs film stability.

Keywords: Gas sensors, Carbone nanotubes (CNTs), Organic vapors, Aromatic vapors, Impedance spectroscopy.

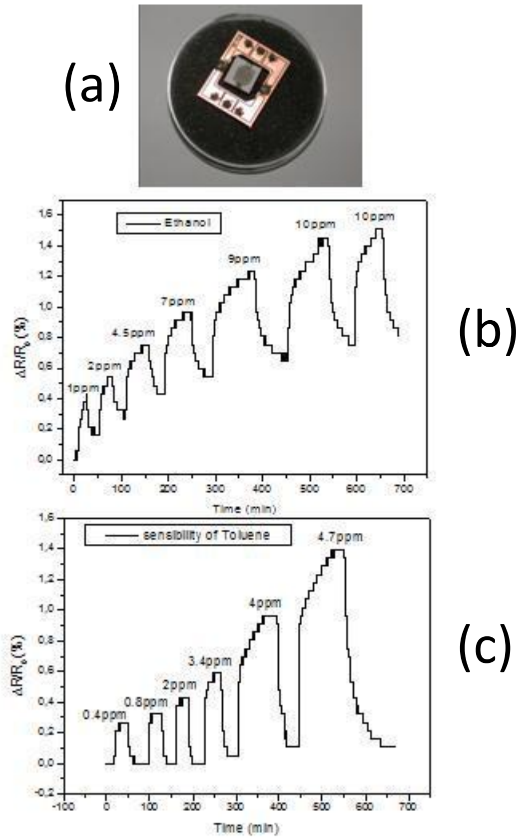

Fig. (a). Gas sensor based on MWCNTs/Rh. (b). Ethanol detection. (c). Toluene detection.

References:

1. S.H. Iijima, (1991), Microtubules of graphitic carbon, Nature, 354, 56–58.

2. I. Hafaiedh, W. El Euch, P. Clement, E. Llobet, A. Abdelghani, (2013), Multi-walled carbon nanotubes for volatile organic compound detection, Sensors and Actuators B: Chemical, 182, 344-350.

3. J.M. Marulanda,(2010),Carbon Nanotubes, ISBN 978-953-307-054-4, 357-374.

4. V.M. Aroutiounian, A.Z. Adamyan, E.A. Khachaturyan, Z.N. Adamyan, K. Hernadi, Z. Pallai, Z. Nemeth, L. Foro, A. Magrez, (2012), Methanol and ethanol vapor sensitivity of MWCNT/SnO/Ru nanocomposite structures, The 14th I.M.C.S, DOI 10.5162/IMCS2012/P1.7.10, 1085-1088.

Theory of plasmon enhanced lasers: Coupling QM to EM at the rate constant level

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Abstract: We report a theoretical study of lasing when plasmonic metallic structures are embedded in a gain medium. We demonstrate theoretically and experimentally a plasmon-enhanced laser that is based on an array of gold particles that has a photonic lattice mode that is coupled to the gold nanoparticle plasmon[1]. After appropriate pumping of the gain medium, light is emitted perpendicular to the array which shows many characteristics that are expected for a laser. To model this result, a four-level system was developed which allows for both spontaneous and stimulated emission between the lasing states, and stimulated absorption or emission for the pumping transition. The theory uses a rate equation description of the gain medium, together with classical electrondynamics for the plasmonic particles, and a constitutive equation of motion for induced polarization in the molecules that is driven by the electromagnetic field of the nanoparticles. The rate equations, constitutive equations and classical electrodynamics solved together using a finite differencing algorithm. This leads to a coherent light emission that shows the expected threshold with pump intensity and a maximum population inversion close to the nanoparticles which is what would be expect for a plasmon-enhanced laser. The dye molecule photophysics near the nanoparticle was also studied, and it is demonstrated that stimulated emission dominates over spontaneous emission above threshold, with most of the stimulated emission being associated with the near-field region near the metal nanoparticle. The effect of the Purcell factor on the lasing action is also reported. We believe that our results are important for the understanding, prediction, and control of processes between molecules and plasmons on the nanometer scale, particularly for the development of nanoscale nanoplasmonic laser devices, and for the development of novel optical spectroscopies and microscopies. Based on this model, further studies should be done to explore and study the influence of geometrical parameters, quantum parameters, type of metal, and dye concentration on lasing action.

Keywords: Plasmonic laser, Nanoparticle, Modeling, gain.

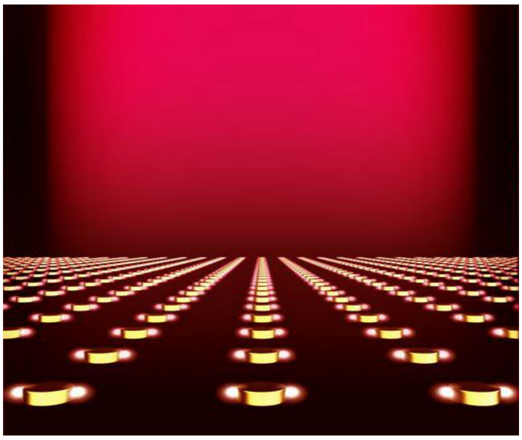

Figure 1: Plasmon-based laser: Optically pumped, 2D arrays of plasmonic Au or Ag nanoparticles surrounded by an organic gain medium were demonstrated to show directional beam emission (divergence angle <1.5° and linewidth <1.3 nm) characteristic of lasing action in the far-field, and behave as arrays of nanoscale light sources in the near-field.

References:

Ref1: Wei Zhou, Montacer Dridi, Jae Yong Suh, Chul Hoon Kim, Dick T. Co, Michael R. Wasielewski George C. Schatz & Teri W. Odom (2013) Lasing action in strongly coupled plasmonic nanocavity arrays. *Nature Nanotechnology 8, 506–511*

Ref2: Model for describing plasmon-enhanced lasers that combines rate equations with finite-difference time-domain. Montacer Dridi and George C. Schatz. *JOSA B*, Vol. 30, Issue 11, pp. 2791-2797 (2013)

Calorimetric Study and optimization of crystallinity rate for the composite: isotactic polypropylene / micro- talc (iPP / µ -talc)

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Abstract: The aim of our work is to show the importance of developing a new reinforcing load of polyolefins namely isotactic polypropylene (iPP), widely used in our daily life and to optimize the crystallinity rate of the composites prepared at different load rate depending on the cooling speed. The company Mutlitibase (France) has developed a talc load of submicron size (intermediate between the nano-load and conventional load) to reinforce an organic matrix of polypropylene in order to solve the problem raised by the exfoliation during the incorporation of load nanoscopic size in polyolefins (PE and iPP).

To demonstrate the efficiency of choice of this mineral load (µ-talc) which will be compared to conventional loads like (standard talc) and ($CaCO_3$), we have operated at a microscopic and structural characterization by different techniques : thermogravimetric analysis (TGA) , differential scanning calorimetry (DSC) , thermal deformation (HDT) , XRD , ...

Then the samples have been prepared by the isotactic polypropylene reinforced by micro-talc with a load rate going from 3 % to 30% by mass. For comparative purposes we have studied other composites with standard talc and calcium carbonate as loads.

As part of the optimization of crystallinity rate, DSC tests were carried out using a full factorial design (7^2 = 49 trials). The results were statistically processed by analysis of variance (ANOVA) to reach mathematical models which will be used for predicting the of crystallinity rate in function of the cooling speed and the load rate. The contour graphs were used to determine the effect of each parameter on the response (the crystallinity rate).

This characterization study has allowed us to prove that the incorporation of this new load of talc into the iPP matrix composite has improved the thermal behavior by distancing, for example, the degradation of the composites to the high temperatures, and that the crystallinity rate is inversely proportional to the cooling speed.

Key words: Polypropylene, composite, DSC, micro-talc, ANOVA**,** crystallinity rate

References:

[H. Naguib, C. B. Park, P. C. Lee, effect of talc content on the volume expansion ratio of PP foams, Journal of cellular Plastics Volume 39 (2003).

Helson M. da Costa, Valéria D. Ramos, Marcia G. de Oliveira; degradation of polypropylene (PP) during multiple extrusions: thermal analysis, mechanical properties and analysis of variance; Polymer Testing, 26 (2007) 676-684.

Bruno Rotzinger, talc-filled PP: a new concept to maintain long term heat stability; Polymer Degradation and Stability 91 (2006) 2884-2887.

Woo Jin Choi, Sung Chul Kim; effects of talc orientation and non-isothermal crystallization rate on crystal orientation of polypropylene in injection-moulded polypropylene / ethylene-propylene rubber/talc blends; Polymer ,45 (2004) 2393–2401.

M. Denac, I. Smit, V. Musil; Polypropylene/talc/SEBS(SEBS-g-MA) composites. Part1. Structure; Composites: Part A 36 (2005) 1094-1101.

D. Frihi, K. Masenelli-Varlot, G. Vigier, H. Satha ; Mixed percolating network and mechanical propriesties of PP / talc composites : effect of the talc particle size ; Journal of applied polymer science, volume 114, issue 5, december 2009.

Effect of heat treatment on physical properties of Titanium dioxide

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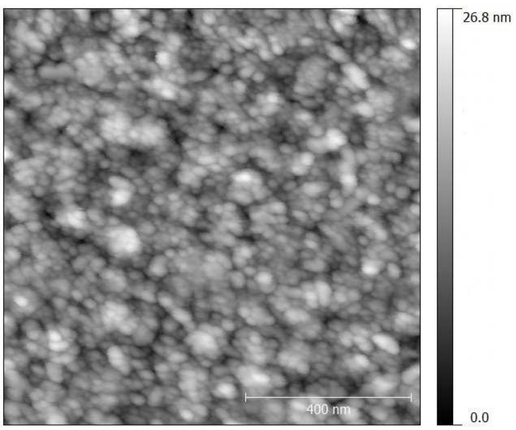
Abstract: Heat treatment usually plays significant role in enhancing thin film physical properties. In the case of Spray fabricated films, the temperature range is chosen well below the melting temperatures. It is expected that such annealing mainly improves the thin film structure. Titanium dioxide thin films are successfully synthesized on glass substrate by spray pyrolysis technique and then annealed in air for different times at a temperature in the range 300-500°C. The properties of the films are investigated by X-ray diffraction, Atomic Force Microscopy, spectrophotometry and spectrofluorimetry. The X-ray diffraction reveals that the as-prepared film exhibits the amorphous phase, while we observe the appearance of the anatase phase in the tetragonal structure with (101) as preferential orientation for annealing temperature at 500°C for 2 hours. The surface relief shown by AFM revealed that surface is more compact, uniform and dense after annealing in air at 500°C for 2 hours (figure 1). Optical analyses by means of transmission T(λ) and reflection R(λ) measurements show interference fringes indicating the homogeneity of TiO_2 thin films and 3.4 eV as a indirect band gap value, this value is the closest to the theoretical optimum value (3.2 eV (E. Haimi et al)). Photoluminescence spectra showed emissions in the UV and visible regions.

Keywords: Spray pyrolysis technique, titanium dioxide thin films, anatase phase, optical window, solar cells.



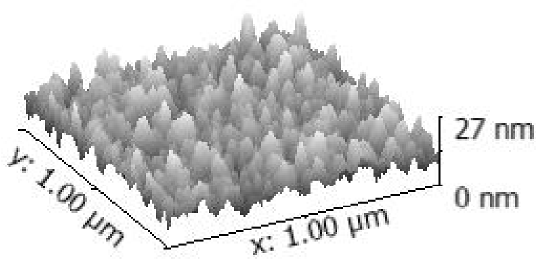


Figure 1: AFM plane and 3D views of anatase TiO_2 thin after an annealing in air at 500°C for 2 hours.

References:

E. Haimi, H. Lipsonen, J. Larismaa, M. Kapulainen, J. Krzak-Ros, S.-P. Hannula, Thin Solid Films 519 (2011) 5882–5886.

Nanotech in Life Sciences & Medicine/ Nanotechnology safety

Polysaccharide Scaffolds for Cardiovascular Tissue Engineering

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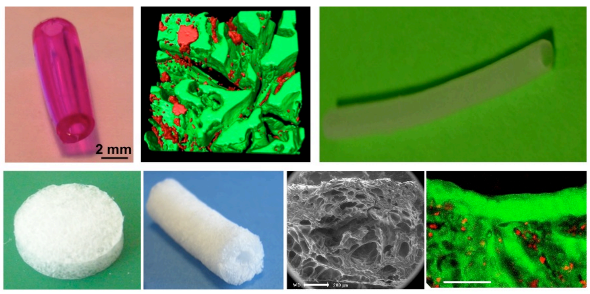
Abstract: One main challenge of tissue engineering is to create an optimal environment for growing therapeutic cells to regenerate damaged tissues. This environment can be reconstituted by using 3D matrices, in which cells can be organized into a tissue-like structure. We have prepared pullulan/dextran porous matrices having controlled pores and porosity that allowed the proliferation and survival of various cell types. These porous hydrogels made of natural biodegradable and biocompatible polysaccharides have architectural characteristics adapted to the culture in 3D. Further studies have demonstrated the performance of these matrices for tissue regeneration. Examples for heart, skin and bone will be presented.

Applications of these scaffolds included the 3D cell culture, the tissue integration/regeneration, and the design of biocompatible materials for cell, drug and gene delivery by chemical functionalization of the polymers and new formulations.



Some references

Chaouat M, Le Visage C, Baille WE, Escoubet B, Chaubet F, Mateescu MA, Letourneur D. A novel cross-linked poly(vinyl alcohol) (pva) for vascular grafts. Advanced Funct Materials. 2008;18:2855-2861.

Autissier A, Le Visage C, Pouzet C, Chaubet F, Letourneur D. Fabrication of porous polysaccharide-based scaffolds using a combined freeze-drying/cross-linking process. Acta biomaterialia. 2010;6:3640-3648.

Robert D, Fayol D, Le Visage C, Frasca G, Brule S, Menager C, Gazeau F, Letourneur D, Wilhelm C. Magnetic micro-manipulations to probe the local physical properties of porous scaffolds and to confine stem cells. Biomaterials. 2010;31:1586-1595.

Abed A, Assoul N, Ba M, Derkaoui SM, Portes P, Louedec L, Flaud P, Bataille I, Letourneur D, Meddahi-Pelle A. Influence of polysaccharide composition on the biocompatibility of pullulan/dextran-based hydrogels. J Biomed Mater Res. Part A. 2011;96:535-542.

Brule S, Levy M, Wilhelm C, Letourneur D, Gazeau F, Menager C, Le Visage C. Doxorubicin release triggered by alginate embedded magnetic nanoheaters: A combined therapy. Advanced Mater. 2011;23:787-790.

Lavergne M, Derkaoui M, Delmau C, Letourneur D, Uzan G, Le Visage C. Porous polysaccharide-based scaffolds for human endothelial progenitor cells. Macromolecular bioscience. 2012;12:901-910.

Le Visage C, Gournay O, Benguirat N, Hamidi S, Chaussumier L, Mougenot N, Flanders JA, Isnard R, Michel JB, Hatem S, Letourneur D, Norol F. Mesenchymal stem cell delivery into rat infarcted myocardium using a porous polysaccharide-based scaffold: A quantitative comparison with endocardial injection. Tissue engineering. Part A. 2012;18:35-44.

Guerrero J, Catros S, Derkaoui SM, Lalande C, Siadous R, Bareille R, Thebaud N, Bordenave L, Chassande O, Le Visage C, Letourneur D, Amedee J. Cell interactions between human progenitor-derived endothelial cells and human mesenchymal stem cells in a three-dimensional macroporous polysaccharide-based scaffold promote osteogenesis. Acta biomaterialia. 201; 9(9):8200-13.

Fricain JC, Schlaubitz S, Le Visage C, Arnault I, Derkaoui SM, Siadous R, Catros S, Lalande C, Bareille R, Renard M, Fabre T, Cornet S, Durand M, Leonard A, Sahraoui N, Letourneur D, Amedee J. A nano-hydroxyapatite-pullulan/dextran polysaccharide composite macroporous material for bone tissue engineering. Biomaterials. 2013;34:2947-2959.

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The nanoparticles protein corona: How to extract a predictive molecular model from the experiments.

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Abstract: Nanoparticles (NP) in the extracellular matrix are immediately coated by layers of biomolecules forming a "protein corona". The protein corona gives to the NPs a "biological identity" that regulates the NP-cell interaction. Therefore, the cell uptake of the NPs is strongly affected by the protein corona. For this reason learning to predict the biological identities of NPs based on a partial experimental knowledge is essential to foresee a priori the safety implications of a NP for human health and, more in general, the environment.

To this goal we propose a multiscale approach that allows us to predict the protein corona composition based on a partial experimental knowledge. The approach, both theoretical and computational, includes protein-protein (Vilaseca *et al.*; 2013) and protein-NP interactions, accounting for the physico-chemical properties (i.e., electrostatic and Van der Waals interactions) and the size of the NPs as in the DLVO theory for colloids.

We study, by numerical simulations, the competitive adsorption of proteins on a NP suspended in blood plasma as a function of contact time and plasma concentration. We consider the case of silica NPs in a "simplified" blood plasma made of three competing proteins: Human Serum Albumin, Apolipoprotein A1 and Fibrinogen. These proteins are of particular interest because they have a high concentration in plasma, or because they are the most abundant in the corona of silica NPs (Milani *et al.*; 2014) Our results are compared with experiments made under the same conditions showing that the approach has a predictive power (Vilanova *et al.*; 2014).

Keywords: protein corona, nanoparticles, molecular modeling, simulations, experiments.

References:

Djeribi, R., Bouchloukh, W., Jouenne, T., Menaa, B. (2012) Characterization of biofilms formation in urinary catheters, *Amer. J. Infect. Control.,* In Press. P.

Vilaseca, P., Dawson, K.A., Franzese, G. (2013) Understanding and modulating the competitive surface-adsorption of proteins, *Soft Matter*, 9, 6978.

Milani, S., Vilanova, O., Dawson, K.A., Franzese, G., Rädler, J. (2014) The Protein Corona in a Three Component Model Plasma, In Preparation.

Vilanova, O., Milani, S., Dawson, K.A., Rädler, J., Franzese, G. (2014) Theoretical and Numerical Predictions Compared to Experiments for Silica Nanoparticles in a Three Component Model Plasma, In Preparation.

Fabrication of gold nanopillars on gold interdigitated impedance electrodes for biological applications

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Abstract: Gold nanopillars have been successfully fabricated on top of interdigitated gold electrodes deposited on a Pyrex substrate and used for cytotoxicity monitoring through the electrochemical impedance spectroscopy technique on tissue cultures. These nanopillars have been fabricated via contact metal deposition. E-beam lithography has been used to define the pattern of nanopillars with dimensions of 150nm diameter and 500nm of distance between their edges in a honeycomb-like structure. These dimensions together with a relatively low aspect ratio (~50nm tall) have been observed not to have negatively influenced the normal cell growth and cell adhesion as these impedance electrodes will be used for tissue cultures testing of cytotoxicity. In this way we hope to increase the sensitivity of this kind of analysis compared to its plain counterpart. Electrochemical sensors with nanopillars have been also fabricated and tested with several buffers and analytes (such as Dopamine, Uric Acid, Ferrocyanide, etc) giving promising results in terms of higher sensitivity.
Besides cytotoxicity monitoring and electrochemical analysis, these devices find applications in many scientific areas such as drug screening, security, biocompatibility, food quality, etc.

Keywords: Biompedance, Citotoxicity, Nanopillars, Cell-cultures, Impedance Spectroscopy, Electrochemical Sensor, Nanofabrication

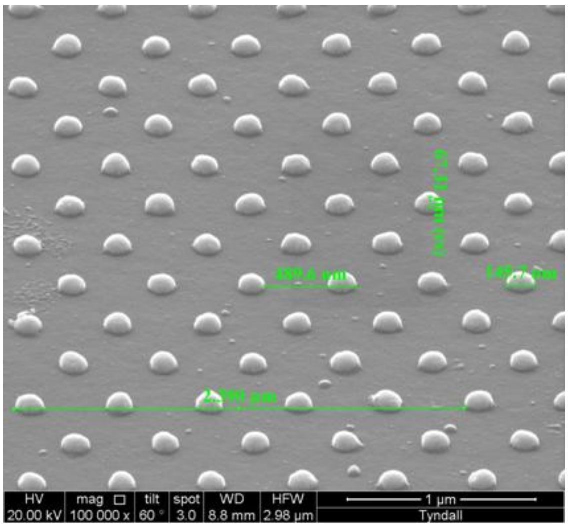

Figure 1: SEM image of the nanopillars on the finger electrode

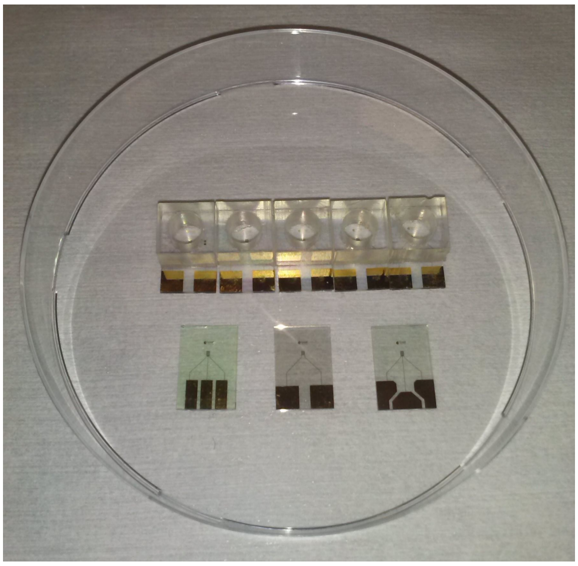

Figure 2: Electrodes for impedance and electrochemical analysis (packaged and not packaged)

Nanohybrid based on Zn(Fe)O pullulan grafted nanoparticles as potential luminescent and magnetic bimodal imaging probes: synthesis, characterization, modification and cytoxicity study

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Abstract:

During the past decades, multifunctional nano-tools able to perform, at the same time, optical and magnetic tasks, have gained a significant attraction (for instance as probes for theranostic applications), where they simultaneously act as luminescent probes for optical imaging and contrast agents for magnetic resonance imaging (MRI). Bioconjugated QDs, because of their photoluminescence, have been already used for ultrasensitive biological labelling, multicolor optical detection. In parallel, Fe based compounds such as oxides have been already considered, in the form of either superparamagnetic, as efficient positive contrast agents to improve MRI sensitivity in medicine. They accelerate the relaxation of the nuclear magnetic moment of water protons in their proximity, thereby greatly increasing the contrast between specific tissues or organs [1].

In this study, we propose to produce Zn(Fe)O nanocrystals by forced hydrolysis in polyol medium and to evaluate their optical and magnetic properties for in vivo multimodal imaging (Figure 1 B and C). The as-prepared particles with 15-17 nm in diameter were successfully coated with the polysaccharide pullulan functionalized with carboxymethyl groups. TEM images evidenced an encapsulation of the oxide cores into a translucent phase. The polymer chains were grown from the surface to yield hybrid NPs with a 3-nm thick organic shell (see Figure 1 A). In order to improve their compatibility with biological media and to allow further modifications by coupling the polysaccharidic shell with ligands of interest, the cytoxicity of bare and coated nanoparticles was assessed on vascular cells.

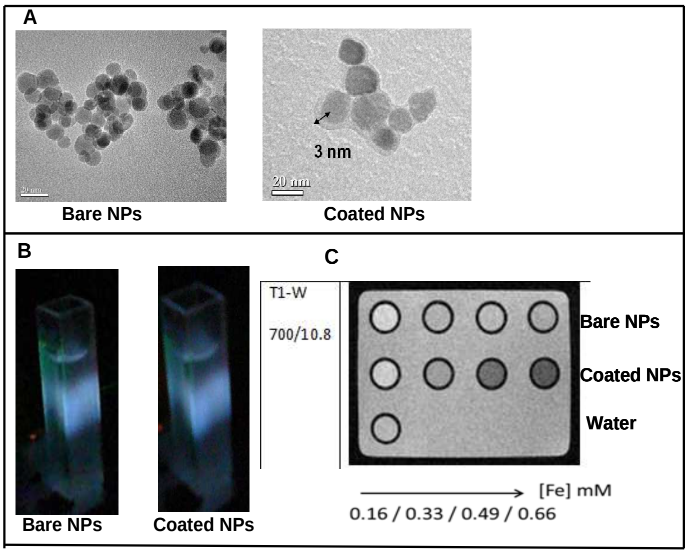

Figure 1: Figure illustrating the optical and magnetic properties of bare and CMP coated Nanoparticles.

Keywords: Nanoparticles, contrast agents, biomedical applications

References:

[1] Lu XM, Jiang RC, Fan QL, Zhang L, Zhang HM, Yang MH, Ma YW, Wang LH, Huang W (2012) *J Mater Chem* 22(14):6965–6973.

Vitamin E Encapsulation Within Pharmaceutical Drug-Carriers Prepared Using Membrane Contactors

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Abstract:

Vitamin E, a physiological antioxidant, has been tested to prevent cigarette smoke toxicity since several pulmonary disorders are mainly caused by oxidative stress phenomena. Nevertheless, the use of conventional pharmaceutical forms (oral or intravenous administration) doesn't allow precise transport of vitamin E to its specific action site, the lung alveoli. Thus pulmonary drug delivery could present a promising alternative to the systemic drug administration. The present study investigated the preparation of pharmaceutical drug carriers encapsulating the vitamin E and intended for pulmonary administration after nebulisation.

The methods used for the drug carriers' preparation were based on the membrane emulsification principle. In these methods, the to-be-dispersed phase was injected in the continuous phase through the pores of a microporous membrane. The advantages of this method are: a better control over the diffusive mixing at the liquid / membrane interface and thus a fine control of droplets size distribution, a less energy consumption and an easy extrapolation of the obtained results for an industrial large scale-up. In order to study the preparation processes, the influence of the formulation factors and the process parameters on the particles characteristics was systematically investigated.

Different experimental set-ups were used: (i) tubular membranes with a cross flow circulation of the continuous phase, (ii) stirred cell device with a flat micro-engineered membrane, (iii) oscillating membrane module in a stationary continuous phase. For direct emulsification, various membranes were used such as: SPG membranes, micro-engineered membranes and ceramic membranes. For premix emulsification, a packed bed of glass beads, called dynamic membrane, was studied.

Four different drug carriers were developed during this study: liposomes, micelles, nano-emulsion and solid lipid particles. The different encapsulating systems were characterized in terms of size distribution, zeta potential, microscopic morphology, encapsulation efficiency and stability. Results showed that the obtained drug carriers presented convenient properties. After nebulisation, the vitamin E loaded particles aggregate leading to an icrease in the average size. A balance between exhaled and lung deposited drug rates exists and it depends on the aerosols particle size. For small sizes, the nebulised suspension is mostly exhaled, larger sizes of the nebulised suspension led to its retention in the upper respiratory tract. In our study, the obtained aerosols presented satisfying aerodynamic characteristics which allowed the prediction (using a mathematical model: Multiple Path Particle Dosimetry "MMPD") of a high level of vitamin E deposit on its action site. Coming work includes an *in-vivo* administration of vitamin E loaded vectors to rats in order to confirm its safety and therapeutic efficiency.

Keywords:

Encapsulation, Nanoparticles, Membrane contacor, Pharmaceutical vectors, Nano-medecine, Vitamin E, Industrial Scale-up, Cigarette toxixity

References:

Laouini, A., Fessi, H., Charcosset, C. (2012) Membrane emulsification: a promising alternative for vitamin E encapsulation within nano-emulsion, *J. Membr. Sci.*, 423-424, 85-96.

Laouini, A., Charcosset, C., Fessi, H., Holdich, R. G., Vladisavljevic, G. T. (2013), Preparation of liposomes: A novel application of microengineered membranes – Investigation of process parameters and application to the encapsulation of vitamin E, *RSC. Adv.*, 3, 4985-4994.

Laouini, A., Charcosset, C., Fessi, H., Holdich, R. G., Vladisavljevic, G. T. (2013), Preparation of liposomes: A novel application of microengineered membranes – Scale-up from laboratory scale to large scale, *Colloid. Surface. B.*, 112, 272-278.

Laouini, A., Koutroumanis, K. P., Charcosset, C., Georgiadou, S., Fessi, H., Holdich, R. G., Vladisavljevic, G. T. (2013), pH-sensitive micelles prepared using a novel membrane contactor method, *ACS. Appl. Mater. Interfaces.*, 5, 8939-8947.

Laouini, A., Charcosset, C., Fessi, H., Shroen, K. (2014), Use of dynamic membranes for the preparation of vitamin E loaded lipid particles: An alternative to prevent fouled observed in classical cross-flow emulsification. *Chem. Eng. J.*, 236, 498-505.

FluidFM: A micromanipulator with force control for single cell adhesion or injection experiments

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Abstract

Nanomedicine requires tools that bridge the gap between the molecular, nanometer-scale level on one side and the single cell and sub-organ level on the other. Among the earliest tools are micromanipulators with thin glass capillaries to do single cell electrophysiology on or injections into single cells. However, the force control on such tools is poor, reducing the success rate of experiments and excluding more sensitive cell types. With the invention of atomic force microscopy (AFM) a technique was invented that owns sensitive force control in the low nanonewton range. For example, AFM has been recently used to measure the nanomechanical signature of breast cancer on biopsies[1]. So far micromanipulation with the AFM at the commercial level was restricted to nanomechanical probing. FluidFM is an invention by Cytosurge and with this technique force control of AFM enters micromanipulation for broader application areas.

A hollow cantilever can be used to pick up beads to create an exchangeable colloidal probe for mechanical probing[2]. But it can also be employed to pick up single cells directly from a surface to probe the cell-surface or cell-cell interaction forces. Probing of adhesion forces of single mammalian and yeast cells could has been studied with FluidFM under a variety of surface and environmental variations[3] . Oppositely, small molecules or particles can be deposited or replaced through the FluidFM manipulator. For example, cooperative vaccinia infection was studied by deposition of countable numbers of virus particles on single cells[4] and bacteria have been sorted by their auto-fluorescence signal[5]. Finally, special manipulators are in development that can inject liquid into a cell or the cell nucleus. So far it was shown that over 30 cells could be injected with a single manipulator and with a transfection efficiency of about 40%[6].

With FluidFM a commercial manipulation tool with force control has become available. Dedicated application modules are developed for a wide range of applications, allowing new experiments in nanomedicine at the single cell level.

References

[1] Plodinec *et al.* 2012, Nature Nanotechn.7. pp. 757-65
[2] Dörig et al. 2013, Biophys. J. 105, pp. 463–472]
[3] Potthoff et al. 2013, PLOS ONE,12, e52712
[4] Stiefel et al. 2012, NanoLett. 12, pp. 4219-27
[5] Stiefel et al. 2013, Appl. Env. Microbiol. 19, pp. 4895–4905
[6] Guillaume-Gentil et al 2013, Small doi: 10.1002/smll.201202276

Enzymatic Degradability of Corn Starch Nanocomposites

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Abstract: Corn starch nanocomposites were placed in a solution containing alpha-amylase (EC 3.2.1.1) and the rates and extents of enzymatic degradation were measured according to weight reduction and reducing sugars production. Alpha-amylase enzyme was obtained from *Bacillus Licheniformis*. According to central composite design (CCD), nine samples with different Na-Montmorillonite (Na-MMT) and glycerol contents were prepared using casting method and experiments were done in three replications. Results were analyzed by response surface methodology (RSM).

By increasing in glycerol content, the weight loss of the films in both water and enzyme solution increased. For each sample, the weight reduction in enzyme solution was significantly higher than results of water solubility which indicate the effect of enzyme degradation. Also, by increase in nanoparticle contents, resistance against enzyme solution will increase and weight loss will decrease (Figure 1). It was found that increase in enzymatic degradation is related to penetration of enzyme solution in the matrix of polymer. Results are in good agreement with published results by Taghizadeh et al; 2012 and Abbasi; 2012.

The Fitting equation for response surface of the degree of enzymatic degradation (%) was obtained equal to -6.01+1.76G-4.62C+0.06G×C, where C is Na-MMT content (0-5%) and G is glycerol content (25-35%) with R^2=99.04%.

Some samples before and after degradation were examined by FTIR spectroscopy(Figure 2). According to FTIR spectra for partially degraded samples, the intensity of the peaks at 1150 and 1040 cm^{-1} associated with starch glycosidic linkages decreased which indicates the action of alpha-amylase in cleaving the glycosidic linkages (Azevedo et al;2003).

Keywords: Corn starch, Nanocomposite, Enzymatic degradation, Water sensitivity, Alpha-amylase

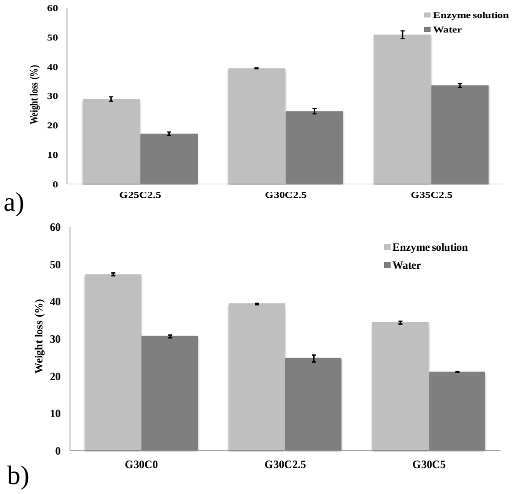

Figure 1: Figure illustrating the weight loss of the samples in water and enzyme solution affected by a) glycerol content and b) Na-MMT content.

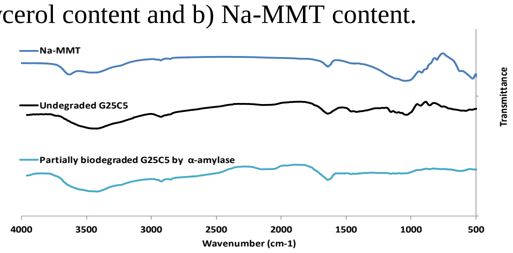

Figure 2: Figure illustrating the FTIR spectrums of Na-MMT and G25C5 before degradation and after partially degradation by alpha-amylase.

References:

Abbasi, Z., (2012) Water resistance, weight loss and enzymatic degradation of blends starch/polyvinyl alcohol containing SiO2 nanoparticle. *J Taiwan Inst Chem Eng*, 43, 264-268.

Azevedo, H.S., F.M. Gama, and R.L. Reis, (2003) In Vitro Assessment of the Enzymatic Degradation of Several Starch Based Biomaterials. *Biomacromolecules*,. 4,1703-1712.

Taghizadeh, M.T., Z. Abbasi, and Z. Nasrollahzade, (2012) Study of enzymatic degradation and water absorption of nanocomposites starch/polyvinyl alcohol and sodium montmorillonite clay. *J Taiwan Inst Chem Eng*, 43,120-124.

Photocatalytic disinfection by a visible light-activated co-doped TiO_2

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Abstract:
Photocatalytic processes are widely recognized as viable solutions for environmental problems. Disinfection of bacteria using nanophotocatalysts is of particular importance, as traditional methods such as chlorination can be chemical intensive and have many associated disadvantages (Nath *et al*.; 2012). Although most of researches on the photocatalytic *Escherichia coli* (*E. coli*) disinfection were performed under UV light irradiation in the past decade (Markowska-Szczupaka *et al*.; 2011), the photocatalytic disinfection under visible light has a great potential. Therefore, disinfection under visible light using enhanced photocatalysts needs more investigation. Enhanced photocatalysts could be prepared by doping of TiO_2 (Fujishima *et al*.; 2011). In this research, Fe and Cd co-doped TiO_2 (Fe-Cd/TiO_2) nanoparticles were synthesized for the first time, and its photocatalytic activity was investigated under visible light. In addition to Fe-Cd/TiO_2, bare TiO_2 nanopowders were prepared using a sol-gel method to compare their characterization and activity. In this way, the morphology and microstructure of the photocatalysts were characterized by means of X-ray powder diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray micro analysis (EDX), transmission electron microscopy (TEM), UV–visible diffuse reflectance spectra (DRS). Average crystal size of Fe-Cd/TiO_2 and the synthesized TiO_2 were determined to be about 17.78 nm and 20.02 nm using XRD patterns and Scherrer's equation, respectively. SEM and TEM images show that the prepared nano particles have similar morphology and shape. However, the particle sizes of the synthesized TiO_2 and Fe-Cd/TiO_2 were 22±4 nm and 18±3 nm, respectively. EDX analysis of Fe-Cd/TiO_2 confirmed the presence of Cd and Fe in this nanophotocatalyst structure. The distribution percentages (%) of Cd and Fe in the nanoparticles are ~2, 3 respectively, as expected. DRS spectra of Fe-Cd/TiO_2 and the synthesized TiO_2 show that doping TiO_2 with Cd and Fe highly increased the amount of light absorbance in visible region (between 380 and 760 nm). Consequently, Fe-Cd/TiO_2 has greater photocatalytic activity under visible light compare to bare TiO_2.
Moreover, the synthesized photocatalysts were used for *E. coli* disinfection (cell density: 10^7 $CFUmL^{-1}$). The results show that Fe-Cd/TiO_2 nanoparticles disinfected *E. coli* much faster than bare TiO_2. On the other hand, this co-doped photocatlyst inactivated *E. coli* almost completely only within 50 min visible light irradiation.

Keywords: nanophotocatalyst, co-doping, highly active, disinfection, visible light.

References:

Fujishima, A., Zhang, X., Tryk, D. A. (2008) TiO_2 photocatalysis and related surface phenomena, *Surf. Sci.*, 63, 515–582.

Markowska-Szczupaka, A., Ulfigb, K., Morawski, A.W. (2011) The application of titanium dioxide for deactivation of bioparticulates, *Catal. Today,* 169, 249–257.

Nath, R. K., Zain, M. F. M., Kadhum, A. A. H. (2012) Photocatalysis- A Novel Approach For Solving Various Environmental And Disinfection Problems: A Brief Review, *J. Appl. Sci. Res.*, 8, 4147-4155.

Encapsulation into nanotubes

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Abstract: The cylindrical hollow space of the carbon nanotubes allows confinement of molecules of different sizes depending on the diameter of the tube. We studied several molecules confined in different CNT sizes : H_2 , X_2, HX (X = F , Cl , Br, I) , C_6H_2 , TiO_2, $(TiO_2)_2$, the anti -HIV drug TIBO and anti- cancer Cis- platinum.

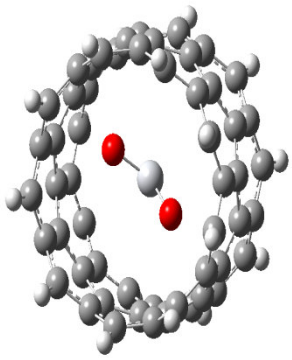

Figure 1 : TiO_2 molecule stabilized into a CNT

Small molecules are used as probes for marking the interior zone of the nanotube in chemical reactivity , physical interaction or no influence. This spatial distribution is a function of the polarizability and polarization hosts .

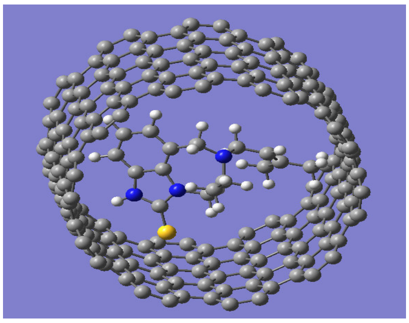

Figure 2 : Anti-HIV TIBO molecule encapsuled into a CNT

Nanotubes can thus stabilize entities low life or unstable as TiO_2 molecular form or dimer. The drugs , such as anti- cancer can be transported and released in protected manner to the target area. In addition , the choice of the diameter may cause slight structural modifications enable the anti -HIV drug to adapt its geometry to the evolution of the AIDS virus .

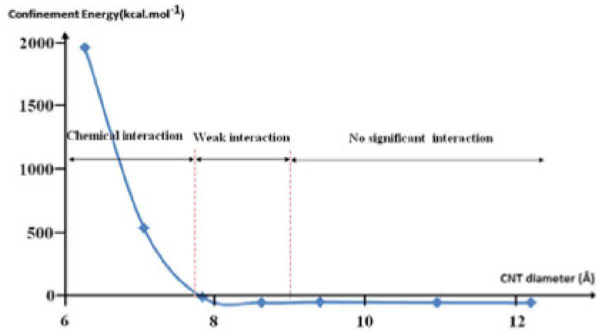

Figure 3: Confinement energy variations versus CNT Diameter

Keywords: Carbon nnotube, encapsulation, confinement energy, polarization, polarisibilmity, van der Walls interactions, anti-tumor, anti-HIV, drug vector

References:

W.Gtari, B.Tangour, International Journal of Quantum Chemistry 2013; 113(21):2397-240

A. Gannounis, M. Ouraghi, S. Boughdiri, R. Bessrour, A. Benaboura, B. Tangour , Journal of Computational and Theoretical Nanoscience 2012; 9(3):379-383.

Z. Hosni, R. Bessrour, B. Tangour, Journal of Computational and Theoretical Nanoscience 2014; 11(2):318-323

Y. Belmiloud, M.Ouraghi, M. Brahimi, A.Benaboura, D.Charqaoui, B.Tangour, Journal of Computational and Theoretical Nanoscience 2012; 9:1101-1108.

R. Bessrour, Y. Belmiloud, Z. Hosni, B. Tangour, AIP Conference Proceedings 06/2012; 1456(1456):pp. 229-239.

Dynamical behavior and rheological properties of complexes particles formed by small globular protein and polyelectrolyte long-chain

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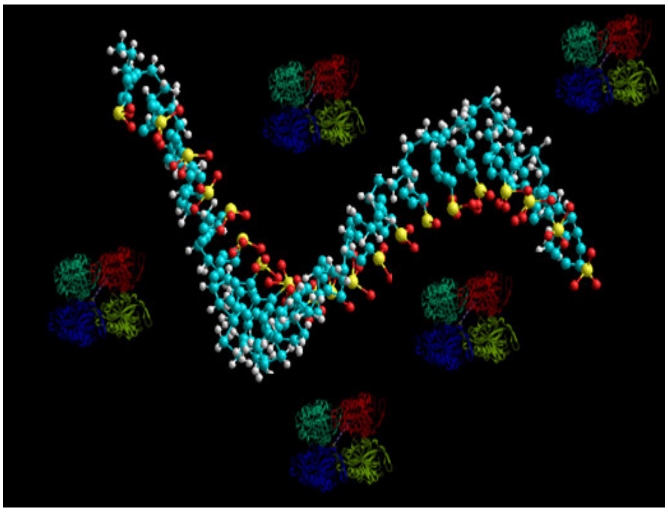

Abstract: The heterogeneous systems containing polyelectrolyte and protein have attracted much attention due to their importance in industrial applications and biological functions. We search to understand the transport properties of complex system formed by a globular protein and NaPSS long-chain. We suggest a method to determine an approximation of the number of proteins molecules bound per polyelectrolyte chain in each phase using Dynamic Light Scattering technique. The stability of complexes particles is studied treating the pairwise interaction. The rheological properties are analyzed basing on empirical model given by Garcia et al. [1], but this model is not in good agreement with our experimental results. So, we try to correct it taking into account the protein-NaPSS interaction parameter.

[1] Garcia R., Clara M.G., Iolanda P., Juan E.F., Agustin C., *Euro. Poly. J.*, **1996**, 33, 10-12.

Semiconductor Nanorods as Acceptors in Förster Resonance Energy Transfer-Based Immunoassays

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Abstract: Förster resonance energy transfer (FRET)-based detection and sensing techniques are among the most prominent methods to probe intermolecular distances and molecular dynamics in biological systems (Medintz *et al*.; 2003). FRET is a non-radiative process, where energy is transferred from an excited molecule (donor, D) to an acceptor molecule (A) in close proximity via dipole-dipole coupling (Sapsford *et al*.; 2006). The ability to synthesize semiconductor quantum dots (QDs) with stable, size-tunable, and bright luminescence, high absorption coefficients and narrow emission lines has expanded the range of useful fluorophores in FRET-based applications. QDs have been used in FRET-based applications as both donor and acceptor pairs (Hildebrandt, 2011). QDs, when synthesized in elongated forms as rods (quantum rods, QRs) assume novel optical properties such as high absorption cross-sections, and absorption and emission of linearly polarized light due to orientation of dipole-dipole moment along the longer axis. Therefore, applications of QRs as FRET donors or acceptors would give the unique ability to obtain additional information on the molecular orientations due to the high sensitivity of FRET to the relative spatial orientation of the D/A dipoles (Sadhu, *et al*. 2010). Despite such unique features, information on the QR-based FRET systems is limited. In this work, we report on the synthesis and surface functionalization of QRs (Figure 1) and investigate their FRET-based applications as acceptors, where luminescent lanthanide complexes (LLC) with extremely long excited-state lifetimes (up to milliseconds) are used as donors. A model system based on biotin/streptavidin binding is used for determination of Förster distances and energy transfer efficiency between LLC and QRs. Large surface area of QRs enables attachment of multiples of recognition molecules and thus increases the molecular binding efficiency. The presented system can be successfully applied to the detection of different (bio)molecular binding events, rendering QRs functional nanomaterials holding great promises for immunoassay-based diagnosis.

Keywords: Förster resonance energy transfer (FRET), nanorods (QRs), luminescent lanthanide complexes (LLC), immunoassays, diagnosis, biomedical applications.

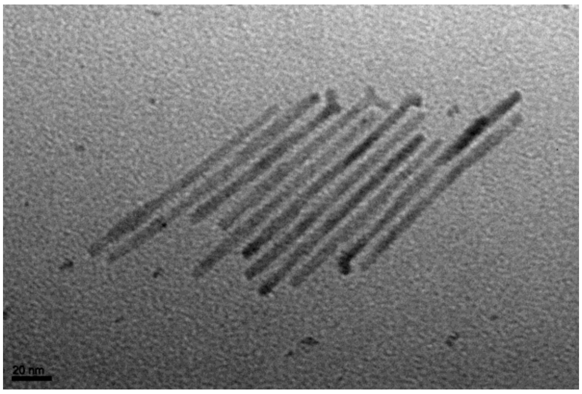

Figure 1: Transmission electron microscopy image of QRs. Length~ 120 nm, width~ 3 nm.

References:

I.L. Medintz, A.R. Clapp, H. Mattoussi, E.R. Goldman, B. Fisher, J.M. Mauro (2003) Self-assembled nanoscale biosensors based on quantum dot FRET donors, *Nature Mater*, 2, 630.

K. Sapsford, L. Berti, I.L. Medintz (2006) Materials for fluorescence resonance energy transfer analysis: beyond traditional donor-acceptor combinations**,** *Angew Chem Int Edit*, 45, 4562.

N. Hildebrandt (2011) Biofunctional quantum dots: controlled conjugation for multiplexed biosensors, *ACS Nano*, 5, 5286.

S. Sadhu, M. Tachiya, A. Patra (2010) A Stochastic Model for Energy Transfer from CdS Quantum Dots/Rods (Donors) to Nile Red Dye (Acceptors), *J Phys Chem C*, 114, 2842.

Bacteriophage sensors integrated in a microfluidic cell for pathogens detection

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Abstract: Nowadays, micro-organisms are still among the leading causes of death in the world. After the events of September 11, 2001, the international community has taken seriously the bio-terrorist attacks using pathogenic bacteria (Anthrax, MRSA). The use of sensors would increase the timeliness of analysis and get impressive information on the presence of pathogens. Miniaturization would provide a system of continuous monitoring and in situ able to compete current methods. E. coli is a common inhabitant of the gastrointestinal tract of human and animal species. While certain strains of E. coli are commensal and are counted from the animal and human microbiota, other strains are more or less capable of potentially pathogenic and cause intestinal and extraintestinal infections infections. E.coli's infections represent a large epidemic and economic impact, it represents also a clue of the environmental pollution [1].

Micro / nanofluidic reveals today as one of the emerging areas as well as in the world of microelectronic and nanotechnology as in the analytical sciences, biology, and biotechnology [2]. Across the last few years, developments have involved miniaturization of electromechanical devices such as accelerometers and pressure sensors which have a wide commercial success. This technology has spread rapidly in the biological and medical fields to give rise to products such as "BioMEMS", "lab on chip" or "μ-TAS" and one of the key points of this junction is at micro / nanofluidic technology that anticipates a basic, important and strategic as microelectronics, for the development of components and integrated systems. Several studies have been conducted by researchers for the detection of biological species (virus, antigen, etc ...) by different types of transducers: optical (SPR), mechanical (quartz microbalance, gravimetric SAW) and impedance measurement. The studies were made on test structures too far from devices for industrial applications [3,4].

In this paper, we describe a new approach for a new diagnostic system of bacteria detection using phages functionalized on interdigitated microelectrodes integrated into a microfluidic cell. A detection limit of 10^3 CFU / ml was obtained with good reproducibility by physisorption. The results show the presence of two signals, an increases followed by a decreases due to bacterial phage infection and lysis.

Keywords: E.coli, Microfluidic cell, Impedance spectroscopy.

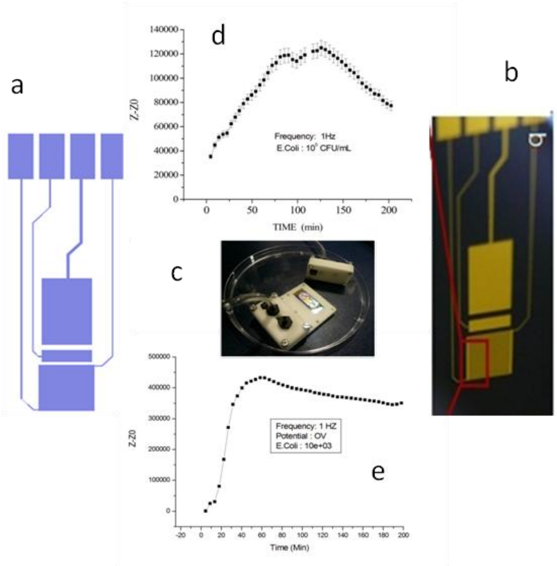

Fig. (a,b). Interdegitated microelectrode. (c). Microfluidic cell. (d). Detection of 10^5CFU/ml of E.coli K12. (e). Detection of 10^3CFU/ml of E.coli K12.

References:

1. M. B. Mejri, H. Baccar, E. Baldrich, F. J. DelCampo, S. Helali, T. Ktari, A. Simonian, M. Aouni, A. Abdelghani, (2010), Impedance biosensing using phages for bacteria detection: Generation of dual signals as the clue for in-chip assay confirmation, Biosens Bioelectron., 26, 1261-1267.
2. Y. Zhang, P. Ozdemir, (2009), Microfluidic DNA amplification: a review, Anal. Chim. Acta, 638, 115-125.
3. A. Shabani, M. Zourob, B. Allain, C. A. Marquette, M. F. Lawrence, R. Mandeville, (2008), Bacteriophage-Modified Microarrays for the Direct Impedimetric Detection of Bacteria, Anal. Chem., 80, 9475–9482.
4. H. Baccar, M. B. Mejri, T. Ktari, M.Aouni, A. Abdelghani, (2010), Surface Plasmon Resonance Immunosensor for Bacteria Detection, Talanta, 82, pp.810–814.

Aknowledgement:
This work was financed by the NATO (Science for Peace Project).

Development of enzyme-based biosensor for environmental monitoring

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Abstract:
Biosensors, combining a selective biological recognition element and a sensitive transducer, are versatile analytical tools applied more and more in different fields, such as medicine, food quality and safety control, and environment pollution monitoring [1, 2]. The intention of this article is to reflect the advances and describe the trends on biosensors for environmental applications [3]. Biosensors are useful analytical tools for environmental monitoring, capable of providing results in real time, simple to use, portable and cost-effective. Biosensors, detecting and measuring specific compounds or compound classes such as pesticides, hazardous industrial chemicals, toxic metals, and pathogenic bacteria, biosensors and bioanalytical assays have been designed to measure biological effects such as cytotoxicity, genotoxicity, biological oxygen demand, pathogenic bacteria, and endocrine disruption effects [4].

Keywords:Enzyme; Biosensors; Environmental analysis

References:

[1] Rodriguez-Mozaz S., Lopez de Alda M.J., Barceló D., "Biosensors as useful tools for environmental analysis and monitoring", *Anal Bioanal Chem,* Vol. 386, (2006), pp. 1025–1041.

[2] Amine A., Mohammadi H., Bourais I., Palleschi G., "Enzyme inhibition-based biosensors for food safety and environmental monitoring", *Biosensors and Bioelectronics*, Vol. 21, (2006), pp. 1405–1423.

[3] Karube I., Nomura Y., "Enzyme sensors for environmental analysis", *Journal of Molecular Catalysis B: Enzymatic*., Vol. 10, (2000), pp. 177–181.

[4] Rogers K. R., "Recent advances in biosensor techniques for environmental monitoring", *Analytica Chimica Acta*., Vol. 568, (2006), pp. 222–231.

Electrochemical sensor based on functionalized magnetic beads for C - reactive protein Immunosensor

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Abstract: Recently, various nanoparticles have found numerous applications in biological and chemical researches. Magnetic beads are based on magnetic nanomaterials which might play an important role in the development of biosensors. Firstly, the magnetic beads have a very large surface to volume ratio and good bio-compatibility. Secondly, these magnetic beads are especially designed to concentrate analyte species for biosensor applications. In this work, we used magnetic nanoparticles functionalized with carboxyl groups for C-Reactive Protein detection. Anti-CRP antibody can be grafted on these magnetic nanoparticles after EDC/NHS activation step (Figure 1). The magnetic nanoparticles layer and the molecular structure of biosensor were characterized by Fourier Transform Infrared Spectroscopy (FTIR), cyclic voltammetry and impedance spectroscopy. The obtained impedance spectra were fitted with electric model. The developed biosensor was able to detect CRP antigen in the range of 0.1-10 pg/ml (Figure 2). Negative test was obtained with non-specific antibody.

Keywords: α-*CRP, FTIR, Cyclic voltammetry, impedance spectroscopy, magnetic nanoparticles.*

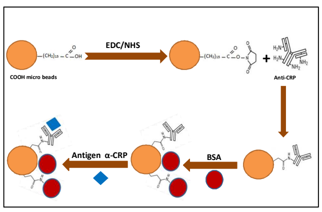

Figure 1: Magnetic nanoparticles functionnalisation

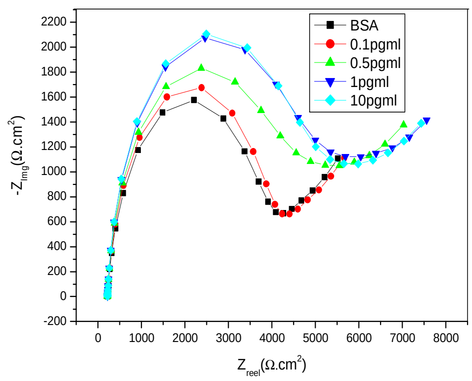

Figure 2: Nyquist impedance plots for gold electrode with magnetic nanoparticles layer after antigen injections

References:

[1] I. Hafaiedh, H.Chammem, A.Abdelghani, E.Ait, L.Feldman, O.Meilhac, L.Mora, (2013), Supported protein G on gold electrode: Characterization and immunosensor application, Talanta, 116, 84–90

[2] G. Peto, G. L. Molnar, Z. Paszti, O. Geszti , A. Beck , L. Guczi, (2002), "Electronic structure of gold nanoparticles deposited on SiO_x/Si (100), *Materials Science and Engineering C*, 19, 95–99.

The Use of Different Solvent Types for Electrospinning of Polycaprolactone Tubular Scaffolds

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Abstract: Polycaprolactone (PCL) is one of the most promising synthetic polymers for tissue engineering owing to its biocompatibility and high elastic behaviour. Moreover, its hydrophobic nature and the high level of crystallinity results in a long degradation time which provides prolonged mechanical support for cells to infiltrate (Edwards *e. al.* 2010; McClure *et al.* 2010). The modification of an electrospinning process with a mandrel collector results in deposition of nanofibers onto a tubular scaffold of varying inner diameters. By combining the favoured properties of PCL with the unique characteristics of a electrospun structures, a promising material for vascular grafts can be obtained (Schueren *et al.* 2011; Wu *et al.* 2010). In this study, PCL with 45000 and 90000 molecular weights dissolved in different types of solvents as acetic acid, formic acid and chloroform:ethanol (9:1; Sigma–Aldrich) at a concentration of 20 w/v % solution were investigated morphologically by using scanning electron microscopy (SEM) and NIS Elements Software System. During production, electrospinnig parameters were fixed at 2 ± 0.5 ml/h flowrate, 10 cm distance and 7.5 kV applied voltage while using 0.6mm needle diameter. Rotational speed of the collector was adjusted to 250r/min for 6mm diameter rotating mandrel (peripheral speed is 4.71m/min). Spinning time was varied from 5min to 60min in order to get a tubular scaffold with adequate wall thickness. According to the results, average fiber diameters were found as 172.92 ± 39nm; 229.41 ± 61nm and 2.08 ± 0.98µm for formic acid, acetic acid and chloroform:ethanol solvent systems respectively. Additionally, bead-like nanofibrous structure was observed dominantly when acetic acid was used as solvent for PCL (Figure 1a). On the other hand, PCL dissolved in formic acid leads to less in amount beads in comparison with PCL-acetic acid solution (Figure 1b). In PCL-chloroform:ethanol solution, continious and smooth fibers without any bead-like formation were achieved that results in better morphology (Figure 1c).

Keywords: polycaprolactone, nanofiber, tubular scaffolds, electrospinning

Figure 1: Morphological analysis of PCL *(a-c; scale bars: 5000X)* scaffolds based on the use of different solvent systems as acetic acid *(a),* formic acid *(b);* and chloroform:ethanol *(c)*. Macroscopic picture of PCL tubular scaffolds *(d)* .

References:

Edwards, M.D., Mitchell, G.R., Mohan, S.D., Olley, R.H. (2010) Development of orientation during electrospinning of fibres of poly(e-caprolactone). *Eur Polym J*, 46, 1175–1183.

McClure, M.J., Sell, S.A., Simpson, D.G., Walpoth, B.H., Bowlin, G.L., (2010) A three-layered electrospun matrix to mimic native arterial architecture using polycaprolactone, elastin, and collagen: A preliminary study. *Acta Biomater*, 6, 2422–2433.

Schueren, L.V., Schoenmaker, B., Kalaoglu, O.I., Clerck, K., (2011) An alternative solvent system for the steady state electrospinning of polycaprolactone, *Eur Polym J*, 47, 1256–1263.

Wu, H., Fan, J., Chu, C., Wu, J., (2010) Electrospinning of small diameter 3-D nanofibrous tubular¨scaffolds with controllable nanofiber orientations for vascular grafts, *J Mater Sci: Mater Med*, 21, 3207–3215.

Sterilization of polymers surface contaminated by Bacillus bacteria using atmospheric dielectric barrier discharge plasma

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Abstract: Dielectric Barrier Discharges (DBDs) at atmospheric pressure are commonly used in the last ten years in many biomedical applications (Fridman, G. *et al.*; 2008). Because of their ambient working conditions, great interests have been focused on the use of these type of cold plasmas for developing a new sterilization processes especially for heat sensitive polymer materials (Benterrouche *et al.*; 2013, Heise *et al.*; 2004). Moreover, due to their safety use for both the operator and the medical sensitive devices, the plasma sterilization process has become an alternative promising technique to other conventional sterilization methods such as those using chemical agents, gamma ray irradiation, UV and thermal sterilization.
In this study, open air atmospheric pressure DBD plasma generated in a controlled chamber using a low cost homemade pseudo-pulsed high voltage power supply, was used to inactivate Bacillus bacteria. The bacteria were spread out on the surface of medical polymer films. Effects of plasma treatment time variations and plasma treatment modes on the germicidal effect (GE) of the created DBD plasma have been investigated. Furthermore, surface properties of the treated polymers have been characterized by water contact angle measurements.
The GE of the created plasma was found strongly dependent on the plasma treatment time; figure 1 reports the influence of this parameter on the inactivation of Bacillus bacteria. A decrease of about 4 decades of the survival bacteria is observed after 16 min of DBD plasma treatment. Moreover, it appears that the polymer surface wettability has a significant role in the bacterial cells distribution and adhesion on the polymer media and then on the germicidal effect of the created plasma. In the other hand, it has been shown that the contaminated substrates position in the reactor (substrates placed in direct discharge mode or in post-discharge mode, called also remote mode) has an effect on the bacteria treatment efficiency. An optimum GE was obtained on polymer substrates pretreated with DBD plasma in direct discharge mode. Indeed, in this mode the bacterial cells are directly exposed to high concentration of both charged and energetic plasma species leading to an important sputtering effect of the bacterial structure. For contaminated samples treated far from the plasma discharge zone (remote plasma mode), the germicidal effect is less important because of a less films exposition to the UV radiation, charged and/or energetic plasma species (in the remote plasma, species are less energetic than those in the discharge mode).

Keywords: dielectric barrier discharge, plasma, polymer, Bacillus bacteria, sterilization.

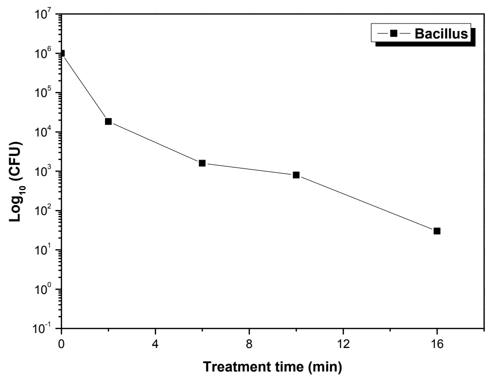

Figure 1: Inactivation kinetics of Bacillus bacteria (spread out on the surface of a culture medium) versus plasma treatment time in the conditions of applied high voltage of 9 kV, its frequency 0.2 kHz and the discharge gap of 5 mm.

References:

Benterrouche, L., Sahli, S., Rebiai, S., Benhamouda A., Sebihi, F. Z. (2013), Inactivation of E. coli bacteria by atmospheric dielectric barrier discharge, *Int. J. Nanotech.*, 10, 543–552.

Fridman, G., Friedman, G., Gutsol, A., Shekhter, A. B., Vasilets, V. N., Fridman, A. (2008), Applied Plasma Medicine, *Plasma Process. Polym.*, 5, 503-533.

Heise, M., Neff, W., Franken, O., Muranyi, P., Wunderlich, J. (2004), Sterilization of polymer foils with dielectric barrier discharges at atmospheric pressure, *Plasmas and Polymers*, 9, 23–33.

Materials for Energy & Environment

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Nano-scale Electronics for Energy & Environment

Key issues for High efficiency Silicon Solar Cells

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There is a growing interest for advanced Silicon solar cells targeting high conversion efficiencies larger than 21%. Such cells are based on architectures such as IBC (InterDigitated Back Contact Cells) or HJT (Heterojunction) which are quite different form traditional ones and which require much more sophisticated interface, film growth and patterning engineering. Recognized for a while as pure technology drivers, they were also considered as too complex to be manufactured at a low cost and therefore limited to High-End specific markets. But significant engineering progress has been achieved recently which has induced both large manufacturing cost reductions together with conversion efficiency increase. As a consequence PV Modules based on those technologies are occupying more and more a significant of market share in the 5 to 10% range which is growing rapidly. As PV module costs are decreasing more rapidly than other costs such as BOS components and installations, the market is requiring more and more higher efficiencies and better performances. Therefore these technologies will not be any more restricted to niche High-end market but can become the new standard.

This talk will emphasize the key physical parameters which make those technologies more powerful than others and will draw some perspectives of their future evolutions. A specific attention will be given to the linked phenomena arising at the nanoscale.

Influence of anisotropy on transmission spectrum and band gaps of elastic plate waves in phononic plate with defect

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Abstract:
Phoxonic crystals have attracted considerable interest because there periodic structures affecting simultaneously the propagation of light (photons) and sound (phonons) of similar wavelengths. For instance, by introducing periodicity of the order of the micron on semiconductor membranes, a phoxonic band gap for near infrared light and sound at GHz frequencies appears. In this context and to contribute to the development in this area, we study the effect of anisotropy on the transmission spectrum of a phononic plate composed with a rectangular rods incorporated in an isotropic matrix as a square lattice periodic (Fig.1). The anisotropy can be tuned efficiently by either rotating the crystalline orientation of the material or changing the filling fraction.

The plane wave expansion (PWE) and ordinary differential equation (ODE) are used to reduce the band structure problem to an eigen value problem. Subsequently by subdividing the plate in layers we applied the Stifness matrics method (SMM), which was used for homogeneous multilayer by Wang.L and al (2001), to implement boundary conditions and finally determine the transmission spectrum. Compared to the method used by Zhilin Hou and al (2004), the (SMM) can be easily adjusted when a new layer is introduced or any defect is considered in the layered system.

For the numerical calculation we consider the 2D phononic plate ZnO/Epoxy, dispersion curves and transmission spectrum both show that band gaps can be modulated, opened and closed by changing the anisotropy.

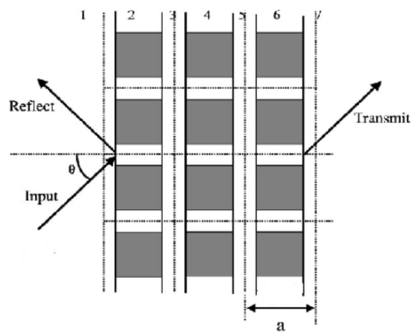

Figure 1: Parallel rectangular ZnO rods embedded in epoxy matrix. The system is finite in z-direction, θ is the incident angle, a is the lattice constant.

Illustration of the results is presented by the variation of the gap width as a function of filling factor for three orientation angles (phi) of the crystallographic axes versus the geometric reference (Fig.2). Figure 3.a present the transmission spectrum of phononic plate and figure.3.b shows the presence of two guided modes within the band gap when the phononic layer located at the middle of the plate is replaced by one homogeneous layer .

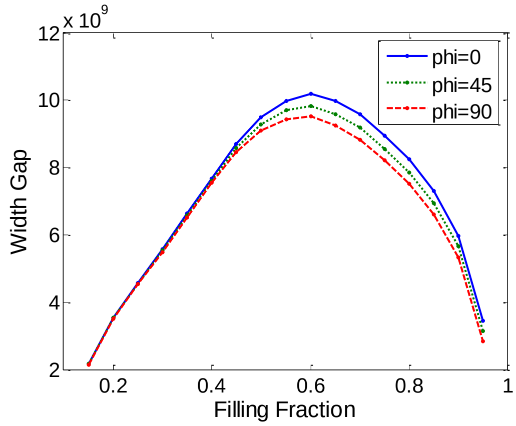

Figure 2: Gap width as a function of filling factor for three orientation angles phi(°)={0, 45, 90}. Θ=0 and a=100nm.

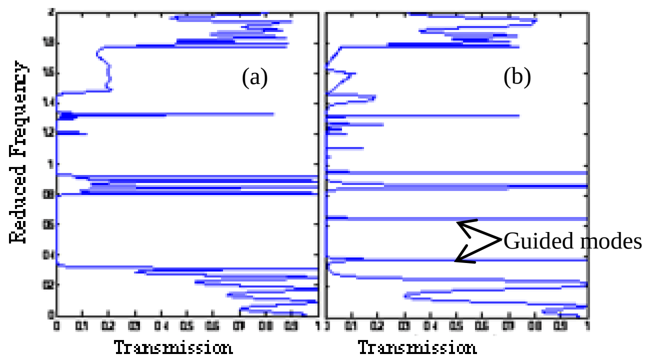

Figure 3:(a)Transmission spectrum of the plate (b) Presence of two guided modes when a phononic layer is replaced by one homogeneous layer .

Keywords: phononic plate, anisotropy, plate wave, band gap, guided mode, PWE, SMM.

References:
Wang.L,. Rokhlin S. I., Ultrasonics **39**, (2001), 413-424.
Zhilin Hou, Xiujun Fu; Calculational method to study the transmission properties of phononic crystals, Physical Review B 70, 014304 (2004)

Analysis of trap centers at the tunnel oxide in single electron photo-detector (photo-SET)

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Abstract: Trapping and accumulation of charges at the interface of the phototransistor and the source of semiconductor formed a potential barrier which induces an increased concentration of charge carriers and consequently, a shift of the threshold voltage. In this paper we present the study of deep traps center, in the small area single electron photodetector (photo-SET or nanopixel). We perform the random telegraph signals (RTS) measured in the dark conditions and under light illumination. From these results, we found that the traps centers are located in the oxide layer to the Si/SiO$_{x=1.5}$ interface, that induces a carrier accumulation in this interface, and causes the formation of the electric field, This result was confirmed by a C-V mesurments where we show the presence of charges in the oxide and oxide-semiconductor interface, so we would expect a trapping of positive charges in the tunnel oxide

Keywords: photodetectuer, RTS (Ramdom Telegraph Signal), traps center.

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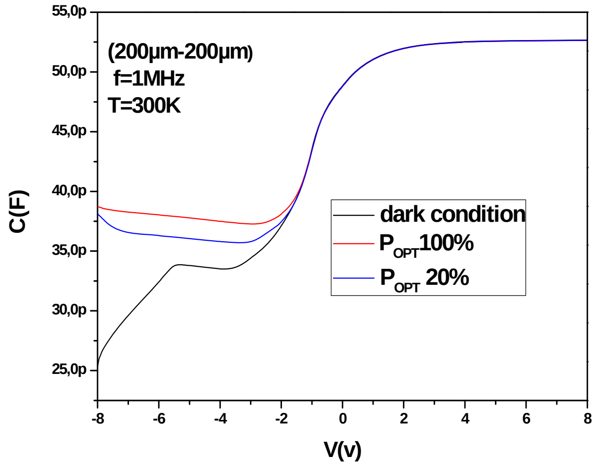

Figure.1. Optical power effect on the C-V characteristicsfor the photo-SET.

References:

M. Troudi, Na. Sghaier, A. Kalboussi, and A. Souifi (2009) ,Analysis of photogenerated random telegraph signal in single electron detector (photo-SET), Optical express(18) .

Z. Shi, J. P. Mieville, and M. Dutoit, (1994), Random telegraph signals in deep submicron n- MOSFET's,IEEE Trans. Electron. Dev. **41**(7), 1161–1168.
.
H. Silva, and S. Tiwari, (2006), Random telegraph signal in nanoscale back-side charge trapping memories, Appl. Phys. Lett. **88**(10), 102105 .

Humidity sensing based on sol-gel grown ZnO nanostructure

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Abstract: Present paper deals with Zinc oxide (ZnO) thin films, electrical and structural properties characterization and relative humidity sensing testing. Films were deposited by the dip coating method on glass substrate , the sols were prepared using zinc acetate mixed with 2-Methoxyethanol and monoethanolamine (MEA) as solvent and stabilizer respectively. After each dip, the sample was dried at 280 ◦C for 8 min, this procedure was repeated for ten times and then the substrate was annealed at 500◦C in ambient atmosphere for 2 hours. The films crystal structure was investigated by means of X-ray diffraction (XRD) analysis. XRD patterns of annealed ZnO thin films exhibit three strong peaks (101), (002) and (100) planes assigned to ZnO Wutrzite structure. ZnO films morphology was investigated by Scanning Electron Microscope (SEM) . SEM images reveal that the synthesized ZnO film are composed with irregular fiber-like stripes and a wrinkle network . Similar structure has been reported in undoped [1] and in doped ZnO thin films [2]. Electrical properties was characterized by mean of four probe resistivity and Hall effect measurement. The obtained results in undoped film are n = 7.79. 10 13 cm-3 , μ = 18.33 cm2v-1s-1 and σ = 2.28 .10-4 (Ω Cm)-1 for free carrier concentration, electron mobility and conductivity respectively.
Relative humidity sensing properties has been studied and determined by variation electrical resistance measurements at various temperature and humidity levels. Our reproducible experimental results show that ZnO has a great potential in humidity sensing. The impedance of the humidity sensor decreases by about six orders with increase in relative humidity (RH) (from 15% to 95%). From humidity sensing tests we inferred that temperature and morphology have a strong influence on the response and recovery times respectively. The fast response time has been explained on the basis of variation of the electric conductivity du water molecules adsorption of on film surface.

Keywords: ZnO, , sol-gel , thin films ,XRD,SEM, Humidity sensing, Response and recovery time.

References:

[1] Chien-Yie Tsay, Kai-Shiung Fan, Yu-Wu Wang , Chi-Jung Chang , Yung-Kuan Tseng , Chung-Kwei Lin, Ceramics International 36 (2010) 1791–1795.
[2] N.V.Kaneva,C.D.Dushkin, Bulgarian Chemical Communications,Volume43,Number2(pp.259-263)2011.

Single-electron photodetector based only on Single-electron devices

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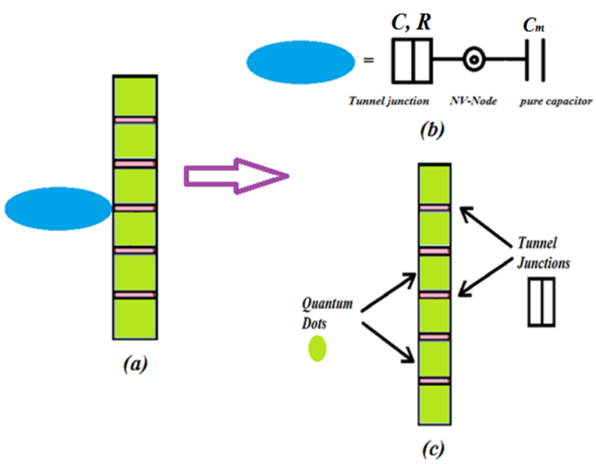
Abstract: We present a concept of novel device architectures of single-electron photodetector with a vertical multi-tunnel juntions Nanowire (MTJs-Nw) channel with 12 quantum dot (QD) embedded between the tunnel juntions coupled with a single-electron box (Si- SEB) nanocrystal-Si of 10nm diameter. Under illumination, the MTJs-Nw was depleted of electrons when a photon is absorbed. Excited charge on a QD is sensed by Si- SEB, as well as charge-sensitive. We have observed an oscillation current through the system indicative of the absorbed photon. During operations, we have detected 7 electrons in Si-SEB with Single-Electron Transistor (SET) hwo is a good single-electron photodetector. Single-photonabsorption events that produce individual photocarriers was observed in *I-V* characteristics Single-Electron Transistor (SET) confirms the single electron transfer. Also we will studie the physical phenomena occurring in the device.

Keywords: quantum dot (QD), Multi-Tunnel Juntions Nanowire (MTJs-Nw), Single-Electron Box (SEB), Single-Electron Transistor (SET), Photodetector.

Figure 1: Figure illustrating the first bloc part of photodetector cell (a) Schematic illustration of designed SEB-Si/ MTJs-NW structures, (b) SEB-Si the bloc of retention charge and sensivity (c) a vertical MTJs-Nw for photon absorption.



References:

Touati, A and Kalboussi. A. (2013), A. Volatile and Non-Volatile Single Electron Memory, *Journal of Nano- & Electronic Physics*, Vol. 5 Issue 3, p03003-1-03003-7. 7p.

Samir Chatbouri, A. Touati, M. Troudi, N. Sghaier and A. Kalboussi. (2013) , Multiple tunnel junctions based nanowire photodetector model for single charge detection, *The European Physical Journal Applied Physics* / Volume 63 / Issue 01 / 10101 (4 pages)

N. Hizem, A. Fargi, A. Kalboussi and A. Souifi. (2013), *Materials Science and Engineering: B*, Volume 178, Issue 20, Pages 1458–1463

High Performance Gas sensor Based on Brush-like Hierarchical ZnO Nanostructures

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Abstract:
Hierarchical nanostructures with higher dimensionality, consisting of nanostructure building blocks such as nanowires, nanotubes, or nanosheets are very attractive. They hold great properties like the high surface-to-volume ratio and well-ordered porous structures, which can be very challenging to attain for other mono-morphological nanostructures. Well-ordered hierarchical nanostructures with high surface-to-volume ratios facilitate gas diffusion into their surfaces as well as scattering of light. Therefore, hierarchical nanostructures are expected to perform highly as gas sensors.[1,2]
A multistage controlled hydrothermal synthesis method to fabricate high performance single ZnO brush-likee hierarchical nanostructure gas sensors from initial nanowires is reported (Fig. 1). The performance of the sensor based on brush-like hierarchical nanostructure is analyzed and compared to that of a nanowire gas sensor (Fig. 2). The hierarchical gas sensor demonstrated high sensitivity toward low concentration of acetone at high speed of response. The enhancement in the hierarchical sensor performance is attributed to the increased surface to volume ratio, reduction in dimentionality of the nanowire building blocks, formation of junctions between the initial nanowire and the secondary nanowires, and enhanced gas diffusion into the surfaces of the hierarchical nanostructures.

Keywords: ZnO, hydrothermal synthesis, gas sensor, nanowires, hierarchical.

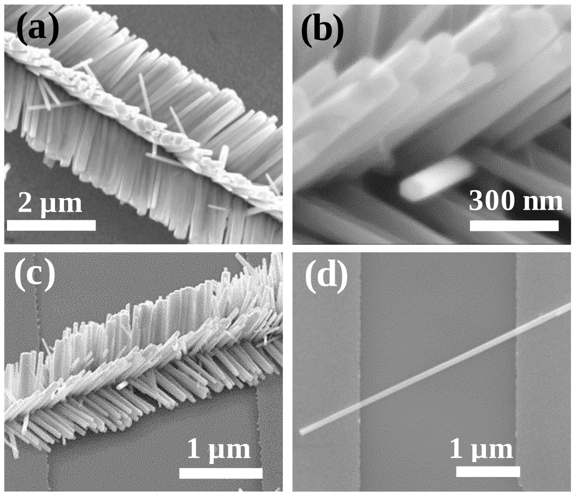

Figure 1: (a) Low and (b) high magnification SEM images of the hierarchical brush-like nanostructure; (c) a single brush-like hierarchical nanostructure, and (d) single nanowire gas sensor.

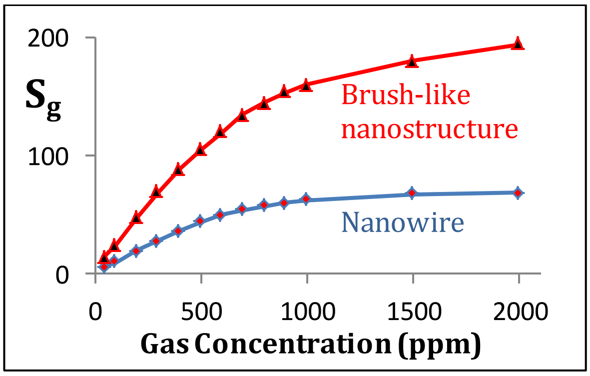

Figure 2: Gas response of the sngle hierarchical brush-like nanostructure versus the single nanowire gas sensor.

References:

1. M. R. Alenezi, S. J. Henley, N. G. Emerson, S. R. P. Silva, *Nanoscale*, **2014**,*6*, 235–247.
2. M. R. Alenezi, A. S. Alshammari, K. D. G. I. Jayawardena, M. J. Beliatis, S. J. Henley, S. R. P. Silva *J. Phys. Chem. C*, **2013**, *117*, 17850–17858.

[Zn-Al] LDH and Polymer-[Zn-Al] LDH composites: synthesis, characterization and application for water depollution

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Abstract: [Zn-Al] LDH were synthesized using the coprcipitation method at pH=10 and $R=n_{Zn}/n_{Al}=3$.Parts of this sample were calcined at 500°C and at 800°C. samples were denoted Zn-Al-3 for the non calcined form, c-Zn-Al-3-500 and c-Zn-Al-3-800 for the calcined forms at 500°C and 800°C respectively. The obtained materials were characterized by different techniques among them: XRD, FTIR, SEM, TEM, TG/DTG, ICP and BET.

It was found that XRD paterns of Zn-Al-3 is typical of LDH materials (ASTM card number 48-1021) (Miyata.,1975). However, the LDH phase is not pure as low intensity peaks of ZnO phase are present in the diffractogram. The layered structure is almost totally destroyed at 500°C and only peaks of low crystalline oxides is present in the diffractogram of c-Zn-Al-3-500. At 800°C, well crystalline ZnO and $ZnAl_2O_4$ are obtained.

The surface area and the textural properties of the samples were obtained by physic-chemical adsorption of nitrogen. Calcination at 500°C led to an increase in the surface area, due to the destruction of layered structure giving rise to the formation of low crystalline ZnO and $ZnAl_2O_4$ phases. As the crystallinity of ZnO and $ZnAl_2O_4$ increases by increasing the calcination temperature to 800°C, the SSA significantly decreases. The adsorption-desorption isotherm of [Zn-Al] LDH, c-Zn-Al-3-500 and c-Zn-Al-3-800 type IV isotherms typical of mesoporous solids, with a type H_3 hysteresis loop. A plateau is observed at low relative pressure suggesting a monolayer adsorption followed by multilayer adsorption and condensation in mesopores. In another side, polyacrylonitrile nanofibers were prepared with the electrospinning technique at optimized conditions. the clay materials are then deposited on the surface of the nanofibers by dipping the fabricated PAN nanofibers into commercial dispersions of the different matrials (0.49 mmol) at the natural pH of the solution several times. Afterwards, the obtained composites were rinsed with water and dried in vacuum oven. The composites materials are characterized by SEM analyses. The obtained composites were tested for the degradation of Indigo carmine dye. Adsorption equilibrium was studied before starting photocatalytic tests. It was found that the retention of the dye is due to the anionic exchange phenomenon in the case of PAN/Zn-Al-3 composite, and to a reconstruction phenomenon (memory effect) in the case of PAN/c-Zn-Al-3-500 composite. All composites showed a good photocatalytic activity for the removal of indigo carmine due to the presence of photoactive species (ZnO and $ZnAl_2O_4$) in all composites (Farhadi et al., 2010, Zhang et al., 2013) . Kinetic study was also investigated and the pseudo-first order fits well the degradation reaction of the dye.

Keywords: [Zn-Al] LDH, PAN- LDH composites, reconstruction, anionic exchange, photocatalysis.

References:

S. Miyata, The syntheses of hydrotalcite-like compounds and their structures and physico chemical properties. I. The systems magnesium(2+)-aluminum(3+)-nitrate(1-), chloride(1-) and -perchlorate(1-), nickel(2+)-aluminum(3+)-chloride(1-), and zinc(2+)-aluminum(3+)-chloride(1-), Clays and Clay Miner. 23 (1975) 369- 375.

S. Farhadi, S. Panahandehjoo, Spinel-type zinc aluminate (ZnAl2O4) nanoparticles prepared by the co-precipitation method: a novel, green and recyclable heterogeneous catalyst for the acetylation of amines, alcohols and phe-nols under solvent-free conditions, Applied Catalysis A: General 382 (2010)

293–302.

L. Zhang, J. Yan, M. Zhou, Y. Yang, Y.N. Liu, Fabrication and photocatalytic properties of spheres-in-spheres $ZnO/ZnAl_2O_4$ composite hollow microspheres, Applied surface science 268 (2013) 237-245.

Nano-Sized Zero Valent Iron and Covalent Organic Polymer Composites for Azo Dye Remediation

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Abstract: Zero valent iron is commonly used in a variety of treatment technologies (e.g. permeable reactive barriers), though recently a heavier focus has been placed on nano-sized zero valent iron (nZVI). Having superior reductive properties and large surface areas, nZVI is ideal for the degradation of chemicals such as azo dyes and halogenated organic compounds, among others (Crane and Scott, 2012). However, stabilization and immobilization of nZVI is a key parameter in its effectiveness as a chemical degradation agent for both *in-situ* and *ex-situ* applications. Most importantly, this inhibits unwanted iron oxidation from the environment and prevents particle agglomeration; but also still allows for contaminant diffusion into the composite matrix, leading to removal and degradation. In this study, the effect of various covalent organic polymers (COPs) as effective supporting materials for nZVI for optimal pollutant removal was assessed. These COPs demonstrate promising results for the ability to adsorb and remove carbon dioxide (Patel *et al.*, 2012), yielding the notion that they are capable of adsorbing water contaminants as well. Composites of nZVI impregnated within COPs of high surface areas exhibit effective ability to decolorize azo dyes, specifically naphthol blue black, up to 96%, over a 30-minute reaction period; comparable to azo dye decolorization rates seen using pure nZVI alone (Nam and Tratnyek, 2000).

Using transmission electron microscopy (TEM), dimensional extrapolation of composite widths were on average approximately 6 nm, with extremes at 2.5 nm and 24 nm. Composite lengths exhibited much more variance, and although the average was approximately 110 nm, many lengths were observed as low as 50-70 nm and as high as 260-280 nm ranges. However, individual composite strands exhibited a tendency to coalesce into porous masses with diameters as large as 10 µm. This phenomena makes makes these composites ideal for use in a sand filtration column for water treatment applications.

BET surface areas of the composites were as small as 5.9 m^2/g using COP61, and as large as 332 m^2/g using COP19. Using water miscible COPs, dye removal rates were as high as 95% and 96% in COPs 1 and 19, respectively. Removal efficiency was determined to be a function of the BET surface area, as well as individual properties of the core/linker molecular make-up of each COP, specifically their wettability in aqueous solution. The synergistic effect of adsorption into the COP matrix and degradation by impregnated nZVI. This translates well for treatment of many groundwater pollutants, including halogenated organics (e.g. TCE), due to the similar chemical reduction mechanism involved.

Keywords: nZVI, covalent organic polymer, azo dyes, naphthol blue black, groundwater contaminant, dye decolorization.

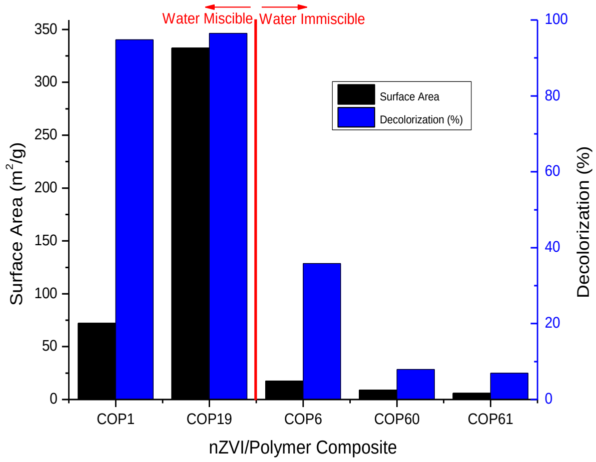

Figure 1: Relationship of composite surface area with decolorization of naphthol blue black ability, in terms of removal percentage, organized by water miscibility.

References:

Crane, R., Scott, T. (2012), Nanoscale zero-valent iron: Future prospects for an emerging water treatment technology, *J. Hazard. Mater.*, 211-212,0, 112-125.

Patel, H., Karadas, F., Canlier, A., Park, J., Deniz, E., Jung Y., Atilhan M., Yavuz C. (2012), High Capacity carbon dioxide adsorption by inexpensive covalent organic polymers, *J. Mater. Chem.*, 22,17, 8431-8437.

Nam, S., Tratnyek, P. (2000), Reduction of azo dyes with zero-valent iron, *Water Res.*, 34,6, 1837-1845.

Simulation study of an Operational Amplifier with non-Ideal CNTFET

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Abstract: Carbon Nanotube Field-Effect Transistor (CNTFET) is a promising candidate for future electronic devices thanks to its ballistic transport, high current, high speed and low power dissipation [21] [32]. Among these characteristics ballistic transport should verify the following condition: the channel length of nanotube should be smaller than the mean free path of acoustic phonon at low bias and optical phonon scattering at high bias voltage [3] [4] [-5]. If this condition is not satisfied, electron phonon scattering effect will be important.

In order to have an accurate model we should to take into account the electron phonon scattering effect.

Two scattering mechanisms have been identified to be important in CNT which are acoustic phonon scattering and optical phonon scattering. Under high bias and for short channel length, optical phonon scattering is the most important mechanism due to its short mean free path (λ_op~15nm) [6]. However, under low bias, acoustic phonon scattering is the dominant scattering mechanism inside the long nanotube due to the long mean free path (λ_ap~0.6μm-1.5μm) depending on the chirality indices and the temperature range [7].

In this study, CNTFET long channel lengths are used. Therefore only the AP scattering will be considered due to working at low bias (V_GS<0.55V) [7]. In order to determine the impact of this effect on electronic circuit operations, Operational Amplifier (Op Amp) is designed and performances are scaled.

The main contribution of this study is to complete the Raychowdhury model by adding AP scattering equation and to analyze the impact of this effect on Operational Amplifier (Op Amp) circuit performances. Finally to compare these results with ballistic Op Amp model. For this purpose, the Verilog-A language [8] is used to implement the CNTFET behavioral model under the ADS environment [9].

Keywords: Carbon nanotube field effect transistor, Acoustic phonon scattering, Verilog-A, Operational Amplifier.

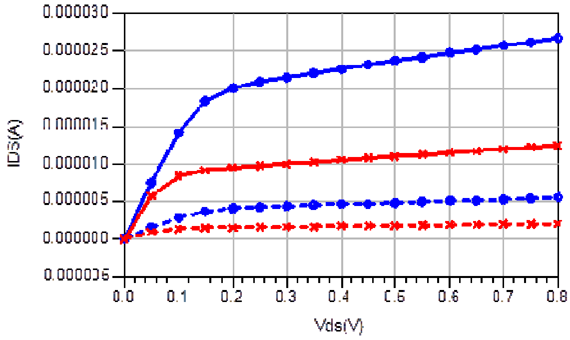

Figure 1. Drain-current I_ds versus drain-source V_ds for gate voltage (V_GS=0.5 V): comparison between ballistic compact model (solid line with circle for d=1.48 nm and with x for d=1.25 nm) and AP scattering compact model CNTFET (dashed line with circle for d=1.48 nm and with x for d=1.25 nm) for (L_ch=1μm)

At low bias and for channel length longer than the mean free path for AP scattering λ_{APhi}, AP scattering effect is the dominant mechanism in the device [7]. This AP scattering mean free path λ_{APhi} is a function of the temperature range and the chirality indices. For example, a temperature variation from 200K to 400K and for chirality indices scaling from (from (13, 0) to (22, 0)), λ_{APhi} variation will be from 659 nm to 1120 nm [7].

Table 1 calculates the different values of the AP scattering mean free path corresponding to different CNT chirality, i.e. diameter.

Using the Landauer equation the current drain I_{DSAP} is calculated.

The AP scattering model is included in the compact model simulation of Raychowdhury's et al, and compared with ballistic model of CNTFET. VERILOG-A language is used to implement the compact model in the ADS software. Fig. 1 shows the comparison of I_{DS} current with ballistic model simulation and with simulation including AP scattering for diameter equal 1.25nm and 1.4878nm for low bias $V_{GS} = 0.5$ V. We can observe with AP scattering model that the current I_{DS} decreases with a ratio of 0.2 compared with the ballistic current. Since neglecting the AP scattering lead to an overestimation of more than 20% of the current I_{DS}.

In order to analyze the impact of AP scattering on analog circuit performances, two-stage Op Amp circuit design using AP scattering model CNTFET has been simulated to determine their performances and compared them with Op Amp using a ballistic model.

The design of ballistic Op Amp is tuned in order to have a compromise between the gain (27.4 dB), bandwidth (15.5MHz) and low power dissipation. Practical robust design values of load (CL) and miller compensation (Cc) capacitances are chosen as 1f F and 0.01pF respectively. The chosen values of these capacitances allow the stability in term of phase margin more than 45 degrees. The different CNTFET Op Amp simulated parameters, using ADS environment are gain, phase margin , -3dB gain frequency, unity gain frequency, common mode rejection ratio (CMRR), Power Supply Rejection Ratio (PSRR), Input common mode voltage range (ICMR) , Vout swing, output resistance (Rout) and power dissipation.

We act on the CNT diameter since diameter is the main parameter that affects CNTFET performances. Table II shows the different diameters and channel lengths used in Op Amp simulation. These diameters are implemented in Op Amp design, for both cases of the ballistic and the AP scattering models. The chosen value of channel length is based on having the scattering case.

We remark that there is a degradation of Op Amp performances with Ap scattering model compared with ballistic model therefore neglecting the AP scattering lead to have not an accurate results.

References:

[1] A. Raychowdhury, S. Mukhopadhyay, K. Roy, "A circuit-compatible model of ballistic carbon nanotube field effect transistor. " IEEE Trans Computer –Aided Design, 2004, vol. 12, n. 10, pp. 1411-1420.

[2] J. Guo, M. Lundstrom, S. Datta, "Performance projections for ballistic carbon nanotube field-effect transistors". Applied Physics Letters, 80, pp. 3192-3194. 2002

[3] P. Avouri, J. Appenzeller, R. Martel, S. J. Wind. "Carbon nanotube electronics" Proceeding of the IEEE, 2003, vol. 91, n. 11, pp. 1772-1784.

[4] A. Javey,J. Guo, M. Paulsson, Q. Wang, D. Mann, M. Lundstrom, H. Dai, " High-field, quasi ballistic transport in short carbon nanotube". Physics Letters, 2004, 92, 106804.

[5] A. Javey, P. Qi, Q. Wang, H. Dai, " Ten- to 50- nm long quasi ballistic carbon nanotube devices obtained without complex lithography" PNAS, 2004, vol. 101, n. 37, pp. 13408-13410.

[6] J. Guo, M. Lundstrom, "Role of phonon scattering in carbon nanotube field-effect transistor." Applied Physics Letters, 2005, vol. 86, pp. 193103.

[7] S. Fregonese, J. Goguet, C. Maneux, T. Zimmer, " Implementation of electron –phonon scattering in a CNTFET compact model" IEEE Transaction On Electron device , 2009, vol. 56 n. 6.

[8] Verilog-A Reference Manual, Agilent Technologies September 2004.

[9] Advanced Design System (ADS) The website of ADS, http:// www.home.agilent.com

Advanced Materials for Water Treatment and Bio-refining

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Abstract

Emerging waste water treatment technologies will be addressed, covering the role of catalysis and priorities for the application of advanced catalysts, adsorbents and nano-materials for the chemical process industry. Potential applications with respect of dewatering of (bio) ethanol, recycle of water in the process industry and the reduction in the waste emissions by introducing new process technologies will be highlighted, along with the reduction of toxicity and improvement of biodegradability in industrial waste water streams.

Nano-technological photo-catalytic materials for waste water treatment using sunlight, technologies to remediate industrially contaminated ground water as well as catalytic ozonation and the reduction of nitrates/nitrites and removal of arsenic in water will be discussed. Finally, research needs to demonstrate the industrial potential for commercialisation by the year 2020 will be presented, including synergistic co-operations.

In a time were the focus is on global warming, CO_2 emission, increased competition, secure energy supply, less consumption of fossil based fuels etc., the use of biomass as renewable energy resource becomes quite essential. Multiple biomass resources are discussed with respect to a variety of fuels, valuable chemicals and energy products and an integrated concept for sustainable technologies within the lignocellulosic biorefinery concept is presented. The first generation of biofuels are addressed whereas the focus of this lecture will be on the second and third generation of biofuels, with synfuels and phenols as the main target products. The challenges regarding the processing of lignocellulosic materials (wooden based biomass) will be highlighted along with the application of porous materials as catalysts for the biomass-to-liquids (BTL) track within the biorefinery concept (see Figure 1).

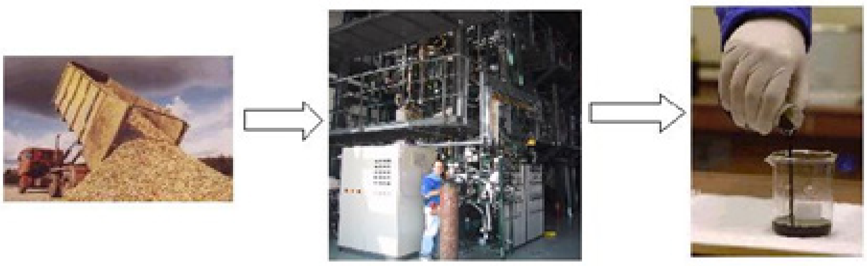

Figure 1 Bio-oil production via biomass catalytic pyrolysis

Since cellulose, hemicellulose and lignin pyrolyse or degrade at different rates and by different mechanisms and pathways their catalytic conversion requires certain attention. Lignin decomposes over a wider temperature range compared to cellulose and hemicellulose, which rapidly degrade over narrower temperature ranges. Challenges related to the catalytic conversion of wooden based biomass, like mechanistic understanding of the complex reactions taking place, the catalyst and process developments as well as the product pattern to be envisaged will be discussed.

Finally, co-processing of bio oils with petroleum fractions in FCC units will be addressed. Fluidized catalytic cracking (FCC) in petroleum refineries allows to adapt fluctuations in feedstock and product requirements. Its main function is to convert high molecular weight hydrocarbons (HCs) obtained from the crude oil distillation (atmospheric residue or vacuum gas oil (VGO)) into more valuable products, mainly gasoline. However, a FCC unit is also able to crack pyrolysis oils, containing, for example, oligomeric molecules from lignin degradation.

Optical properties of Si-delta doping on multi-stacked InAs/InGaAs/GaAs intermediate-band solar cells

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Abstract:

We report in this work the effects of Si-delta doped GaAs spacer layer on the optical properties of 20-stacked InAs/InGaAs/GaAs coupled quantum dots intermediate band solar cells heterostructures grown by Solid-Source Molecular Beam Epitaxy (SS-MBE). The samples were investigated via photoluminescence (PL) and photocurrent (PC) spectroscopy. Two different families of quantum dots (QDs) were observed in the photoluminescence spectra and clearly identified in the atomic force microscopy image (AFM). Also the PL spectrum shows a dramatic decrease in PL intensity and a remarkable blue shift of approximately ~ 70 and 100meV respectively for large and small QDs with doping, which most likely due to the incorporation of nonradiative impurities caused by Si- delta doping, to the more frequent filling by the additional electron of the sub-band level in the InAs QDs and promoted by the strain driven In/Ga intermixing between QDs and GaAs spacer layer. The PC measurement exhibits a drop of the photocurrent accompanied by weak absorption in the extended range with doping.

Keywords Si-delta doping, molecular beam epitaxy, quantum dots, In/Ga intermixing and intermediate- band solar cell

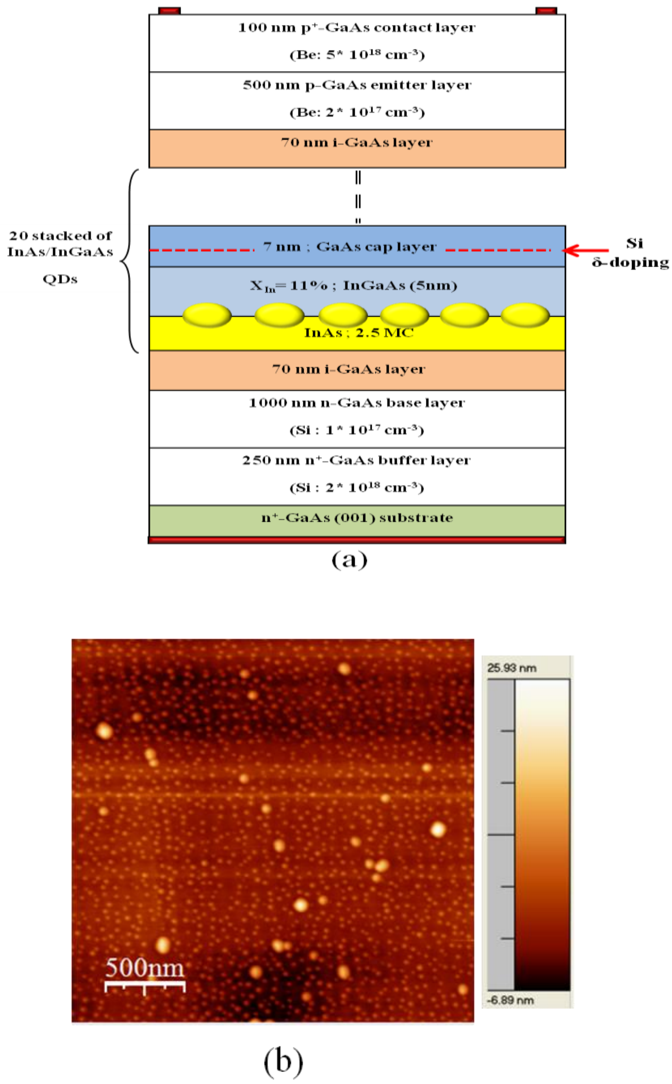

Figure: Figure illustrating (a) The growth diagram of 20-stacked coupled InAs/InGaAs/GaAs quantum dots solar cells of undoped and doped structure.(b) AFM image of uncapped QDs sample for one layer stacked InAs/$In_{0.11}Ga_{0.89}As$ QDs grown on GaAs (001). Scan size is 2.5µm x 2.5µm.

Impact of non-functionalized and amino-functionalized multiwall carbon nanotubes on pesticide uptake by lettuce (*Lactuca sativa* L.)

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Abstract: Carbon nanomaterials such as C_{60}/C_{70} fullerenes, single/multiwall carbon nanotubes (S/MWCNT), have been the focus of much interest with regard to agricultural applications, although the scientific literature here is rather thin and conflicted (Mota *et al.,* 2013). Given CNT chemical and physical properties, interactions with coexisting organic chemicals can be anticipated (Wang *et al.*, 2012; De La Torre-Roche *et al.*, 2013). In this research study, the phytotoxicity of non-functionalized and amino-functionalized multiwall carbon nanotubes (NF-MWCNT and NH_2-MWCNT) (Figure 1), as well as CNT impact on coexistent pesticide uptake, was investigated in lettuce (*Lactuca sativa* L.). A special focus was on the accumulation of *p,p'*-DDE, *cis*-chlordane, *trans*-chlordane, and *trans*-nonachlor in edible parts (fresh leaves), a major pathway for human exposure to contaminants. Lettuce seeds were sawn directly into CNT-amended vermiculite (3333 mg kg^{-1}) to monitor phytotoxic effects from early stages but both CNT did not influence seed germination (82-96%) or plant pre-growth. The subsequent 19-d exposure to pesticides (100 ng L^{-1} each) resulted in their significant uptake by lettuce roots with negligible translocation to shoots (less than 1%). Consequently, no clear impact on plant growth, total pigment production and tissue lipid peroxidation could be noticed during this period. The presence and type of CNT largely influenced pesticide accumulation in lettuce seedlings. In this regard, both CNT significantly reduced pesticide availability in vermiculite due to strong adsorption, especially in presence of NF-MWCNT. The addition of humic acid completely reversed the reduced accumulation of pesticides induced by NH_2 functionalization likely due to strong competition over adsorption sites on the nanomaterial. These findings have implications for food safety and for the use of engineered nanomaterials in agriculture, especially with leafy vegetables.

Keywords: NF-MWCNT; NH_2-MWCNT; lettuce; pesticides; uptake

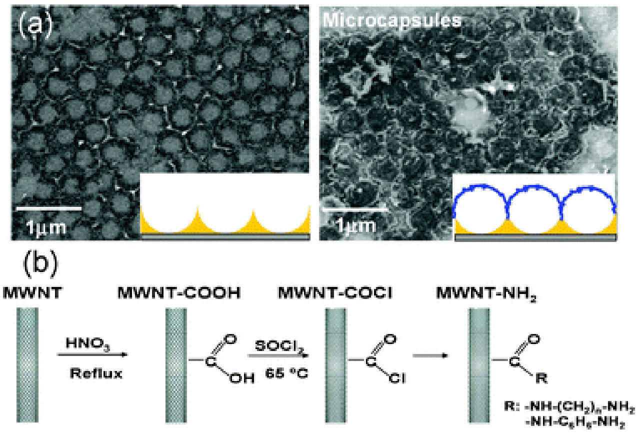

Figure 1: MWCNT functionalization with NH_2. In general functionalization is usually done by oxidation using HNO_3, $KMnO_4$, etc. The defects and the ends of the CNT are thus functionalized by carboxyl groups. These carboxylic groups are then used as reaction precursors in the functionalization with amino-groups.

References:

De La Torre-Roche, R., Hawthorne, J., Deng, Y., Xing, B., Cai, W., Newman, L.A., Wang, Q., Ma, X., Hamdi, H., White, J.C. (2013), Multiwalled carbon nanotubes and C_{60} fullerenes differentially impact the accumulation of weathered pesticides in four agricultural plants. *Environ. Sci. Technol.*, 47, 12539-12547.

Mota, L. C., Urena-Benavides, E. E., Yoon, Y., Son, A. (2013), Quantitative detection of single walled carbon nanotube in water using DNA and magnetic fluorescent spheres. *Environ. Sci. Technol.*, 47, 493-501

Wang, L.; Huang, Y., Kan, A. T., Tomson, M. B., Chen, W. (2012), Enhanced transport of 2,2',5,5'-polychlorinated biphenyl by natural organic matter (NOM) and surfactant modified fullerene nanoparticles (nC_{60}). *Environ. Sci. Technol.*, 46, 5422-5429.

Spatial Resolved Measurements of the Local Efficiency in CIGS Thin-Film Based Solar Cell

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$Cu(In,Ga)Se_2$ (CIGS) based Solar Cells are well known as one of the highest efficient solar devices. The highest efficiency for CIGS solar cells, according to the National Renewable Energy Laboratory, is 20.8%. Nevertheless, Scientific literature shows that there are still many basic questions in CIGS research intensely debated such as grain boundaries (Rau *et al*., 2009), and the presence of defects (Igalson *et al*., 2009). Exploiting these questions could increase the efficiency and reduce the production costs. A large variety of experimental techniques have been used in order to characterize photovoltaic devices. Among them, Scanning Near-field Optical Microscopy (SNOM) is used. SNOM is a powerful technique that scans a tapered optical fiber across the sample, illuminating only that area of the sample that lies directly under the tip aperture (~100nm). Kept within few nanometers of the surface, the tip illuminates the sample in the near field allowing the collection of optical information, better than the diffraction limit of the operating light, of the surface of the sample. Topographic information are equally obtained. In addition, this technique could be used in order to perform spatial resolved photocurrent measurements on solar cell samples (Feron *et al*., 2013).

We report the application of SNOM to mapping the photocurrent produced by CIGS solar cells under local monochromatic illumination. We demonstrate the influence of the presence of inhomogeneities on the top surface of the sample on the local current generation. Topographic and photocurrent images are obtained (Figure 1). The usage of 100 nm aperture tips shows that the big "islands" contribute significantly less to the overall produced current than the surrounding regions. The photocurrent map shows that the produced photocurrent in such regions is three to four times smaller than the current produced in other regions (Figure 1b).

In the opposite, regions presenting small aggregates show more uniform current on the length scale of few hundreds of nanometers. This demonstrates that the local efficiency of the solar cell depends on the morphology of the top electrode surface also.

Keywords: SNOM, Photovoltaic, CIGS thin-film Solar Cell.

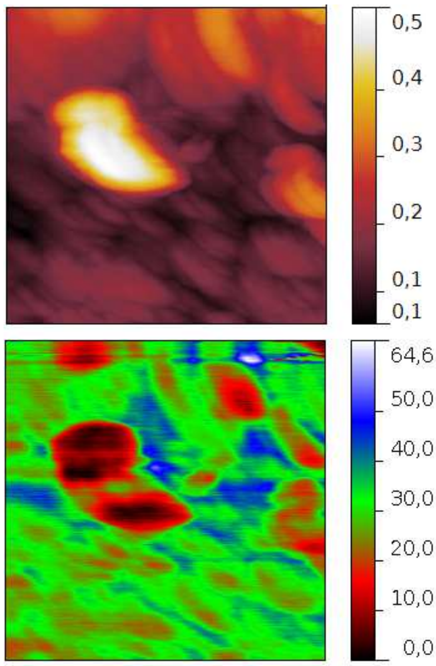

Figure 1: Topographic (top) and Photocurrent (bottom) images of a CIGS photovoltaic device. Large regions (bright on the topographic image) correspond to big aggregates producing lower current (red-dark on the current map) and smaller aggregates producing much higher current. The scale bar is $10X10\mu m^2$. The color scale is expressed in μm (top) and in *nA* (bottom).

References

Rau, U., Taretto, K., Siebentritt, S. (2009) Grain boundaries in $Cu(In,Ga)(Se, S)_2$ thin-film solar cells. *Applied Physics A*, 96, 221–234

Igalson, M., Urbaniak, A., Edoff, M. (2009) Reinterpretation of defect levels derived from capacitance spectroscopy of CIGSe solar cells. *Thin Solid Films*, 517, 2153–2157

Feron, K., Nagle, T.-J., Rozanski, L.-J.,Gong, B.-B., Fell, C.-J. (2013) Spatially resolved photocurrent measurements of organic solar cells: Tracking water ingress at edges and pinholes, *Solar Energy Materials & Solar Cells*, 109, 169–177.

Spin Orbit Torque (SOT) nanodevices for ultra energy efficient and non-volatile applications

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Abstract:
The discovery of the Giant Magneto Resistance (GMR) (awarded Nobel Prize Physics 2007) was the founding step of Spintronics. Afterward, the giant step advancing Spintronics came from creating the Magnetic Tunnel Junction (MTJ) (Moodera *et al*.; 1995). The discovery of MTJs induced a rapid development era on spin-based integrated circuits (ICs), such as Magnetic Random Access Memory (MRAM). MTJ-based MRAM is the promising technology candidate to govern the future storage market. It provides a combination of fast access time, non-volatility (NV), data retention, zero-standby power, endurance and high density. The first two generations of MRAMs were based on Field Induced Magnetic Switching (FIMS) and Thermally Assisted Switching (TAS), consecutively (Kang et al.; 2014). Now, a great interest is given to MTJs based on Spin Transfer Torque (STT) (Kang et al.; 2014). The scalability is improved and the required storage current is decreased over previous MTJ generations (FIMS and TAS). However, the common write and read path through STT-MTJs decreases their reliability. Recently, SPINTEC researchers have proved that such an issue could be avoided by the demonstration of Spin-Orbit-Torques in ferromagnetic thin films (Miron et al,; 2011). We report the benefits brought by the SOT device to increase the reliability of MTJ based ICs. Besides, a macrospin compact model in Verilog-A has been developed to describe the behavior of the SOT-MTJ device and enable its integration into semiconductor commercial design flows to realize hybrid CMOS/magnetic ICs. Simulations results show the great potential of SOT-MTJ to improve the writing energy by 5× compared with STT-MTJs. Also, a very fast switching (hundreds of picoseconds) has been observed in experimental samples (ref) and theoretical simulations (Garello et al.; 2013).
Results are very encouraging for future complex hybrid magnetic/CMOS systems targeting Application Specific Integrated Circuits (ASICs) and memories. Portable applications such as mobile phones and digital cameras are among the possible device candidates in the market which can profit from the power efficieny, and the instant on/off of the ICs based on SOT nanodevices. Furthermore, the intrinsic hardness to radiation of MTJs is a very interesting asset for aerospace and military applications.

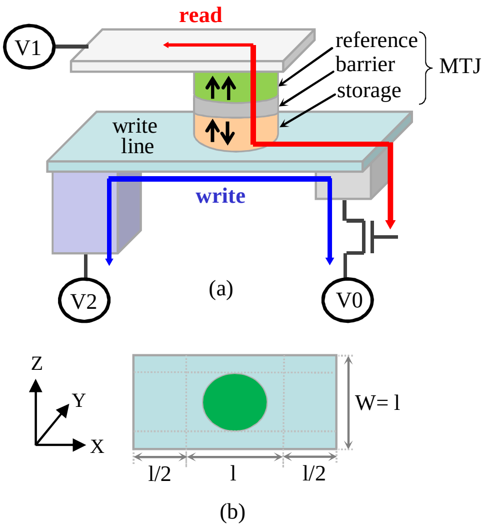

Figure 1: 3-terminal SOT device (a) two independent paths for write and read operations. The reference layer magnetization is pinned. The storage layer magnetization is programmable (up or down); In-plane current injection through the write line induces the perpendicular switching of the storage layer. When the reference and the storage layers have a parallel magnetization state, the resistance of the MTJ is R_{min} (logic '0'). When the reference and the storage layers have an anti-parallel magnetization state, the resistance of the MTJ is R_{max} (logic '1') (b) top view of the SOT-MTJ with experimental dimension assumptions.

References:

Moodera,J,S., Kinder,L,R., Wong, T,M., Meservey,R. (1995) magnetoresistance at room temperature in ferromagnetic thin film tunnel junctions,´ *Phys. Rev. Lett, Vol. 74, PP. 3273-3276.*

Kang,W., Zhao,W., Klein,J-O., Wang,Z., Y,Zhang., Zhang,Y.,Ravelosona, D.,Chappert,C. (2014), An Overview of Spin-based Integrated Circuits, *Procs. Of IEEE ASP-DAC.*

Miron, I.M., Garello,K., Gaudin,G., Zermatten, P-J., Costache, M-V., Auffret, S., Bandiera, S. Rodmacq, B., Schhuhl, A., Gambardella, P., (2011) , Perpendicular switching of a single ferromagnetic layer induced by in-plane current injection", *Nature 476.*

Garello. K, C. O. Avci, I. M. Miron, O. Boulle, S. Auffret, P. Gambardella, G. Gaudin,' Ultrafast magnetization switching by spin-orbit torques', *arXiv:1310.5586v1 (2013)*

Design of a UV-Protected Nonwoven Fabric with Anti-mosquito Property

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Abstract: Ultra-violet (UV) degradation is one of the major problems of textile materials which are constantly exposed to sunlight (Harini *et al*., 2012). The protection extended by the textile materials is denoted by Ultraviolet Protection Factor (UPF) which depends on the chemical structure of fibers (Saravanan, 2007). In this study, UV protected nonwoven fabrics with anti-mosquito (AntiM) property were designed by using both nano and conventional finishing to investigate their effects on mechanical and comfort properties of samples. Two types of UV protective finishes and one type of AntiM finish were used on 100% polyester spunbond nonwoven fabrics with a concentration of 10g/l. While UV1 is a conventional finish which is a dispersion of triazine, UV2 is a nano finish which is composed of ZnO. Also BEMATIN 988 was used as a AntiM finish. All finishing treatments were done by padding process. UPF, tensile strength, air permeability, permethrin amount and colour fastness to light of samples were analyzed. Some of the datas are listed in Table 1. Results showed that, all of the samples have colour fastness of 4 or 5 which confirms that the fabric has high resistivity to light. Permethrin amount was found adequate to put away mosquitos from the specimens which have AntiM finish. When UPF results are examined, it is clearly seen that while sample 2 has the highest value (UPF - 10.10), sample 6 has the lowest one (UPF - 4.18) which shows that AntiM fnish has a negative effect on ultraviyolet protection of the samples. On the other hand, tensile strength has an increment with UV1 treatment but no difference is notted in AntiM treated samples. Lastly, all finished samples have lower air permeability values than sample 1 which is not treated.

Keywords: UV protection factor, anti-mosquito, air permeability, nonwoven, permetherin.

Table 1. UPF and air permeability results of samples.

Sample No	Type of Finish	UPF (%)	Air Permeability (cfm)
1	-	4,39	377
2	UV1	10,10	296
3	UV1-AntiM	8,06	232
4	UV2	4,45	231
5	UV2-AntiM	4,19	207
6	AntiM	4,18	242

References:

Saravanan, D. (2007), UV Protection Textile Materials, *AUTEX Res. J.*, 7, 53-62.

Harini, D., Sharada Devi, A., Anitha, D., (2012), Non-woven Drapery Lining With Ultra Violet Resistance, *J.Res. Angrau*, 40(3), 33- 36.

Characterization of Dry Fibers of *Optunia ficus-indica* Cladodes' as Lignocellulosic Feedstocks for Biorefineries

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Abstract: The of lignocellulosic material of the dry fibers of *Optunia ficus-indica* cladodes', makes them a potential substrate of biorefineries. In this context, this work aims to explore the nature of this source of biomass available in the Mediterranean region in general and especially in Tunisia as well as in the Grand Maghreb. Thus, the structural, the physico-chemical and thermogravimetric characterization of the dry fibers of *Optunia ficus-indica* Cladodes' have been the theme of this study.

During this investigation, it was shown that 98 % of the dry matter of the cladodes of *Optunia ficus-indica* have a lignocellulosic nature with a fibrous structure having a pore aspect highlighted by light and electron microscopy. Furthermore , the study of the sorption isotherm of these fibers, has shown that for a microclimate with a saturated water content of aw = 1 , the maximum amount of water that could be absorbed by the sample, is about 16g of water / g of sample . Moreover , the thermogravimetric analysis of the dry fibers of the cladodes of *Optunia ficus-indica* shown that at the temperature limit of 500 °C, the lignocellulosic fraction is incinerated and degraded with a percent loss of mass Δm which is about 88%.

At the end of this study , it is appropriate to conclude that the physico- chemical properties as well as the structural and the thermogravimetric characteristics of the dry fibers of *Optunia ficus-indica* cladodes'are similar and comparable to several types of lignocellulosic biomass from the group of herbs or herbaceous and they are different from the biomass of soft and hardwood.

Keywords: Biorefineries, Lignocellulosic fibers, cladodes of *Optunia ficus-indica*, physico-chemical characterization, structural study, thermogravimetric analysis.

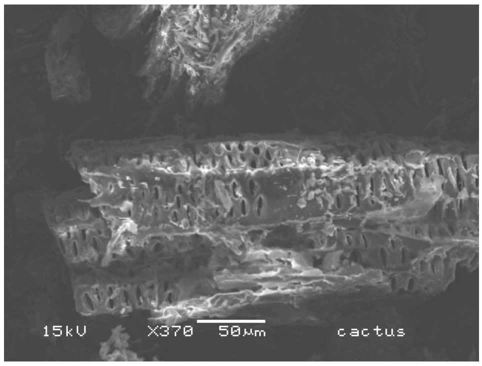

Figure 1: Scanning electronic micrographs SEM of dry cactus cladodes fibers (370 X).

References:

Ciannamea E.M., Stefani P.M., Ruseckaite R.A. (2010). Medium-density particle boards from modified rice husks and soybean protein concentrate-based adhesives. *Bioresource Technology*, 101, 818–825.

García-Ibañez P., Sánchez M., Cabanillas A. (2006). Thermogravimetric analysis of olive-oil residue in air atmosphere. *Fuel Processing Technology*, 87,103–107.

Hamdi M. Nutritional and Medicinal Uses of Prickly Pear Fruit and cladodes: Processing Technology Experiences and Constraints (2006). Handbook of Fruits and Fruit Processing. *Edition Blackwell Publishing*, USA, 651-664.

FPGA-based real time implementation of a controller algorithm for water pumping system powered by a wind/photovoltaic hybrid power system

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Abstract: In this paper an FPGA-based implementation of a real time controller algorithm to controller an induction motor (IM).The motor is used to drive a centrifugal water pump powered by a hybrid wind/ photovoltaic system. The algorithm controller has been designed using the very high-speed description language (VHDL) and implemented on The Altera® DE0-Nano Development board. The board features the Altera Cyclone® IV 4C22 FPGA.

The simulation was conducted using the Matlab/Simulink, PSIM and the ModelSim programs. While the dynamic part (inverter, motor, buck…) is executed in the Matlab and PSIM, The ModelSim performed the command control witch is written in VHDL-code. The three programs work in Co-Simulation mode provided by the link-for- ModelSim and Simcoupler toolbox in simulink. The algorithm and the hardware have been simulated and tested by the power produced by the hybrid wind/photovoltaic system installed at the faculty of science of Tunis. Experiment result by using FPGA control is used to prove how the proposed methodology is an efficient water pumping system control procedure.

Keywords: Photovoltaic, Wind, Hybrid Water pumping system, FPGA, VHDL, Induction motor (IM), controller algorithm

References:

Mellit H. Rezzouk , A. Messai , B. Medjahed: FPGA-based real time implementation of MPPT-controller for photovoltaic systems, Renewable Energy 36 (2011) 1652e1661.

Messaoud Makhlouf, Feyrouz Messai , Hocine Benalla : Vectorial command of induction motor pumping system supplied by a photovoltaic generator, *Journal of* electrical engineering, vol. 62, NO. 1, 2011, 3–10.

Mezghani. D, Mami .A, 2009, " Bond graph modelling and improved V/F control of pumping photovoltaic installation: simulations and measurements, STA, pp 1274-1285.

Rahul Dubey : Introduction to Embedded System Design Using Field Programmable Gate Arrays, ISBN 978-1-84882-015-9, © 2009 Springer-Verlag London Limited.

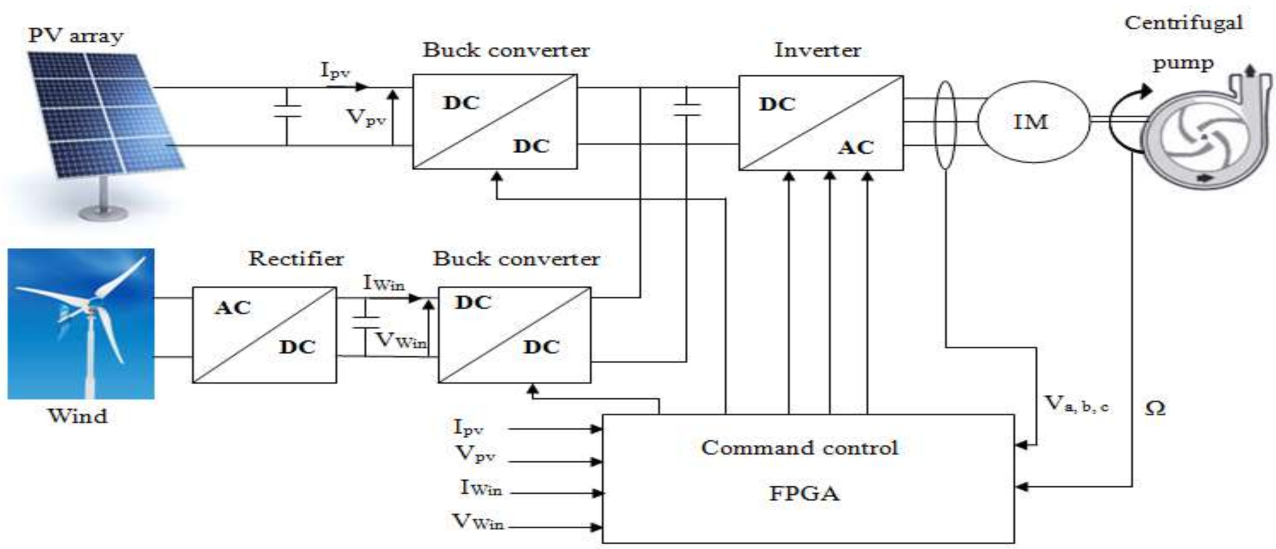

Figure 1: Photovoltaic/Wind pumping system

Defluoridation of drinking water using functionalized SBA-15 type ordered mesoporous silica

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Abstract: Most of the remediation technologies available today, while effective, very often are costly and time-consuming, particularly pump-and-treat methods (Hichour et al.; 1999). Water treatment technology suggests that many of the issues involving water quality could be resolved or greatly ameliorated using nanoparticles (Ben Amor, 2011, 2012). The application of specific nanoparticles can effectively, inexpensively, and rapidly render usable potable water is being explored at a variety of institutions.

The present survey highlights for the first time that glucamine-modified ordered mesoporous silica type SBA-15 (Ben Amor, 2012) can be used as adsorbents for the uptake of Fluoride from water. By means of X-ray diffraction (XRD), N_2 adsorption-desorption, Thermogravimetry (TGA) and Fourier transform InfraRed (FTIR) the structure and physico-chemical properties of the materials were characterized.

Batchwise adsorption test of prepared adsorbent was carried out in aqueous sodium fluoride solutions and real water containing fluoride ion. Physico-chemical parameters such as adsorbent dose, pH, initial fluoride concentration, temperature, equilibrium contact time and co-existing anions were studied in a series of batch adsorption experiments. Fluoride ion adsorption was determined using fluoride ion selective electrode. Adsorption of fluoride on the adsorbent was saturated within 3 hours in solution containing 2 mg/L of fluoride, with 2 g/L of adsorbant dose. The effects of pH were found to play a major role. The maximum adsorption of fluoride could be obtained in the solution at about pH 3. The N-methylglucamine post-synthesis grafted SBA-15 possessed higher defluoridation capacity, about 50% of F^- removal, than unmodified SBA-15 which showed only a 5% of F^- removal. The pH changes during the adsorption process suggested that the OH^- on the surface of the material was the adsorption sites. The more adsorption sites were formed on glucamine-modified SBA-15, which possessed abundant surface hydroxyl groups compared with unmodified SBA-15, resulting in higher efficiency of F^- removal.

Keywords: defluoridation, adsorption, SBA-15, grafting.

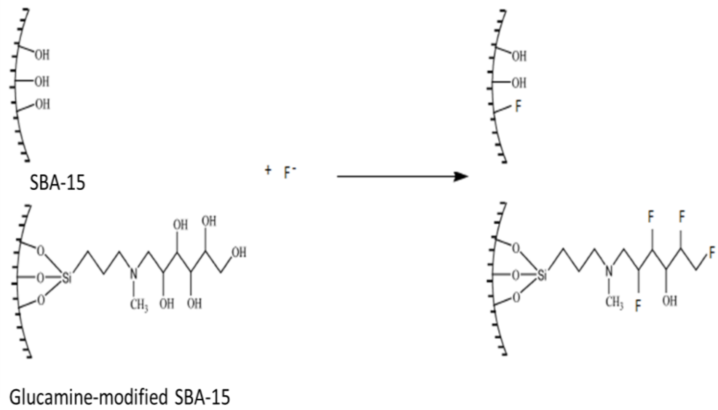

Figure : Figure illustrating the fluoride adsorption into hydroxyl groups on both SBA-15 and Glucamine-modified SBA-15

References:

Hichour, M., Persin, F., Sandeaux, J., Molénat, J., Gavach, C. (1999), Défluoruration des eaux par dialyse de Donnan et électrodialyse, *Rev.Sci. Eau.*, 12, 671-686.

Ben Amor, T. (2011), Synthèse et caractérisation de silices mesoporeuses hydrophobes à porosité contrôlée.

Ben Amor, T., Loic, V., Lebeau, B., Marichal, C. Influence of synthesis parameters on the physico-chemical characteristics of SBA-15 type ordered mesoporous silica, *Micropor. Mesopor. Mater.*, 153, 100-114.

Ben Amor, T., Miesch, J., Montégut, G., Nouali, H., Marichal, C., Lebeau, B. (2012) , Post-synthesis grafting of fluoropropyl groups on SBA-15 type ordered mesoporous silicas, *Eur.J. Inorg. Chem.*, 5371-5379.

Investigating effects of an argon-based non-thermal atmospheric pressure plasma jet on inactivation of E-Coli

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Abstract: During the last decade, non-thermal plasmas have been widely studied for several medical applications such sterilization (Uhm *et al.*, 2011), blood coagulation and teeth whitening (Park *et al.*, 2012), dermatology (Heinlin *et al.*, 2010) and cancer healing (Han *et al.*, 2013). Among the studied cold plasma techniques for medical field, plasma jets sources are the most promising ones. These kind of non-thermal plasmas are created at atmospheric pressure and can have a small section (less than a millimeter to a few centimeters), allowing them then to be used for a very located treatment. In this work, some investigations have been carried out to generate an argon-based non-thermal atmospheric pressure plasma jet (NAPPJ). The argon gas was injected through the inner electrode of a homemade dielectric barrier discharge-based cylindrical reactor linked to a high voltage pulse generator Redline G2000 (Figure 1). The produced plasma jet length (Figure 2) was found dependent on the excitation signal parameters (voltage and frequency values). A plasma jet length varying from 0 to 5 cm has been obtained by applying an excitation voltage in the range 6 - 10 kV with a signal frequency in the range 10 - 50 kHz. This non-thermal atmospheric pressure plasma jet has been applied to inactivate E-Coli bacteria. In order to determinate the plasma jet action field around the impact point on the contaminated surface, the treated sample has been placed at different distances inside the jet or far from its end. The efficiency of the plasma jet treatment on the E-coli bacteria has been studied according to the contaminated samples positions and the exposure time to the NAPPJ. Microscopy observations have revealed that the exposure of the E-coli bacteria to our NAPPJ induces a consumption of its genetic material. This consumption is more pronounced when the treatment time is increased and/or the distance samples - plasma source is reduced. A removal of the entire microorganism's cadavers can be obtained by increasing the exposure time and reducing samples - plasma source distances; this behavior can be explained by an ablation effect of the bacteria constituents by the plasma reactive species produced in the plasma jet.

Keywords: non-thermal atmospheric pressure plasma jet, micro-organisms inactivation, E-Coli bacteria, plasma jet parameters effects.

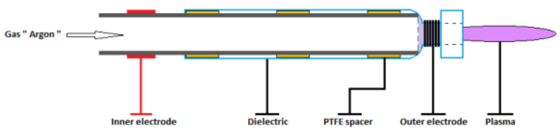

Figure 1: Schematic representation of the plasma jet reactor.

Figure 2: Photo of the argon-based non-thermal atmospheric pressure plasma jet (V = 10 kV; f = 10 kHz).

References:

Han, X., Klas, M., Liu, Y., Stack, M. S., Ptasinska, S. (2013) DNA damage in oral cancer cells induced by nitrogen atmospheric pressure plasma jets, *Appl. Phys. Lett.*, 102, 233703.

Heinlin, J., Morfill, G., Landthaler, M., Stolz, W., Isbary, G., Zimmermann, J. L., Shimizu, T., Karrer, S. (2010) Plasma medicine: possible applications in dermatology, *J. Dtsch. Dermatol. Ges.*, 8, 968-976.

Park, G. Y., Park, S. J., Choi, M. Y., Koo, I. G., Byun, J. H., Hong, J. W., Sim, J. Y., Collins, G. J., Lee, J. K. (2012) Atmospheric-pressure plasma sources for biomedical applications, *Plasma Sources Sci. Technol.*, 21, 043001.

Uhm, H. S., Hong, Y. C. (2011) Various microplasma jets and their sterilization of microbes, *Thin Solid Films*, 519, 6974-6980.

Cytotoxic effects of treated effluents and industrial wastewater discharges on mammalian cell lines

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Abstract: Persistent organic compounds, released with the treated sewage effluents and the industrial discharges into recipient water bodies, enter the environment and pose a risk to animal and human life (Smital *et al.,* 2011). A range of toxicity bioassays which account for the biological effects of the pollutants has been developed to assess the potential toxicity risk of chemical mixtures against living cells (Hendricks and Pool, 2012). The current study aimed to determine the cytotoxic effects of industrial wastewater and treated sewage effluents discharging into a main River in Tunisia. These environmental matrices were screened for chemical parameters. Then, cytotoxicity was assessed using MTT *in vitro* toxicity test with mammalian cell lines. According to preliminary chemical analysis, high organic pollution was detected for some samples of treated wastewater and for industrial water due to high levels of chemical oxygen demand which exceeded the Tunisian guidelines. Moreover, significant cytotoxicity was registered for the highest concentration of water samples. In fact, the cell viability decrease was dose dependent for all the tested samples.

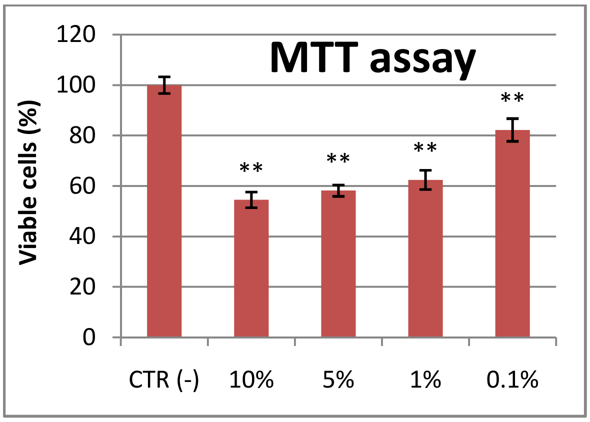

Figure 1: MTT assay results

Thus, water samples may contain diversity of organic contaminants considered as potentially hazardous complex mixtures and representing a potential environmental risk for surface water. Hence, on one hand the implemented assay pointed out the insufficiency of the applied treatment technology to completely eliminate toxic micropollutants from treated effluent. On the other hand, industrial wastewaters should be controlled and pretreated before being discharged into surface water. This finding may support decisions makers to take corrective measures to protect surface water from pollution which threaten aquatic life and human health as well.

Keywords: Cytotoxicity, MTT, mammalian cell lines, treated effluents, industrial wastewater

References:

Smital, T., Terzic, S., Zaja , R., Senta, I., Pivcevic, B., Popovic, M., Mikac, I., Tollefsen, K.E., Thomas, K.V., Ahel, M. (2011) Assessment of toxicological profiles of the municipal wastewater effluents using chemical analyses and bioassays, *Ecotoxicology and Environmental Safety*, 74, 844–851.

Hendricks, R., Pool, E.J. (2012) Rapid *in vitro* tests to determine the toxicity of raw wastewater and treated sewage effluents, *Water SA*, 38.

Bioremediation of Pesticide Contaminated Soils: microbiological methods for feasibility assessment and monitoring

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Abstract: There is rising public concern as a wide variety of toxic organic chemicals are being introduced deliberately into the environment. Pesticides are one common example of these chemicals, which enter the soils frequently in recent years. Chlorinated phenols (CPs) are a group of ionisable organic compounds of major environmental concern. Chlorophenols, particular those with three or more chlorine atoms, have gained an increasing use as fungicides, herbicides and insecticides (Roy and Hänninen, 1994). Pentachlorophenol (PCP) from the category of CPs generated harmful effects in aquaculture or soil systems (Hechmi et al., 2013). Thus, the cleanup PCP contaminated soils is imperative and it is critical to develop efficient approaches to remove multiple contaminants from soils. The need to remediate these natural resources has led to the development of new technologies that emphasize the destruction of the pollutants rather than the usual approach of disposal. Bioremediation is the use of biological interventions of biodiversity for mitigation of the noxious effects caused by environmental pollutants in a given site (Latha and Reddy, 2013). Bioremediation with divers' aspects more recently, phytoremediation has emerged as one of the alternative technologies for removing contaminants from the soil. Phytoremediation, a plant based green technology, has received much attention after the discovery of hyperaccumulating plants which have the inherent ability to accumulate, translocate, and concentrate high amount of certain xenobiotics in their above-ground/harvestable parts (Rahman and Hasegawa, 2011).This contribution provides background information on the PCP soil phytoremediation, discusses the prospective of using biological methods for addressing this approch and describes several microbiological methods which can be used for the feasibility assessment of soil phytoremediation .

Keywords: Soil, Pentachlorophenol, Phytoremediation, Micobial enumeration, Dehydrogenase activity.

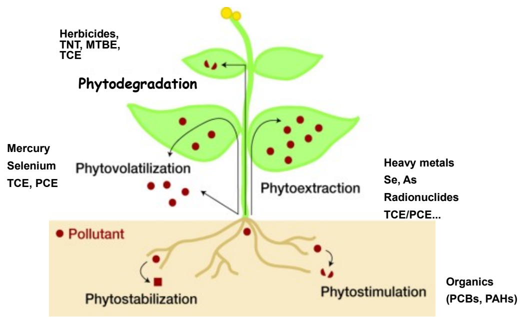

Figure 1: Phytoremediation Process (*Pilon-Smits (2005)*)

References:

Hechmi, N., Ben Aissa, N., Abdenaceur, H. and Jedidi, N. (2013), Evaluating the phytoremediation potential of *Phragmites australis* grown in pentachlorophenol and cadmium co-contaminated soils, *Environ Sci Pollut Res.,* DOI 10.1007/s11356-013-1997-y.

Asha Latha, A., Reddy, S. (2013), REVIEW ON BIOREMEDIATION – POTENTIAL TOOL FOR REMOVING ENVIRONMENTAL POLLUTION, Int J Basic Appl Chem Sci 3(3), 21-33.

Pilon*, Smits. (2005),* Phytoremediation, *Annu Rev Plant Biol., 56: 15-39.*

Rahman, M.A. and H. Hasegawa (2011) Aquatic arsenic: phytoremediation using floating macrophytes., *Chemosphere* 83, 633–646.

Roy, S. and Hänninen, O. (1994) , Pentachlorophenol: Uptake/elimination kinetics and metabolism in an aquatic plant, *Eichhornia Crassipes*, *Environ Toxicol Chem* 13, 763–773.

Removal of Organic Pollutants Using Commercial Nanofiltration and Reverse Osmosis Membranes

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Abstract: The removal of disinfection byproducts (DBPs), their precursors (e.g. humic acids)[2,3] and phenol derivatives has become an essential step during water treatment processes due to their negative health effects. In this work, the efficiency of different commercial nanofiltration (NF) and reverse osmosis (RO) membranes for the removal of chloroform (as the major component of DBPs) and humic acid (as a DBPs precursor), 2-nitrophenol and trichlorophenol (phenol derivatives) from drinking water was investigated. Seven different commercial membranes were used for that purpose including NF90 and NF270 for NF process and TM820, SW30HR, SW30XLE, BW30 and XLE for RO process. The surface and structural properties of the commercial membranes were characterized using, e.g. Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), contact angle and Zeta-potential measurements[1]. In addition, a custom made dead end filtration cell was utilized to measure of the water flux and the rejection of organic pollutants.

From the permeability tests, it was revealed that NF-90 rejected humic acid better than NF-270 (99% and 98%, respectively). For RO membranes, the rejection of humic acid was almost 100%. In case of chloroform, NF-90 (which was more hydrophobic than NF-270 according to contact angle measurements) rejected chloroform by 92%, while for NF-270 the rejection was only 76%. For the six membranes the rejection of chloroform can be summarized in the following order SW-30 > BW-30 > TM-820 > XLE > NF-90 > NF-270. Regarding the rejection of phenol derivatives, the rejection of 2-nitrophenol by NF-270 was 87% while 92.5% for NF-90 after 7 hours of continuous operation.

For the long time filtration experiments, it was shown that BW30 and SW30 had high rejection values for chloroform with only a slight decrease in the flux. For the mixture solutions composed of humic acid and chloroform with different molar ratios, it was found that the increase of

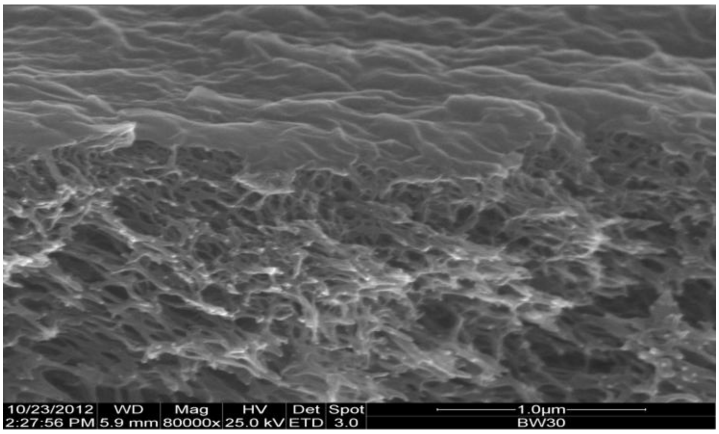

Figure 1: Figure illustrating the morphology of virgin commercial RO membrane (BW30 membrane).

the humic acid content led to a slight increase in the rejection of chloroform and a decline in the flux for the studied membranes. Overall, the current results showed that both SW-30 and BW-30 can be used efficiently to control the DBPs level in the produced drinking water.

Keywords:

Humic acid, Chloroform Removal, Nanofiltration, Reverse Osmosis and Phenol derivatives

References:

[1] C. Y. Tang, Y.N. Kwon and J.O. Leckie, Probing the nano- and micro-scales of reverse osmosis membranes— A comprehensive characterization of physiochemical properties of uncoated and coated membranes by XPS , TM, ATR-FTIR, and streaming potential measurements, J. Membr. Sci., 287(2007) 146–156.
[2] M. I. Badawy , T. A. Gad-Allah, M. E. Ali , Y. Yoon, Minimization of the formation of disinfection by-products, J. Chemosphere 89 (2012) 235–240.
[3] G. Hua , D. A. Reckhow, Effect of pre-ozonation on the formation and speciation of DBPs, water research 47 (2013) 4322 -4330.

Nanoparticles for Energy Applications

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Providing our society with clean and affordable energy has become a one of the most important challenge of our times. In the past few years, the use of nanomaterials for energy-relevant technologies has become a topic of rapidly increasing interest, because nanostructured matter offers a route to novel materials, tailored to exhibit specific properties, and because nanoscale systems have a huge surface-to-volume ratio and many energy-relevant processes take place at surfaces and interfaces (friction, charge transfer and storage, light-energy conversion, etc.). Some major challenges that need to be overcome to use nanotechnology in energy-relevant technologies are the production of sufficient amounts of material, a thorough understanding of the basic properties, and the integration into technologically relevant structures.

In this talk, these topics will be addressed in the context of a few examples, which show the potential of nanomaterials in energy technologies. In particular, the use of nanoparticles from the gasphase will be discussed. Select topics will include Thermoelectrics, Photovoltaics, Solid-State Lighting, and Battery Technologies.

Development of Large Stroke Microelectrostatic Actuators and Piezo Nanofibers Based Energy Harvesters with Applications

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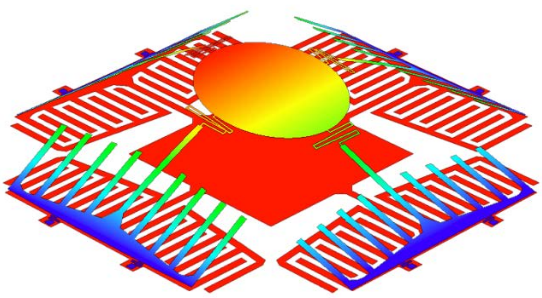
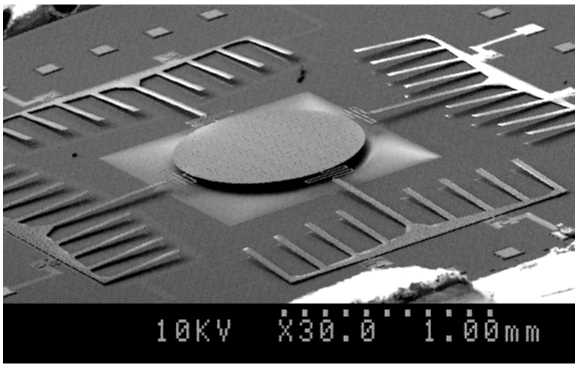
Abstract: Out-of-plane micro actuators can be used in many applications such as adaptive optics, spatial light modulation, micro endoscopic confocal imaging, positioning micro lenses for auto focusing/zooming, micromanipulators or micro stages and vector display. Most of these applications require a large out-of-plane displacement ranging from few micrometers to hundreds of micrometers. Micro electrostatic actuators offer low power consumption, fast response, high accuracy and high compatibility with IC fabrication technologies. They are the preferred choice for most industrial applications. However, it is very challenging to achieve a large out-of-plane motion using electrostatic actuators. The talk will present a novel micro electrostatic actuator platform that provides bi-directional out-of-plane motion through a special arrangement of electrodes. The actuator uses only 2 active layers, can be manufactured using standard surface microfabrication processes and can provide a stroke that is orders of magnitude higher than standard electrostatic actuators. Different implementations of the actuator are shown and their use for developing a number of applications including 3D micromirrors for vector display and automotive head up display, laser pointers with enhanced graphics capability, and tunable capacitors for wireless applications. A brief overview of other research activities including digital microfluidic chips developed for the automation of biomedical assays and energy harvesters for creating self-powered wireless sensors using piezo nanofibers manufactured using electrospinning will also be discussed and their characteristics and challenges presented.

Keywords: MEMS actuators, microfabrication, display technologies, piezoelectric energy harvesting, digital microfluidics.



(a)



(b)

Figure 1: 3D micromirror driven by four repulsive-force actuators ((a) model and (b) prototype)

References

S. He, R. Ben Mrad and J.S. Chang, "Development of a High-Performance Micro Electrostatic Repulsive-Force Rotation Actuator," IEEE/ASME JMEMS, 19, 2010, 561-569.

J. Chong, S. He and R. Ben Mrad, Development of a Vector Display System Based on a Surface-Micromachined Micromirror, IEEE Trans. Industrial Electronics, Vol. 59 , 12 , 4863-4870, 2012..

S He, R Ben Mrad and J Chong, Repulsive-force out-of-plane large stroke translation micro electrostatic actuator, J. Micromech. Microeng. **21** (2011).

M.J. Schertzer, MJ Ahamed, P. Lea, R. Ben Mrad, and P.E. Sullivan "Characterizing the surface quality and droplet interface shape for micro-array plates," Langmuir, **2012**, *28* (26), 9961–9966.

MJ Ahamed, R Ben Mrad, and PE Sullivan "A Drop-on-Demand based Electrostatically Actuated Microdispenser," IEEE/ASME Journal of Microelectromechanical Systems, Vol. 22 , 1, 177-185, 2013.

M.J. Schertzer, R. Ben Mrad, and P.E. Sullivan "Automated detection of particle concentration and chemical reactions in EWOD devices" Sensors and Actuators B: Chemical, 164(1) 1–6, 2012.

M.J. Schertzer, R. Ben-Mrad, and P.E. Sullivan, "Mechanical Filtration of Particles in Electrowetting on Dielectric Devices" IEEE/ASME Microelectromechanical Systems, 20(4), 1010-15. 8/2011

Luminescent solar concentrators based on molecular cocrystals as novel fluorescent materials

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Abstract: Thin-film luminescent solar concentrators (LSCs) have been proposed as a promising technology to reduce manufacturing and installation costs of photovoltaic (PV) systems and to simultaneously achieve a more efficient light management in PV devices (Debije *et al.*, 2012). In order to achieve optimal optical efficiency of devices, different promising luminescent species have been synthesized and incorporated in high performance LSC devices, such as organic dyes, quantum dots and inorganic phosphors/rare earth ions. However, a fundamental issue common to all these systems is the need of achieving high levels of solubility of the luminescent species in the host matrix material during processing in order to obtain high device efficiencies. In fact, poor dye solubility may lead to the formation of dimers and aggregates that may cause drop of fluorescence quantum yield and device performance (Griffini *et al.*, 2013). For this reason, appropriate choice of luminophore/host matrix combination is very important for optimal LSC device operations. In this work, we report the preparation of fluorescent films based on PMMA doped with Ac/Tc host/guest cocrystals and their use in LSC devices (Fig. 1). The fluorescent polymeric films were obtained by spin coating a solution of PMMA containing Ac and Tc onto glass substrate. Different process parameters were analyzed and their effect on the photophysical properties of the films and on device performance were investigates. An absolute device efficiency as high as 2.50% was found for our best LSC devices, with an optical efficiency of 23.72% and a concentration factor C of 0.83%. These results open up new strategies for the preparation of efficient fluorophores for LSC applications. In addition, due to the higher photostability of molecular crystals compared to common organic dyes, LSC device lifetime is also expected to benefit from their use.

Keywords: luminescent solar concentrators, photovoltaics, molecular cocrystals, anthracene, thin films, light management, energy.

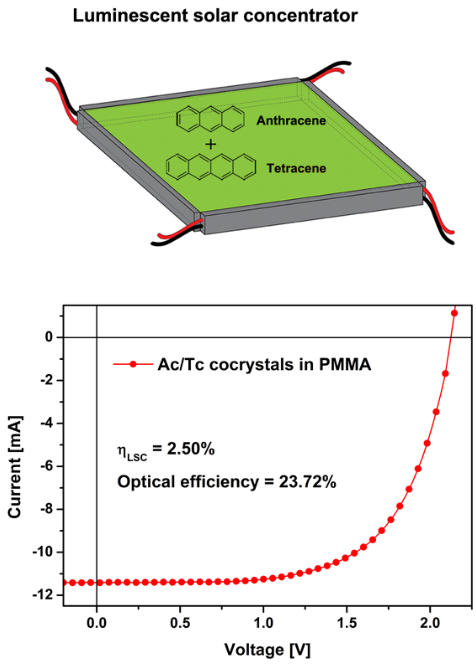

Figure 1: Schematization of a thin-film luminescent solar concentrator with the molecular structure of the materials employed in this work (top) and I-V curve of best performing LSC device prepared in this work (bottom).

References:

Debije, M.G., Verbunt, P.P.C. (2012) Thirty years of luminescent solar concentrator research: solar energy for the built environment, *Adv. Energy Mater.*, 2 , 12–35.

Griffini, G., Levi, M., Turri, S. (2013) Novel crosslinked host matrices based on fluorinated polymers for long-term durability in efficient thin-film luminescent solar concentrators, *Sol. Energy Mater. Sol. Cells*, 118, 36-42.

Griffini, G., Brambilla, L., Levi, M., Castiglioni, C., Del Zoppo, M., Turri, S. (2014) Anthracene/tetracene cocrystals as novel fluorophores in thin-film luminescent solar concentrators, *RSC Adv.*, 4, 9893-9897.

Hybrid energy storage.
Merging the Chemistries of Batteries and Supercapacitors

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Abstract:

Global warming didn't do the trick. But the end of cheap oil has suddenly moved long overdue projects such as the development of viable electric vehicles from the drawers of scientists and engineers onto the desktops of CEOs and Ministers.
And it is clear that in the EV race batteries are the limiting step. But, despite the two centuries since Volta's inventive discovery, battery technologies are still lagging behind the harsh performances demanded by industry.
A combination of high specific energy for extending driving ranges and higher specific power for acceleration is very hard to get for electro-ionic devices like batteries.
That is why there is still room for new and novel types of materials in this trade.
Hybrid materials offer opportunities for synergic behavior and improved properties with respect to their individual components.[1] Among many possible combinations, those formed by electroactive and conducting elements are of particular interest for energy storage applications.[2] As a matter of fact, hybrid nanocomposite electrodes integrating electroactive oxides (or phosphates) and conducting carbons have long been prepared and studied for rechargeable lithium batteries.[3]
In our group we have developed a whole line of work dealing with the prospective research of hybrid combinations of electroactive and conductive materials for energy storage applications. Among electroactive components we have used a wide variety of inorganic species, from oxides (or phosphate) [4] to polioxometalate (POM) clusters,[5] but also conducting organic polymers (COPs) or carbon materials (See Figure), the later two also providing suitable conducting properties.
As a matter of fact we have prepared hybrids along the three sides of the triangle shown, [4-7] as will be discussed in this presentation.

Keywords:
Energy Storage, Lithium Ion Batteries, Supercapacitors, hybrid materials.

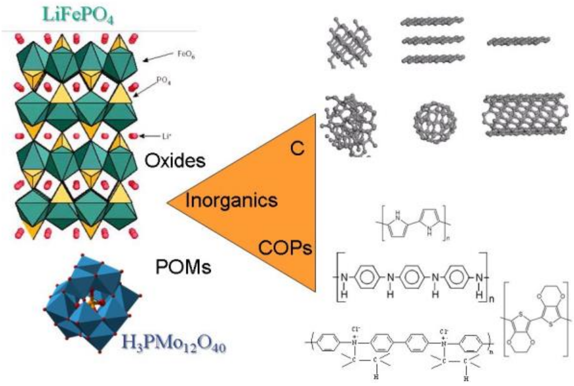

Figure 1: SEM image of as-prepared $LiFePO_4$ microspheres.

But in addition to hybrid materials and hybrid electrodes another line of action deals with the possible design and implementation of hybrid devices between batteries and supercapacitors. This is an even more challenging line of work which could begin with but eventually go beyond the combination of capacitive – faradaic electrodes in an attempt to develop the intensely sought-for combination of high power and energy densities.

[1] P. Gomez-Romero Adv.Mater. 2001, 13(3), 163-174.
[2] P. Gomez-Romero, O. Ayyad, J. Suarez-Guevara and D. Muñoz-Rojas J. Solid State Electrochem. 2010 14(11), 1939-45
[3] Ait Salah, A.; Mauger, A.; Zaghib, K.; Goodenough, J. B.; Ravet, N.; Gauthier, M.; Gendron, F.; Julien, C. M.
J. Electrochem. Soc. 2006, 153(9), A1692-A1701.
[4] A. Fedorkova, A. Nacher-Alejos, P. Gomez-Romero, R. Orinakova, D. Kaniansky. Electrochimica Acta. 2010, 55(3), 943-947
[5] J. Vaillant, M. Lira-Cantu, K. Cuentas-Gallegos, N. Casañ-Pastor and P. Gómez-Romero Progress in Solid State Chemistry, 2006, 34, 147-159.
[6] M. Baibarac and P. Gómez-Romero
Journal of Nanoscience and Nanotechnology, 6(2) 2006, 289-302.
[7] M. Baibarac, M. Lira-Cantú, J. Oró Solé, N. Casañ-Pastor and P. Gomez-Romero Small 2006, 2(8-9), 1075-1082.

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