## Day 1
### 16 October 2017

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<tr>
<td>09:00-09:30</td>
<td>Registrations</td>
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<td>09:30-09:40</td>
<td>Opening Ceremony and Introduction</td>
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<td><strong>Keynote Forum</strong></td>
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<tr>
<td>09:40-10:10</td>
<td>Sang Yeol Lee, Cheongju University, Republic of Korea</td>
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<td>10:10-10:40</td>
<td>Olga E. Glukhova, Saratov State University, Russian Federation</td>
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<td><strong>Coffee Break: 10:40-11:00</strong></td>
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<td>11:00-11:30</td>
<td>Alexander M. Korsunsky, University of Oxford, UK</td>
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<tr>
<td>11:30-12:00</td>
<td>Alessandro Di Cerbo, University of Modena and Reggio Emilia, Italy</td>
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**Advanced Nanomaterials & Nanomaterials Fabrication, Characterization and Tools and Nanoscale Electronics**  
**Session Chair: Alessandro Di Cerbo, University of Modena and Reggio Emilia, Italy**

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<th>Time</th>
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<tr>
<td>12:00-12:20</td>
<td>Cooperative magneto-optic interactions for encrypting information in hierarchical nanostructures</td>
<td>Carlos Torres-Torres, Instituto Politecnico Nacional, Mexico</td>
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<tr>
<td>12:20-12:40</td>
<td>Synthesis of Reduced Graphene Oxides and Its Applications for Fog Harvesting and Oil Spill Cleanup</td>
<td>Nyan-hwa Tai, National Tsing-Hua University, Taiwan</td>
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<tr>
<td>12:40-13:00</td>
<td>How disperse filler particles affect the physics and mechanics of polymer composites</td>
<td>Konstantin Zershchikov, Constanita-2 LLC, Russia</td>
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<td><strong>Lunch: 13:00-14:00</strong></td>
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<tr>
<td>14:00-14:20</td>
<td>Wearable electronic devices using graphene and its hybrid nanostructures</td>
<td>Jang-Ung Park, Ulsan National Institute of Science and Technology, Republic of Korea</td>
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<td>14:20-14:40</td>
<td>Mechanical properties and characterization of CNT and graphene reinforced ceramics composites</td>
<td>Byung-Koog Jang, National Institute for Materials Science, Japan</td>
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<tr>
<td>14:40-15:00</td>
<td>Organic-Inorganic Hybrid Biomaterials. Bottom-up Approach</td>
<td>Ahmad Mehdi, Université Montpellier, France</td>
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<td>Time</td>
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<td>15:00-15:20</td>
<td>Title: PVC and PES waste/nanoclay mixtures - mechanical properties and stability</td>
<td>Dagmar Merinska</td>
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<tr>
<td>15:20-15:40</td>
<td>Title: Preparation and Evaluation of Basic Properties of PVC/PVB/clay Nanocomposites</td>
<td>Alice Tesarikova</td>
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<td>Coffee Break: 15:40-16:00</td>
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<tr>
<td>16:00-16:20</td>
<td>Title: Thermal stability through doping: zirconia nanoparticles for applications in hightemperature photonics</td>
<td>Gregor T. Dahl</td>
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<tr>
<td>16:20-16:40</td>
<td>Title: Synthesis and Optical Properties of Monodisperse ZrO2@SiO2 Core-Shell Particles for Application as Structural Colors</td>
<td>Maik Finsel</td>
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<td>16:40-17:00</td>
<td>Title: Self-assembled iron oxide/oleic acid -based nanocomposite with exceptional isotropic mechanical properties</td>
<td>Artur Feld</td>
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<td>17:00-17:20</td>
<td>Title: Simulations of Nylon 6/Starch Nanocomposites to analyze the Mechanical behavior</td>
<td>Sanjay Krishna</td>
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<tr>
<td>17:20-17:40</td>
<td>Title: Effect of doping on particle size of CuO</td>
<td>Ashwani Sharma</td>
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Day 2
17 October 2017

Keynote

08:50-09:20 | Adnane Abdelghani, National Institute of Applied Science and Technology, Tunisia

Nanotech for Energy and Environment, Nanotech in Life Sciences and Medicine & Nanotechnology safety & Nano Applications

Session Chair: Subhash Shah, The University of Oklahoma, USA

Session Introduction

09:20-09:40 | Title: Title: CASI-F applied to critical issue analysis and assessment of Li-ion battery technology solutions | Rafael Popper and Mika Naumanen, VTT Technical Research Centre of Finland Ltd, Business, Finland |

09:40-10:00 | Title: Nanotechnology: Innovative Applications in the Oil & Gas Industry | Subhash Shah, The University of Oklahoma, USA |

10:00-10:20 | Title: An applicable molecular CO2 reduction catalyst to nanomaterials for artificial photosynthesis | Hitoshi ISHIDA, Kitasato University, Japan |
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<tr>
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<tr>
<td>10:20-10:40</td>
<td><strong>Title: Materials Development for Efficient Direct Borohydride Fuel Cells</strong>&lt;br&gt;Yogeshwar Sahai, The Ohio State University, USA</td>
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<td>10:40-11:00</td>
<td><strong>Title: Alignment of nerve cells by protein microcrysta</strong>&lt;br&gt;Hajime Mori, Kyoto Institute of Technology, Japan</td>
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<td><strong>Coffee Break: 11:00-11:20</strong></td>
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<td>11:20-11:40</td>
<td><strong>Title: Redox proteomics in sentinel organisms as a readout for nanoparticle toxicity</strong>&lt;br&gt;David Sheehan, University College Cork, Ireland</td>
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<tr>
<td>11:40-12:00</td>
<td><strong>Title: Advances in Nanoscale Materials, Processing, and Properties</strong>&lt;br&gt;David E. Luzzi, Northeastern University, USA</td>
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<tr>
<td>12:00-12:20</td>
<td><strong>Title: Toxic Potential of Benzo[a]pyrene and 9-Nitroanthracene Surface Modified Carbon Black Nanoparticles on None- and Pre-damaged Mice Lungs in Long-term Exposure</strong>&lt;br&gt;Bernd Mueller, Philipps University, Germany</td>
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<td>12:20-12:40</td>
<td><strong>Title: Biocompatible multifunctional magnetic nanoparticles for possible applications in nanomedicine</strong>&lt;br&gt;Silvia Villa, Università di Genova, Italy</td>
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<td>12:40-13:00</td>
<td><strong>Title: Laser-Induced Reversion of Precipitates in an Al-Li Alloy by Pulsed Laser Atom Probe Tomography</strong>&lt;br&gt;Muna Khushaim, King Abdullah University of Science and Technology, Saudi Arabia</td>
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<td>13:00-13:20</td>
<td><strong>Title: Design of cobalt (II)-cerium (III) metal coordination polymer as heterogeneous catalyst precursor for Fischer-Tropsch synthesis</strong>&lt;br&gt;Haiquan Su, Inner Mongolia University, China</td>
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<td><strong>Lunch: 13:20-14:20</strong></td>
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<td>14:20-14:40</td>
<td><strong>Title: Design of photocatalyst based on the niobium and tantalum nano-materials and its application in remediating water environment contaminatees</strong>&lt;br&gt;Xiaojing Wang, Inner Mongolia University, China</td>
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<td>14:40-15:00</td>
<td><strong>Title: Amaltas Silver Nanoparticles and their enhanced action against some bacterial strains</strong>&lt;br&gt;Samin Mushtaq, Lahore College for Women University, Pakistan</td>
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<td><strong>Posters Presentation: 15:00-16:00</strong></td>
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<td><strong>Title: Template synthesis and study of intermetallic (Co-Sn, Ni-Sn, Co-Ni) nanoparticles and their carbon-containing nanocomposites</strong>&lt;br&gt;Ivania Nikolova Markova, University of Chemical Technology and Metallurgy, Bulgaria</td>
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<td>2</td>
<td><strong>Title: Polyethyleneimine and Chitosan-based precursor liquid crystalline system with in situ gelling for buccal drug delivery systems</strong>&lt;br&gt;Marlus Chorilli, Universidade Estadual Paulista, Brazil</td>
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| 3 | Title: The interplay between breast cancer cells and hyperglycemia  
   Sae-Wan Kim, Kyungpook National University, South Korea |
|---|---|
| 4 | Title: Comparative study of three different graphene oxide synthesis methods  
   Prajakta A. Barve, Savitribai Phule Pune University, India |
| 5 | Title: Potential Nano-biotechnology approaches for early diagnosis of lung cancer  
   Shital Vishnu Sable, Savitribai Phule Pune University, India |
| 6 | Title: Simple Transformation of Hierarchical Hollow Structure by Reduction of Metal-Organic Frameworks and Their Catalytic Activity in Oxidation of Benzyl Alcohol  
   Kang Hyun Park, Pusan National University, Republic of Korea |
| 7 | Title: Synthesis and characterization of magneto responsive nanocomposites of monodisperse superparamagnetic iron oxide nanoparticles homogenously dispersed in a poly(ethylene oxide) melt.  
   Agnes Weimer, University of Hamburg, Germany |
| 8 | Title: Evaluation of Cu-coated graphite compacts prepared by pulsed current activated sintering process  
   Jun-Ho Jang, Korea Institute of Industrial Technology, Korea |
| 9 | Title: Preparation of cation and anion exchange membranes for reverse electrodialysis by radiation-induced grafting method  
   Sawada Shinichi, National Institutes for Quantum and Radiological Science and Technology |
| 10 | Title: Insecticidal properties of nanoencapsulated essential oil extracted from Artemisia sieberi on Xanthogaleruca luteola  
   Maryam Vahabi, Tarbiat Modares University, Iran |
| 11 | Title: Advanced synthesis of barley nanoparticles during its invitro growth  
   Syeda Shehwar Zahra, Lahore College for Women University, Pakistan |

**Day 3**

**18 October 2017**

- Discussions and Networking over Lunch
- Lunch: 13:00-15:00
- Closing Ceremony

Please join us at 6th World Congress and Expo on Nanotechnology and Material Science during April 16-18, 2018, Valencia, Spain
About us:

At Scientific future, we organize and facilitate professional and scientific conferences. Scientific future is one of the innovative organizers of conferences, workshops and exhibitions. Our conferences offer premier content, tremendous delegate experience and extraordinary networking opportunities. Each meeting is organized by leaders in the field, using their expertise to ensure the key topics are covered. The focus on discussion throughout the meeting offers each attendee, at any stage of their scientific career, to get involved in the discussion. Scientific future is provider of information, solutions to enhance the performance and progress of science, nutrition, health, and technology professionals, and is empowering them to make better decisions, deliver better care, and sometimes make groundbreaking discoveries, that advance the boundaries of knowledge and human progress.

Who we are

We spread the science among researchers

“Science and engineering are vital for economic growth, and we need to do everything we can, to inspire the next generation and show them the vast range of careers available to them.”

Science Minister David Willetts.

As scientific meetings are at the heart of a scientist’s professional life since they provide a beyond price opportunity for schooling, chum around for the networking, and seeking innovative ideas. In addition, meetings should be enjoyable experiences that add exciting breaks to the usual routine in the laboratory.

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Upcoming Conferences
### Scientific Future Group Upcoming conferences

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Keynote Forum
Day 1
Nano-layered structure of transparent conducting amorphous oxides for low emissive smart window and green building energy efficiency

Nano-layered structures for low emissive smart window application have been fabricated by using controlled multilayer system of amorphous transparent semiconductor and metallic Ag. Thickness of multilayered film in nano scale has been systematically changed for high transmittance in visible range and low emissivity in infrared range for energy saved low emissivity applications. The simulation and experimental results of the transmittance with different Ag thicknesses have been compared to explore the possibility of the improved optical property with thinner Ag layer structure and the transparent conducting oxides applications for transparent electrodes. It has been found that the formation of thin Ag nano-layer has been transited from island formation to a continuous layered structure occurred at above certain critical thickness. Continuity of the Ag nano-layer is very important for the optical properties to obtain low emissivity. The thickness of Ag layer can be decreased mainly due to amorphous oxide layer having smooth surface roughness and low surface energy. This could provide the possibility of low emissivity window applications with low cost for green building energy efficiency.

Biography:
Dr. Sang Yeol Lee has been a full professor at the department of semiconductor engineering in Cheongju University from 2011. He finished his Ph.D at the department of electrical and computer engineering in State University of New York at Buffalo, NY, USA in the year of 2002. He worked as a senior researcher at Electronics and Telecommunications Research Institute (ETRI) in Korea until 1995 and full professor in Yonsei University until 2007. He also worked as a principle research scientist in KIST(Korea Institute of Science and Technology) until 2011. He worked Los Alamos National Lab in USA as a visiting scholar from 2002 to 2003 in Electronic Device Team. His major research interests are oxides nano-structures for low emissivity, oxide electronics including oxide thin film transistors for next generation display applications and logic circuits for IC applications, oxide nano-bio sensors, touch screen panels with TCOs, nanoelectronics and memory devices. He has been served as organizers, chairs, key-note speakers and many invited speakers in international conferences including MRS-spring 2014 at San Francisco(USA) and AVS 2015 at San Jose(USA) and published more than 200 papers in notable journals.
Olga E. Glukhova  
Saratov State University, Russia

Novel hybrid carbon materials and their applications in the development of nanoelectronics and nanophotonics

At the present, one of the most perspective directions in materials science is the development of 2D semiconductor materials promising as the element base of multifunctional electronic devices. 2D-materials based on graphene obtained advantages over possible analogues due to features of their structure, namely the atomic thickness and hexagonal lattice. Also, 2D-graphene materials look attractive from an optical point of view. In particular, some graphene-based devices of photonics and optoelectronics have already proposed. Among these devices there are transparent electrodes in displays, solar cells, photodetectors, optical modulators. These devices work in a very wide range of wavelengths - from the ultraviolet, visible and near infrared regions of the spectrum to the middle and far infrared regions, as well as the terahertz range. Other perspective materials for optoelectronics and nanophotonics are the carbon nanotubes. Earlier, the models of carbon nanotube-based photovoltaic and light-emitting diodes were presented. Currently, the actual problem is the development of element base for optical devices and photonics new generation of working in a broad frequency range.

Using modern methods of predictive modeling and technologies for synthesis of hybrid carbon nanostructures we have developed the models of new nanodevices. In particular, we have created the prototypes of nanodevices for detection of THz radiation on the basis of carbon nanotubes with encapsulated fullerenes. A new type of polarizer based on 2D-hybrid graphene/carbon nanotubes composite is developed. New electronic and optical properties of 2D- and 3D-carbon composite materials are demonstrated.

Biography:

O.E. Glukhova, Doctor of science in physics and mathematics, now is a head of Department of Radiotechnique and electrodynamics at Saratov State University and leads the Division of Mathematical modeling in Educational and scientific institution of nanostructures and biosystems at Saratov State University. She received her DSc degree in solid state electronics and nanoelectronics from Saratov State University in 2009. Her main fields of investigation are: nanoelectronics, molecular modeling of biomaterials and nanostructures, molecular electronics, mechanics of nanostructures, quantum chemistry and molecular dynamics, carbon nanostructures (fullerenes, nanotubes, graphene, graphane). She has published about 170 peer-reviewed journal papers and four monographs.
FIB-DIC mechanical microscopy investigation of Nature’s strain engineering of the human dentine-enamel junction

Human dental tissues are hydrated biological mineral composites of hydroxyapatite crystallites within an organic matrix. Dentine and enamel have a hierarchical structure that delivers their versatile mechanical properties. A strong and durable bond between dentine and enamel is formed by the dentine enamel junction (DEJ), an important biological interface that resists failure under long-term harsh thermal and mechanical conditions in the mouth, and only succumbs to disease such as dental caries. Understanding the underlying reasons for this remarkable combination of strength and toughness remains an important challenge, both in the context of dentistry, and from the point of view of pursuing biomimetic advanced materials engineering.

One may hypothesise that residual strain develops in the vicinity of the DEJ during odontogenesis (tooth formation). The experimental and interpretational challenges that could not be overcome until recently presented an obstacle to the evaluation of residual stress in the vicinity of the DEJ at the appropriate spatial resolution. We used the recently developed FIB-DIC micro-ring-core method to determine the residual elastic strain at micron resolution. The residual strain profiling across the transition from dentine to enamel are correlated with the study of internal architecture using X-ray scattering (SAXS/WAXS). We illustrate how this provides improved insight into the origins of the remarkable performance of the DEJ.

Biography:
Professor Alexander M. Korsunsky (AMK) is a world-leader in engineering microscopy of materials systems and structures for optimisation of design, durability and performance. He leads MBElem lab at the University of Oxford, and the Centre for In situ Processing Science (CIPS) at Research Complex at Harwell. He consults Rolls-Royce plc on matters of residual stress and structural integrity, and is Editor-in-Chief of Materials & Design, a major Elsevier journal (2016 impact factor 3.997). Tan Sui and AMK lead a major EPSRC research project on nanoscale analysis and modelling of human dental caries.
Mechanical phenotyping characterization of K562 cells challenged with oxytetracycline

Antibiotics have generally the purpose of ensuring wellness. A human clinical study revealed huge amounts of oxytetracycline (OTC) and doxycycline in 15 gym-trained subjects, heavy meat consumers, which were affected by several food intolerances and had never used antibiotics in their life [1]. Subsequent in vitro studies suggested a toxic role for OTC, which resulted in a marked pro-inflammatory effect, e.g. IFN-γ release, both in canine and human peripheral blood lymphocytes as well as a pro-apoptotic effect on K562 cells [2, 3]. Now we investigated the behavior of K562 cells challenged with OTC for different incubation times by using the Micropipette Aspiration Technique.

We observed that, in the first stage of apoptotic process, OTC significantly increases the cortical tension and the formation of blebs in K562 cells giving rise to specific behaviors while these are aspirated inside a micropipette. In this context, alterations of mechanical properties of living cells might be considered as reliable markers of the presence of a pathological state.

Moreover, this potential toxicity of OTC, widely present in meat meals (for animals pet food) and intensive farming-derived meat (for human food), appears of great relevance suggesting a possible implication for the onset of new health risks, depending on the site of entry of OTC in the food supply chain.

Biography:

In 2007 he achieved the Master Degree in Medical Biotechnologies at University of Modena (Italy), in 2011 obtained the title of PhD in nanoscience and nanotechnology at the same University and in 2016 he got the post graduate diploma in Clinical Biochemistry at University “G. d’Annunzio” of Chieti (Italy). As a postdoc he conducted highly interdisciplinary researches, ranging from nanotechnology to nanomedicine, microbiology, nutrition and translational medicine focusing on the mutual biological interactions between nutraceuticals, drugs and living systems. He is author or co-author of more than 40 articles in peer-reviewed international journals.
5th International Conference on
Nanotechnology and Materials Science
October 16-18, 2017, Dubai, UAE

Scientific Sessions
Day 1
Cooperative magneto-optic interactions for encrypting information in hierarchical nanostructures

Carlos Torres-Torres
Instituto Politécnico Nacional, México

The third-order nonlinear optical properties exhibited by anisotropic nanostructured materials are strongly sensitive to morphology and polarization of light. In this direction, the vectorial behavior of optical beams can be a powerful tool for exploring particular characteristics in nanomaterials. Instrumentation of all-optical signals in ultrafast nanosystems can be carried out by recording the nonlinear optical transmittance controlled by multi-wave mixing experiments. However, here is described, how the surrounding media where the nanoparticles are immersed can be able to modulate important parameters with influence on the optical transmittance of nanophotonic signals. Significant magnetic contributions that may be responsible for a modification in the resonance or in the scattering of light can be promoted by hybrid and hierarchical nanoparticles. In this research are discussed the implications of collective nonlinear magneto-optic effects in low-dimensional materials. Quantum and cryptology applications based on superposition and multiplexing signals can be contemplated.

Biography:
Carlos Torres-Torres has a PhD in Optics obtained in the Center for Scientific Research and Higher Education at Ensenada, Mexico. His main researches are about Nonlinear optics exhibited by nanostructures. He has been awarded by the Materials Research Society in United States of America during 2013 regarding his studies about low-dimensional materials. He has been awarded as the best reviewer in 2015 by the Journal of Optics and Laser Technology Elsevier; and also he has been awarded as an outstanding reviewer of the Journal of Physics: Applied Physics by the Institute of Physics of United Kingdom.
Synthesis of Reduced Graphene Oxides and Its Applications for Fog Harvesting and Oil Spill Cleanup

Nyan-Hwa Tai*, Duc Dung Nguyen and Hung-Tao Chou
National Tsing-Hua University, Taiwan

This work demonstrates an efficient method to fabricate flexible carbon-fiber cloths (FCFC) for fog harvesting and graphene based-sponges (GS) for absorbing spilled oil. The FCFCs have both superhydrophobic and hydrophilic properties in the same face, which can be used effectively for water collection from fog. In addition, the GS with the superhydrophobic and oil-hydrophilic properties can be adopted to clean up oil spillages. In the processing of FCFCs, polydopamin (PD), titanium oxide and poly (N-isopropylacrylamide) were used and the process of the mussel adhesion protein-inspired surface chemistry was applied. The presence of carboxyl-, amino-, imino-, and phenyl- groups of the PD coating layer turns the surface into hydrophilic regardless of its original property and promote the adhesion of the substances. The FCFC exhibited excellent performance in water collection with an efficiency over 200 mg cm\(^{-2}\)h\(^{-1}\). In addition, a simple dipping process was adopted for fabricating superhydrophobic and superoleophilic GS using commercial sponge as the backbone; the synthesized GS possessed very outstanding performance for absorbing spill oil with excellent absorption capacities over 160 times their own weight.

Biography:
Nyan-Hwa Tai, a Distinguished Professor of Tsing-Hua University, received his Ph.D. degree from Mechanical Engineering, University of Delaware, USA in 1990. He works for National Tsing-Hua University science 1990; his study involves processing and characterizations of nanocomposites and he focused on the syntheses and applications of graphene and graphene oxides more recently. He published over 220 scientific journal papers with over 4000 citations and a H-index of 31.
How disperse filler particles affect the physics and mechanics of polymer composites

K. Yu. Zershchikov
Constanța-2 LLC, Volgograd, Russia

A method has been developed to calculate the filler interparticle spacing and the matrix to filler contact area taking into account the filler’s properties, namely the size and shape of particles and the volume fraction in the matrix. Assuming that the properties of polymer composites containing hard inelastic filler particles depend on the polymer’s behaviour in the interparticle spaces, the effect of the filler’s properties on some physical and mechanical composite parameters has been studied. The studies examined how the filler’s shape, size and quantity affect the strength, elongation at break, shrinkage and linear expansion coefficient. Experimental testing of the assumptions has shown good repeatability of the calculation results.

Biography:
Born 2 December, 1961 in Volgograd, Russia. In 1984, graduated from Volgograd Technical University as a mechanical engineer, started his carrier at a structural steel plant as a manager and was promoted to production supervisor. In 1989, started teaching at Volgograd Technical University, in 1993 defended the Candidate of Technical Sciences thesis titled ‘Residual stresses in metal-polymer composites’. Since 1993, heads the company Constanța-2 LLC that develops novel composites and fabricates polymer and composite seals.
Wearable electronic devices using graphene and its hybrid nanostructures

Jang-Ung Park
Ulsan National Institute of Science and Technology, Republic of Korea

Recently, wearable electronics detecting the physiological change for the diagnosis of disease have attracted extensive interests globally. Among them, contact lens is one of the most attractive candidate for the continuous and wireless health monitoring. To realize these personal see-through, devices all device components are required to be transparent and stretchable in order to be integrated into the multiplexed sensor system including wearable soft contact lenses. However, the transparent and stretchable sensors integrated on the biomaterials are not yet been realized. In this talk, we presented an unconventional approach to form transparent, flexible and sensitive multiplexed sensors for diagnosing diabetes and glaucoma based on hybrid nanostructures using one-dimensional metal nanowires and two-dimensional graphene. Additionally, the entirely integrated sensors on the contact lens are designed to be R (resistance) L (inductance) C (capacitance) structure operating via radio frequency for wireless and real-time sensing. In this respect, power sources, associated circuitry, and interconnect electrodes are not required in this system. We further present real-time in-vivo glucose monitoring in rabbit and ex-vivo intraocular pressure sensing in bovine eyeballs wirelessly for applications in wearable electronics. The advance of these electronics using hybrid structures provides a route towards future electronics.

Biography:
Jang-Ung Park achieved his Ph.D. from University of Illinois at Urbana-Champaign (UIUC) in 2009. After that, he went on to work as Postdoctoral Fellow at Harvard University. He is now an Associate Professor in School of Materials Science and Engineering at UNIST. His current research is focused on nanomaterials synthesis and wearable electronics.
Mechanical properties and characterization of CNT and graphene reinforced ceramics composites

Byung-Koog Jang\textsuperscript{1}, Young-Hwan Han\textsuperscript{2} and Sukyoung Kim\textsuperscript{3}

\textsuperscript{1}\textit{National Institute for Materials Science, Japan}
\textsuperscript{2}\textit{Wuhan University of Technology, China}
\textsuperscript{3}\textit{Yeungnam University, Republic of Korea}

CNT (Carbon Nanotube) have attracted great interest because of their unique structural, electronic, physical, and thermal properties, such as high electrical conductivity, thermal conductivity, and elastic modulus. It has been reported that CNT are 100 times stronger and 6 times lighter than steel. Therefore, CNT are added to metal, polymer, or ceramics to improve mechanical and thermal resistance or electrical conduction.

Among these, CNT addition into engineering ceramics is expected to offer good damage and wear resistance, exhibited by the lower friction and damage absorption characteristics of carbon material. The goal of the present study is to improve the damage and wear resistance of alumina ceramics by the addition of CNT, considering only the content of CNT in the composites. The load displacement curves were influenced by the CNT content in the composites. The hardness and toughness of Al\textsubscript{2}O\textsubscript{3}-CNT nanocomposites were also affected by CNT contents, which, in turn, influenced the wear characteristics of the composites.

In addition, carbon nanotube (CNT) have emerged as one of the ideal reinforcement agents due to their exceptional mechanical properties and superior thermal and electrical properties. In this work, the effect of carbon nanotube (CNT) reinforcement and the transformation toughening mechanism on the fracture toughness of 3mol\% yttria-stabilized zirconia (YSZ) has been investigated. Graphene nanoplatelets (GNPs)-reinforced hydroxyapatite composites were analyzed in two directions of the applied pressure (perpendicular and parallel). Platelet-shaped pores were observed in the cross-section normal to the applied pressure, whereas elongated or buttonhole type pores around the agglomerated GNPs were found in the parallel cross-section.

Biography:

Dr. Byung-Koog Jang is working at National Institute for Materials Science in Japan and is researching regarding on the development of CNTs reinforced nano composites (Al\textsubscript{2}O\textsubscript{3}/CNTs, ZrO\textsubscript{2}/CNTs, HAp/CNTs), thermal barrier coatings and porous ceramics. He has been mainly taking charge of processing, sintering by spark plasma sintering & reaction bonded sintering as well as mechanical evaluation of advanced nano ceramics & composites. He is also an expert about the evaluation of the thermal conductivity of bulk materials and coatings based on the laser flash method. He received Ph.D at the University of Tokyo, Japan, 1994.
Organically functionalized silica constitutes a very fascinating class of materials. Indeed, by changing the nature of the organic moiety, it is possible to obtain materials presenting a large diversity of properties.

Sol-gel process is a very convenient approach by his compatibility with all types of physical, chemical, biochemical and biological units. Thus, this process opens very wide possibilities of materials design for specific applications such as catalysis, separation environment, medical, optics etc. When biomolecules like peptides and proteins are used in hybrid silica, they are either non-covalently entrapped in the silica matrix, leading to unavoidable leaching, or grafted onto the silica matrix. In fact, grafting approaches present important limitations. First, the control of the reaction can be difficult and has to be performed at high concentration of the bimolecular and the conditions used are generally not compatible with handling of peptides. Second, grafting is strongly dependent on the type and the topography of the material itself, leading to non homogeneous modification.

Recently, we developed the synthesis of biosilica materials by direct functionalization approach. This method is easy and general enough to be applied to any type of peptides and any type of silica. Our approach relies on the synthesis and isolation of hybrid peptide building blocks bearing trialkoxysilyl function as a linker group at a suitable position within the peptide sequence.

By sol-gel process, these building blocks can be used in combination with additional silica or organosilica precursors to yield hybrid bioorganic-inorganic materials in one step.

Biography:
Ahmad Mehdi was born in Lebanon in 1967. He moved to France in 1986, where he received his BSc in applied chemistry from the University of Poitiers in 1990 and his PhD in 1994 in organometallic chemistry from the University of Montpellier under the supervision of Professor Robert Corriu. He becomes assistant professor in 1996 and full professor of chemistry in 2008 at Polytechnic School of the University of Montpellier and Institute of Charles Gerhardt Montpellier. He has co-authored more than 160 publications and patents. His current research interests concern the multifunctional hybrid materials for health, energy and green chemistry applications.
Mixtures of PVC and PES waste (shredded fibers) were prepared in order to create a way how the waste of PES raster coming from hydroisolation foils can be again used and not stored. After the grinding of waste from mentioned foils this waste is divided into three different fractions. The first one is PES shredded material with the rest of plasticized PVC, where the amount of PVC material is so high that it can be re-worked easily and it is possible to add it into the origin mixture for the production of above mentioned hydroisolation foils. The next second fractions obtain significantly less of PVC material and here PVC must be added and the optimal way for their mixing into the material with required properties must be found. In order to find the way of PES waste and nanofiller synergy, the montmorillonite in one concentration was added to prepared samples of PVC/PES waste. The influence of it on the mechanical properties and stability was studied.

There exist some studies about the recycling of PVC [1-3], but none about the combination of PVC and PES shredded material obtained in the form of waste. In our work all three fractions were added into two types of PVC and there were mixed on double roll equipment (to use the conditions and way as close to the practise as possible). Mechanical properties were measured on the prepared samples (bodies were cut from the rolled film) and the values of pure PVC mixture and mixtures with different filling of PES shredded material were observed. The same procedure was applied on the samples with nanofiller. One of results is shown in the Graph 1.

Graph 1. Mechanical properties of PVC and fraction 3 of PES waste(yellow) and with nanofiller (blue)

Next evaluated properties concerned of PVC mixture stability, heat and light. In Graph 2 it is possible to see difference in the size of the peak of degraded material before and after lightening.

Graph 2. Light degradation of used materials

Summary:

The PES waste it is possible to add into the PVC mixture, but the adding of nanofiller did bring significant improvement of properties.

This work was supported by project of TACR TH01030054.

Biography:

Měřínská Dagmar is Assoc. Prof.,PhD. At Tomas Bata University in Zlin, Czech Republic. Her Scientific Fields of Expertise and Interests include, (Nano) composite materials with polymer matrix, Polymer chemistry, Packaging materials, polymer plastics recycling.
Preparation and Evaluation of Basic Properties of PVC/PVB/clay Nanocomposites

A. Tesarikova\textsuperscript{a}, D. Merinska\textsuperscript{a}, M. Tupy\textsuperscript{b}
\textsuperscript{a}Tomas Bata University in Zlin, Czech Republic
\textsuperscript{b}Fatra a.s, Napajedla, Czech Republic

The main aim of this study was the comparison of mechanical properties, hardness and TEM of blends of plasticized poly(vinyl chloride) (PVC) with poly(vinyl butyral) (PVB) \cite{1, 2}. The possibility of the re-use of recycled PVB from waste of windshields was studied. Nanocomposites of PVC/PVB/clay (montmorillonite MMT), prepared by melting and mixing in a twin-screw extruder were evaluated.

PVC plasticized with 38 \% of diisononyl phthalate (DINP), and PVB plasticized with 28 \% of triethylene glycol, bis(2-ethylhexanoate) (3GO) and recycled PVB (rec. PVB) were tested \cite{3}. The filler as an organically modified MMT with tradenames Cloisite 93A and 30B were used. The concentration of all the above-mentioned fillers added to the polymeric matrix was 3, 5 and 7 wt. \%. Blends used for the determination of basic properties of PVB/PVC mixtures in various ratio were prepared in continual BUSS extruder with two kneading chambers. Process conditions were 160 °C of temperature and rotation speed 55 rpm \cite{4, 5}.

The high PVB molecular weight can provide very high tensile strength of material. Measurement showed that fillers do not deteriorate mechanical properties and hardness of filled PVC/recycled PVB blends. The same fact was also observed for fillers in virgin PVB. As was shown by TEM analyses - the nanofiller achieves a definite degree of intercalation.

The improvement of mechanical properties in scale from 60 – to 90 \% of PVB was probably caused by mentioned high molecular weight of PVB (Fig. 1).

![Fig. 1: Mechanical properties of PVC/PVB/clay nanocomposites](image)

Further, the comparison showed that the ideal filling is 3 wt. \% of fillers. This study seems to clarify a little more efficiency of PVC/PVB composites applications such as flooring, many uses in civil and automotive engineering.

Biography:

She studied Bachelor and Masters degree at Tomas Bata University in Zlin, Czech Republic and currently study PhD degree at the same University, Faculty of Technology, Department of Polymer Engineering.
Topic of her PhD study: Multifunctional Polymer and Specialty Films.
Work experience: She collaborated in a team of experts to address current problems of companies involved in the project called “Nanostructured packaging materials of exceptional utility properties and easier recycling” and “The use of nanomaterials and natural extracts as functional materials in the development of active packaging materials with barrier, anti-microbial, protective and oxygen absorbing effect” She is currently working on the project “Treatment options for PES lint and other technological waste”. Shi is author and co-author 5 publications of polymer nanocomposites films.
Thermal stability through doping: zirconia nanoparticles for applications in high temperature photonics

Gregor T. Dahl, Maik Finsel, Sebastian Döring, Horst Weller, Tobias Vossmeyer

University of Hamburg, Germany

Ceramic materials, such as zirconia, are widely used in various high temperature applications. Micro- and nanoparticles consisting of this material are promising building blocks for chemically and thermally stable photonic glasses with tailored optical properties for the employment in advanced thermal barrier coatings, thermophotovoltaics, and structural colorants. For such specific applications, the precise control over size and shape during the particle synthesis is essential. Additionally, pure zirconia undergoes fracture and mechanical destabilization at elevated temperatures due to phase transformations and grain growth. Consequently, our work focuses on the detailed understanding of the particle synthesis and the parameters affecting size, shape and morphology of the obtained particles. Specifically, we study the potential stabilization of zirconia by doping the material with selected trivalent metals. Here, we modified existing synthesis protocols for zirconia particles based on sol-gel chemistry and identified the influence of various parameters controlling particle size and morphology. In extended studies we developed procedures for the production of particles with adjustable diameters from below 100 nm up to several microns. By mixing zirconium and yttrium (also aluminum) precursors with different mixing ratios, particles with varying doping levels were obtained. Our most recent studies concentrate on the effect of the alumina concentration in zirconia microparticles on particle size and thermal stability at temperatures up to 1200 °C. We demonstrate that higher doping levels influence the particle growth conditions significantly towards smaller particle sizes. The as-synthesized particles were dried and calcinated in order to remove any organic residues from the synthesis. Multiple samples were heated to different temperatures between 600 °C and 1200 °C. The samples were characterized by ex situ TEM/EDX for qualitative comparison of the temperature stability and determination of the elemental composition as well as by ex situ XRD and Rietveld refinement for quantitative phase analysis and microstructural analysis. Our findings suggest that alumina doping of zirconia particles increases their structural integrity at temperatures above 800 °C, even with low dopant concentrations. The results of XRD phase analysis indicates an increasing stabilization of the metastable tetragonal phase against phase transition to the monoclinic polymorph. The inhibition of this microstructural change is likely to be responsible for the observed higher thermal stability.

Biography:

Gregor T. Dahl studied chemistry and biochemistry at the LMU in Munich, Germany, including a one semester visit at the Sorbonne University UPMC in Paris, France, and finished his bachelor degree with a thesis on novel materials for LED phosphors. He continued his studies at the University of Hamburg, Germany, where he completed his master degree with a thesis on gold nanoparticle composite membranes for applications in micro-electromechanics and sensors. Since October 2016, he is a PhD candidate and researcher at the Institute for Physical Chemistry in Hamburg, studying the thermal destabilization mechanisms in undoped and doped zirconia micro- and nanoparticles, particularly with regard to potential applications in high-temperature photonics.
Synthesis and Optical Properties of Monodisperse ZrO2@SiO2 Core-Shell Particles for Application as Structural Colors

Maik Finsel, Gregor Dahl, Horst Weller, Tobias Vossmeyer, Sebastian Döring, Gerold A. Schneider, Quynh Yen Nguyen, Guoliang Shang, Alexander Yu. Petrov, Manfred Eich

1University of Hamburg, Institute of Physical Chemistry, Germany
2Hamburg University of Technology, Institute of Advanced Ceramics, Germany
3Hamburg University of Technology, Institute of Optical and Electronic Materials, Germany
4Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research, Institute of Materials Research, Germany
5ITMO University, Russia

In recent years, zirconia (ZrO2) micro- and sub-microparticles gained considerable attention due to their outstanding properties, including chemical inertness, thermal stability and high refractive index. These excellent features of zirconia-based materials enable a broad variety of applications ranging from fuel cells, catalysis, sensors to electro- and bioceramics. Furthermore, zirconia microparticles have been proposed for applications as building blocks in photonic glasses for high-temperature applications, including thermal barrier coatings (TBC) and structural colors (SC).

For structural colors, well-defined monodisperse core-shell particles with smooth surface and strong refractive index contrast are needed. These requirements can be achieved by encapsulation of spherical zirconia particles with a suitable shell material. For example, to achieve the desired properties for structural colors Al2O3, SiO2, and polymers have been used to form the shell. Most preparative methods for such core-shell particles use organic ligands (e.g. polymer, citric acid) as adhesive layer between the core and the shell. One of the main obstacles of this approach is that it precludes high-temperature applications. Here, we developed a straightforward approach to prepare ZrO2@SiO2 core-shell composites without using additional organic coupling agents.

The most striking result is that the obtained core-shell particles with diameters in the 200-500 nm range withstand temperatures up to 1000 °C whereas size-comparable zirconia particles disintegrate when heated to 800 °C as shown by XRD, SEM and cross-sectional TEM characterization. Furthermore, core-shell composites synthesized using polyvinylpyrrolidone (PVP) as interfacial coupling agent also disintegrate when heated to 800 °C, most likely due to decomposition of PVP.

For applications as structural colors, a strong refractive index contrast between the core and shell materials is favorable, which is obtained by the ZrO2/SiO2 combination. We demonstrate that the position of the reflection edge in the visible wavelength range can be tuned by varying the silica shell thickness of the particles.

Biography:

Maik Finsel conducted his master thesis investigating the mechanical properties of nanoparticle composites (University of Hamburg, 2015) and spent one semester in Denmark (Southern University of Denmark, Odense, 2014) working on transition metal complexes. He gained expertise in the synthesis and characterization of doped and undoped zirconia microparticles working on his PhD project since 2015 at the University of Hamburg, Germany. He also works on the encapsulation of ceramic microparticles with silica and alumina to achieve dielectric core-shell particles for photonic high-temperature applications such as thermal barrier coatings and structural colors.
Self-assembled iron oxide/oleic acid-based nanocomposite with exceptional isotropic mechanical properties

Artur Feld\textsuperscript{1,2}, Axel Dreyer\textsuperscript{3}, Andreas Kornowski\textsuperscript{1}, Ezgi D. Yılmaz\textsuperscript{3}, Heshmat Noei\textsuperscript{4}, Andreas Meyer\textsuperscript{1}, Tobias Krekeler\textsuperscript{5}, Chengge Jiao\textsuperscript{6}, Andreas Stierle\textsuperscript{4,7}, Volker Abetz\textsuperscript{1,8}, Horst Weller\textsuperscript{1,2,3,10} and Gerold A. Schneider\textsuperscript{9}

\textsuperscript{1}Institute of Physical Chemistry, Hamburg University, Grindelallee 117, D-20146 Hamburg, Germany
\textsuperscript{2}The Hamburg Center for Ultrafast Imaging, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany
\textsuperscript{3}Institute of Advanced Ceramics, Hamburg University of Technology, Germany
\textsuperscript{4}DESY NanoLab, Deutsches Elektronensynchrotron DESY, Notkestrasse 85, D-22607 Hamburg, Germany
\textsuperscript{5}Electron Microscopy Unit, Hamburg University of Technology, Eißendorfer Str. 42, D-21073 Hamburg
\textsuperscript{6}FEI Company, Achteweg Noord 5, 5651 GG, Eindhoven, the Netherlands
\textsuperscript{7}Physics Department, Hamburg University, Jungiusstrasse 11, D-20355 Hamburg, Germany
\textsuperscript{8}Institute of Polymer Research, Helmholtz-Zentrum Geesthacht, Germany
\textsuperscript{9}Center for Applied Nanotechnology, Grindelallee 117, D-20146 Hamburg
\textsuperscript{10}Department of Chemistry, Faculty of Science, King Abdulaziz University, Saudi Arabia

Inspired by nature one of the most promising and challenging approaches is to synthesize nanocomposites, which consist of a combination of soft organic and hard ceramic materials.\textsuperscript{1–3} Iron oxide such as magnetite is very suitable for the synthesis of nanocomposite, because magnetite nanoparticles are extensively studied regarding their size and shape controlled synthesis and also nature makes use of iron oxide as an ultra-hard material in chiton radular teeth.\textsuperscript{4} Usually, it was only possible to achieve good mechanical strength with high aspect ratio layered structures of minerals. Approaches with the use of monodispersed nanoparticle supercrystals results in weak mechanical properties in these composites.

We present the successful manufacturing of a nanocomposite consisting of oleic acid coated spherical iron oxide nanoparticle with exceptional isotropic mechanical properties.\textsuperscript{5} We developed a concept to link iron oxide nanoparticles in a well-ordered superstructure by oleic acid molecules during a thermal process. The synthesis process is divided into four stages: sedimentation, drying, pressing and heat treatment. Whereby, the crosslinking of the oleic acid molecules by their double bond is initiated by thermal annealing up to temperatures of 350 °C.

The exceptional mechanical properties - bending modulus of 114GPa, hardness of up to 4GPa and strength of up to 630MPa - are dominated by the covalent backbone of the linked organic molecules. To our knowledge these are the highest combined values of elastic modulus, strength and nanohardness ever reported for a synthetic bioinspired organic/inorganic nanocomposite.

Biography:

Artur Feld is a postdoctoral fellow at the University of Hamburg in the workgroup of Prof. Dr. Horst Weller. Artur earned a bachelor of science, master of science and a doctorate in chemistry from the University of Hamburg with the main topics nanocomposites and nanohybrids. He works in the department of physical chemistry and “The Hamburg Centre for Ultrafast Imaging” and focuses on the size and shape controlled synthesis of iron oxide nanoparticles and especially on mechanisms of nucleation and growth of iron oxide nanoparticles in solution.
Simulations of Nylon 6/Starch Nanocomposites to analyze the Mechanical behavior

Sanjay Krishna
Sardar Vallabhai National Institute of Technology, India

Nylon-6 is a prominent polymer used in automobile and aerospace industries, known for its mechanical properties. Nylon-6 based nanocomposites are used for this very purpose. In this communication, Starch nanoparticles are used as reinforcements, as it was found to be used in enhancing the mechanical properties of composites and blends. Simulations of nylon-6 based nanocomposites were carried out with different weight proportions of starch nanofillers using Material Studio 5.5 from Accelrys. Cell models of the respective polymer matrix and nano-reinforcements were built, followed by Geometric Optimization to optimize the structure and stabilize the system and finally simulations of the nanocomposite system were carried out to calculate the mechanical properties such as Young's Modulus, Bulk Modulus, Shear Modulus and Poisson ratio. The properties were compared with nylon 6/nano-clay nanocomposites, which shows excellent mechanical behaviour and are used in the automotive sector. The main idea is to inculcate a natural, renewable, non-degradable and easily-available biopolymer that provides good mechanical properties to nanocomposites which are comparable with current advanced materials.

Biography:
Mr. Sanjay Krishna is a research scholar at the Chemical Engineering Department of Sardar Vallabhai National Institute of Technology, India. He is currently working on “Simulations of Nylon 6 based nanocomposites to study mechanical properties”. He completed his Integrated B.Tech+M.Tech from IIT Roorkee, one of the premier institutes of India, working on “Molecular Simulations of PVA based oil-repellent coatings”. He has carried out major projects which include – (1) “Genome modeling to study DNA looping” from Rice University Houston, USA, and (2) “Simulations of charge transfer through DNA” from KMUTT Bangkok, Thailand. His research interests include Modeling & Simulations, Polymer composites & blends and Biopolymers.
Nano materials have wide range of applications due to their interesting size-dependent chemical and physical properties compared to particles of size in the range of micrometer. Metal oxide nanoparticles are very useful in the field of sensing, optoelectronics, catalysis, and solar cells due to their unique physical and chemical properties differing from bulk. Copper oxide nanomaterials have attracted more attention due to its unique properties. Cu$_2$O (Cuprous oxide) and CuO (Cupric Oxide) are two important oxide compounds of copper. Cuprous oxide is p-type direct band gap semiconductor with band gap of 2 eV and Cupric oxide has a monoclinic structure and presents p-type semiconductor behavior with an indirect band gap of 1.21–1.51 eV. They have lower surface potential barrier than that of metals, which affects electron field emission properties. Strontium Oxide is a highly insoluble thermally stable source suitable for glass, optic, and ceramic applications. Strontium oxide is a strongly basic, colorless oxide that forms elemental strontium when heated with aluminum in a vacuum. Here an attempt is made to synthesis (Sr$_x$Cu$_{1-x}$O) nanoparticles by sol–gel method. Five samples were prepared by changing concentration of strontium and their XRD is studied comparatively. We see that as we increase the concentration of strontium, the size of nanoparticles increase which is obvious as radius of strontium atom are bigger than copper atom.
5th International Conference on
Nanotechnology and Materials Science
October 16-18, 2017, Dubai, UAE

Keynote Forum
Day 2
Nanosensors and New ideas of Start-Up

In this work, we present an approach for the use of nanosensors for analyte (pesticides, bacteria, heavy ions, C-Reactive Protein, neurotoxin gaz,vapors, etc..) detection for different applications (food analysis, water analysis, medical diagnostic, security, environment, etc..). Most of the analyze detection systems used are time consuming, enable remote sensing and need different steps of preparation. The development of new devices needs laboratory experiment for stability, rapidity and reproducibility studies. We will show the need of the market and the applications for such devices in biotechnology, medicine and security.

Biography:

Prof.Dr.A.Abdelghani is a Full Professor at the National Institute of Applied Science and Technology (INSAT, Tunisia) working mainly in the field of Microsensors and Microsystems. He obtained the Habilitation in Physics in Tunisia (faculty of Science of Tunis) in 2004 and a Habilitation (worldwide recognition for conducting and leading research) in "Sciences pour l’Ingénieur" in 2009 at the Ecole Normale Supérieure de Cachan (France). He is now the leader and principal investigator of a research group working mainly on gas sensors based on functionalized carbon nanotubes (metallic oxides, nanowires, nanoneedles, polymers) and on the development of interdigitated gold microelectrodes integrated in microfluidic cell for bacteria analysis in biologic medium. He published more than 90 papers in International Journals (H-index 24, December 2016) and supervised more than 12 Ph.D theses and 30 master's student. He is deeply involved in industrial applications in his field of research with implications for the design and the development of affordable and cost-effective sensing devices for diagnostics and theranostics which will have an effective impact in the developing countries. He received the Tunisian President Award of the "best scientific researcher" in Tunisia in 22 July 2015.
5th International Conference on
Nanotechnology and Materials Science
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Scientific Sessions
Day 2
CASI-F applied to critical issue analysis and assessment of Li-ion battery technology solutions

Rafael Popper\textsuperscript{1,2} and Mika Naumanen\textsuperscript{1}
\textsuperscript{1}VTT Technical Research Centre of Finland Ltd, Business, Innovation and Foresight, Vuorimiehentie3, FI-02044 Espoo, Finland
\textsuperscript{2}The University of Manchester, Manchester Institute of Innovation Research, Oxford Road, M13 9PL, Manchester, United Kingdom

We apply CASI-F (Common Framework for the Assessment and Management of Sustainable Innovation) to analyse critical issues that influence the uptake of nanotechnologies in battery technologies.

Due to climate change as well as the growing capacity of new storage media for electric power, electric mobility represents a future vision for individual mobility on an environmentally-friendly basis. The lithium-ion battery is considered the key technology for future (electric) engine systems. However, lithium-ion battery technology could be considered to be at the peak of technical enhancement. A number of researchers are trying to shift away from conventional Li-ion battery technology and implement nanotechnology to other energy storage devices in order to make them more cost competitive and influence superior performance as compared to Li-ion batteries. A careful analysis and evaluation of the advantages and disadvantages of these approaches is therefore indispensable.

Besides technological aspects, CASI-F includes wider market and ecosystem development considerations, i.e. economic, environmental, social, government and infrastructure systems. Since the product market is influenced by changing socio-technical system conditions at the niche, regime and landscape levels, we need to evaluate the development of broader issues, e.g. regulation and legislation, norms and standards as well as infrastructure and user acceptance. For example, one can expect that recyclability and sustainability will play an ever increasing role in electric mobility solutions. Aspects of all these areas play a huge role in market development.

Biography:

Rafael Popper (PhD) is Principal Scientist in Foresight, Organizational Dynamics and Systemic Change at VTT Technical Research Centre of Finland, and Research Fellow at the Manchester Institute of Innovation Research of the University of Manchester. He is Director of Executive Education in Foresight and Horizon Scanning at the Alliance Manchester Business School, and Innovation Director and CEO of Futures Diamond Ltd (UK and Czech Republic). He has also worked at United Nations Industrial Development Organisation (UNIDO) and as consultant for the European Commission, World Bank and other international, governmental and business organisations in Europe, Latin America, Africa, Asia and Australia.

Mika Naumanen (MSc Tech, MSc Econ) is a senior scientist in the Innovation and Knowledge Economy group of VTT. He has run VTT’s “business from technology” program and managed a portfolio of business development projects in the fields of Industrial Systems Management, Services and Built Environment, ICT and Electronics. These activities include monitoring and forecasting technology development paths as well as developing indicators and providing analysis of how these projects meet the national research and innovation policy objectives. Naumanen is a visiting scholar in Statistics Finl and also.
Nanotechnology: Innovative Applications in the Oil & Gas Industry

Subhash N. Shah, Muili F. Fakoya and Harshkumar Patel

The University of Oklahoma, USA

Many research efforts are being directed towards the unlocking of immense and diverse benefits of nanotechnology in the oil and gas industry. Mainly, the research efforts have been through the usage of various nanoparticle types and sizes. Nanoparticles exhibit unique properties due to huge surface area and highly activated particle surface.

Nanoparticles can be deployed in different fluid systems to facilitate new applications, alternative methodologies, and reinforcement of existing technologies as reported in literature. Most of the earlier studies have revealed some interesting applications of non-metallic nanoparticles, and recently, researchers have also presented innovative usages of metallic and para-magnetic nanoparticles. Depending on the type and size, nanoparticles have been observed to alter various fluid and petrophysical properties as well as molecular level physico-chemical processes – base fluid viscosity, filtration loss control, fines migration control, foam or emulsion stability, interfacial tension, thermal upgradation of heavy oil etc. Currently, nanoparticles have been identified to have potential applications in almost all disciplines of the oil and gas industry such as exploration, drilling, logging, hydraulic fracturing, formation damage, enhanced oil recovery, ex-situ upgrading of oil shales/bitumen etc.

This paper aims to provide an overview of the major applications of nanoparticles, their potential benefits, and associated economical and/or technical challenges and solutions. The authors will also highlight some of the latest developments and ongoing research to identify promising areas for future research. Overall, this study is intended to serve as a useful guide for both researchers as well as practicing professionals in the oil and gas industry.

Biography:

Professor Subhash Shah, Ph.D., P.E. is an Emeritus Professor in the Mewbourne School of Petroleum and Geological Engineering at the University of Oklahoma (OU). He recently retired from OU after serving 22 years as Stephenson Chair Professor and also as the Director of OU’s Well Construction Technology Center. Dr. Shah holds a B.S. degree from the University of Baroda, India, and M.S. and Ph.D. degrees from the University of New Mexico, USA, all in chemical engineering. Dr. Shah is considered to be one of the world leaders in hydraulic fracturing, horizontal/multilateral well completions/stimulation, and coiled tubing technology. He has a distinguished career in the oil and gas industry that spans over 40 years: 18 years in industry and 22 years in academics. He is one of the most recognized members of the OU petroleum engineering faculty and has inspired numerous undergraduate and graduate students from all over the world. Dr. Shah's industrial experience includes research in the areas of well stimulation and completion, drilling, cementing, and coiled tubing. Dr. Shah was recognized as a "Distinguished Technical Member" at Halliburton. Dr. Shah successfully initiated and established a joint-industry consortium on the Coiled Tubing Applications. His work has resulted in more than 270 technical papers in 30 international journals and two chapters in technical books. Dr. Shah has held various offices and served on numerous committees in Professional Organizations. He has served on the NSF review panels. Dr. Shah is a member of the Petroleum Society, the Society of Petroleum Engineers and the American Institute of Chemical Engineers. He is a registered professional engineer in the State of Oklahoma. Dr. Shah was recognized as the Society of Petroleum Engineers (SPE) 2012-13 "Distinguished Lecturer". In 2014, he was elected as the "Fellow" of the American Institute of Chemical Engineers.
An applicable molecular CO$_2$ reduction catalyst to nanomaterials for artificial photosynthesis

Hitoshi ISHIDA
Kitasato University, Japan

Utilization of carbon dioxide attracts much attention in relation to artificial photosynthesis, solar fuels, and atmospheric CO$_2$ concentration decrease. The metal complexes which can electrochemically or photochemically reduce CO$_2$ have been actively researched. They are frequently called as the molecular catalysts, which are expected to design and modify on the molecular level as we require. In the metal complexes, we have investigated the photochemical CO$_2$ reduction catalyzed by trans(Cl)-Ru(bpy)(CO)$_2$Cl$_2$ (bpy: 2,2'-bipyridine). The ruthenium complex can efficiently reduce CO$_2$ to carbon monoxide (CO) and formate (HCOO$^-$) in N,N-dimethylacetamide (DMA)/water in the presence of [Ru(bpy)$_3$]$_2^{2+}$ as the photosensitizer and 1-benzyl-1,4-dihydronicotinamide (BNAH) as the electron donor. The catalytic reaction mechanisms still remain unclear, but a characteristic of the homogeneous molecular catalysts allow it possible to detect or isolate the reaction intermediates. Second characteristic is that the molecular catalysts can be applied to the nanomaterials to construct the heterogeneous catalysts for artificial photosynthesis.

In this lecture, our recent results on photocatalytic CO$_2$ reduction by trans(Cl)-Ru(bpy)(CO)$_2$Cl$_2$ and the derivatives are introduced. The reaction mechanisms are discussed in the viewpoints of the product selectivity (CO/HCOO$^-$). Finally the application of the molecular catalyst to nanomaterials is discussed by introducing our recent work on periodic mesoporous organosilica (PMO) modified with two different ruthenium complexes as catalytic and photosensitizing sites (Figure).

Biography:
Hitoshi Ishida is Associate Professor of Graduate School of Science, Kitasato University since 2001. He received his B.S. and Dr. degrees at Osaka University on electrochemical/photochemical CO$_2$ reduction catalyzed by ruthenium complexes. He worked at Kumamoto University as assistant professor (1988-1997) and the group leader (1997-2001) of Inoue Photochirogenesis project, ERATO, JST. He served as the President of the Photofunctional Complexes Research Association Japan for the period 2012-2014. His current research interests are in developing functional molecules based on metal complexes and peptides toward artificial photosynthesis.
Materials Development for Efficient Direct Borohydride Fuel Cells

Yogeshwar Sahai and Jia Ma
The Ohio State University, USA

This presentation will include materials development for alkaline direct borohydride fuel cells (DBFCs). Chitosan-based chemical hydrogel membrane and catalyst binder were developed by the authors and used in DBFCs. The chitosan-based borohydride fuel cell gave more than 50% higher power performance than the commercial Nafion-based one. The authors are the first to develop a chitosan membrane which resulted in much higher power density than the commercially used Nafion-based membranes. The chitosan-based catalyst binder also gave about 20% higher power density values than Nafion as catalyst binder. This chitosan-based membrane has also been successful in alkaline ethanol fuel cells. The estimated cost of chitosan-based membrane is less than 10% of the cost of Nafion. For borohydride electro-oxidation, an effective anode consisting of Ni-based composite electrocatalysts loaded on Ni foam substrate was developed and employed. The use of Ni-based catalyst reduces the cost of fuel cell without compromising its performance. Thin film electrode was prepared by electroless plating and physical vapor deposition. A nanoscale thin film anode delivered comparable power performance to an ink pasted electrode with a much higher catalyst loading. Development of these materials in preparing polymeric membrane and electrode will be presented in this paper. The performance results and effect of these materials in reducing the cost of fuel cells will be also discussed in this presentation.

Biography:
Dr. Yogeshwar Sahai is a Professor Emeritus in Materials Science & Engineering Department at The Ohio State University, Columbus, USA. He obtained his Ph.D. from Imperial College of Science and Technology, University of London, England in 1979. He was a research associate at McGill University, Montreal, Canada before joining the faculty position at OSU in January 1983. He was Distinguished Visiting Professor at Tohoku University in Japan during 1995-96. His research is in clean energy areas, including fuel cells, batteries, polymeric electrolyte membranes, and catalysts for electrochemical applications. Dr. Sahai has published over 140 technical papers in peer reviewed journals and refereed proceedings, and has published 5 books and 5 patents. He has received several awards for his teaching, research, and leadership from professional societies, universities, and industries.
Alignment of nerve cells by protein microcrystal

Hajime Mori
Kyoto Institute of Technology, Japan

The development of complex tissues relies on signals provided by growth factors secreted by neighboring cells. The development of micron-scaled structures that can deliver defined growth factors from specific locations over extended periods will enable new approaches for regenerative medicine.

Here, nerve growth factor (NGF) was encapsulated into insect virus-derived protein microcrystals. NGF-containing microcrystals were spotted onto a cover slip to create a circular field of the microcrystals. PC12 cells were seeded and cultured with serum-free medium under static conditions without media change. Alignment of PC12 cells via the extended axon along the periphery of the microcrystals fields was observed.

Nerve cell differentiation was confirmed by expression of specific markers, tau and neurofilament. The connections of PC12 cells were also formed between the extended axon and the growth cone-like structure which were induced by NGF-encapsulated protein microcrystals. NGF was thought to be slowly released from the microcrystals field, resulting in a steady, physiologically-relevant gradient of NGF at the periphery of the field. NGF-encapsulated protein microcrystals mimic the in vivo extracellular matrix and contribute to nerve repair and regeneration. To our knowledge, this is the first report of the autonomous alignment of nerve cells.

Biography:
Hajime Mori has completed his PhD at the age of 26 years from Nagoya University and postdoctoral studies from The National Institute of Agrobiological Sciences. He is now a trustee and vice-president, and also professor of Kyoto Institute of Technology. He has published about 100 papers in reputed journals and has been serving as the editor of Journal of Insect Biotechnology and Sericology.
Redox proteomics in sentinel organisms as a readout for nanoparticle toxicity

David Sheehan
University College Cork, Ireland

Oxidative stress occurs when supply of reactive oxygen species (ROS) exceed the cell or organism's antioxidative defences. ROS very rapidly attack important cell components such as DNA, cell membranes and proteins. Quantitatively, proteins absorb most ROS. Oxidative stress is commonly associated with toxicity of metal and metal oxide nanoparticles. We have developed a redox proteomics toolkit to allow assessment of relative toxicity of different metal and metal oxide nanoparticles to sentinel organisms such as Daphnia magna, oysters and mussels. The toolkit assesses protein carbonylation (formation of aldehyde or ketone groups) and oxidation of protein thiols. These covalent modifications have the ability to inactivate proteins or lead to their accelerated turnover due to processes such as protein aggregation. We can analyze redox effects on the proteome through one and two dimensional electrophoresis. Peptide mass fingerprinting by tryptic digestion facilitates protein identification. We can draw the conclusions that copper and zinc oxide nanoparticles are much more toxic than TiO$_2$ and that some proteins are preferentially targeted by ROS giving insights to the biochemical processes affected by metal nanoparticles.

Biography:
Prof David Sheehan is Dean of the College of Science at KUSTAR, Abu Dhabi. His PhD in Biochemistry is from Trinity College Dublin (1985) and he holds DSc for published work from the National University of Ireland. He taught at University College Cork, Ireland 1989-2016 and was Head of School of Biochemistry & Cell Biology 2013-2016. He has published 120 peer-reviewed papers and four books including two editions of his textbook Physical Biochemistry: Principles and Applications (2001, 2009). He is an expert on environmental toxicology and is interested in redox effects of metal oxide nanoparticles in Biological model systems.
The nanotechnology revolution is being built from advances in synthesis techniques, processing methods, computational modeling, manufacturing, measurement, device concepts and realization. Of particular interest for this talk are advances in materials and device concepts that have realized new opportunities for processing. This in turn has yielded new materials behaviors, new device properties, and performance well beyond that currently available. In this talk, new nanoscale processing for patterned and layered materials will be covered with particular attention to the use of magnetic nanomaterials to control and/or enhance processing and materials or device properties and performance. Important advances through the use of nanomaterials, and nanoprocessing to realize breakthrough performance in thermal management and electromagnetics will be covered.

Biography:
David E. Luzzi is Vice Provost for Research Innovation and Development & Vice President for the Northeastern University Innovation Campus in Burlington.
Toxic Potential of Benzo[a]pyrene and 9-Nitroanthracene Surface Modified Carbon Black Nanoparticles on None- and Pre-damaged Mice Lungs in Long-term Exposure

B. Müller, N. Schreiber, E. Kotte
Philipps University, Germany

Rationale: Selective synthesis of engineered carbon black nanoparticles (CBNPs) is associated with specific particle surface modification in order to fulfill demands for their points of application. Opposite, airborne CBNPs can unspecifically interact with atmospheric components and thus alter their surface area. To date there is not much known about the toxic potential of inhaled surface modified nanoparticles on the respiratory tract during long-term exposures. This study was done using Printex® 90 as basic particle to which benzo[a]pyrene or 9-nitroanthracene was bound. In addition, acetylene carbon black with polycyclic aromatic hydrocarbons was studied to mimic an environmental relevant particle. All CBNPs were tested on mice with healthy and pre-damaged lungs. We expected that 1. Surface modifications (benzo[a]pyrene, 9-nitroanthracene or polycyclic aromatic hydrocarbons) are more harmful to healthy lungs and 2. Pre-damaged lungs show stronger reactions than healthy subjects.

Methods: Subchronic exposure of CBNPs was done on 10 wk old BALB/c mice. Lung pre-damage was initiated by a 72 h exposure with 5 ppm nitrogen dioxide (NO₂). Healthy subjects received ambient air. All mice were treated with particle suspensions on day 0 and every following second week for 3 months. Saline, DQ12 quartz and unmodified Printex®90 served as controls. At the end lungs were prepared for histological examinations using picrosirius red and immunohistochemical glutathione reductase and γ-H2AX genotoxicity staining. Bronchoalveolar lavage fluid (BAL) was performed to compare total cell yields, cell compositions and phospholipid as well as protein concentrations. Type II pneumocytes were finally isolated to examine cell protein concentrations and mRNA expressions of surfactant synthesis enzymes like choline phosphate cytidylyltransferase α.

Results: Lung tissue staining revealed equal nanoparticle distribution across the lungs but showed no signs of thickened alveolar septa, increased collagen structures or changes in glutathione reductase or γ-H2AX expression. However, all surface modifications induced decreased protein concentrations in healthy and increased protein levels and elevated total cell yields in BAL fluids of NO₂ pre-damaged mice lungs compared to their corresponding saline controls.

Conclusions: 1. None of the CBNP surface modifications induced massive changes in lung structure but exhibited measurable changes in BAL protein and phospholipid concentrations or total cell yield as well as altered type II pneumocyte cell yields, protein concentrations and mRNA expressions. 2. Pre-damaged lungs seem to react not as sensitive as expected but different compared to healthy subjects. We speculate, that protein corona formations on functionalized particle surfaces might inhibit modification associated toxic effects on lung structures.

Biography:
Professor Bernd Müller is a biologist working and teaching on the Philipps University Marburg, Germany. He works in the field of inhalative environmental air pollutants and their effects of the respiratory system. He is leads the Laboratory of Respiratory Cell Biology in the Medical Faculty, and is head of the multidisciplinary NanoCOLT project which is a substantial part of the Germany BMBF Government NanoCare program. He consults several institutions and companies on lung toxicity matters of engineered carbon black nanoparticles as well as of gaseous engine exhausts.
Biocompatible multifunctional magnetic nanoparticles for possible applications in nanomedicine

Silvia Villa, Chiara Lambruschini, Luca Banfi, Paola Riani, Fabio Canepa, Annalisa Relini, Fabio Morana and Renata Riva
Università di Genova, Italy

Multifunctional nanoprobes combining magnetic nanoparticles (MNPs) with organic dyes have attracted great interest due to their promising applications in biomedical field. Among the wide selection of different nanoprobes, iron oxide nanoparticles (SPIONs), loaded with different functionalities, provide promising application in the drug delivery therapy. In cancer treatment a possible drug delivery approach is the well known prodrug monotherapy (PMT), in which the drug is released by enzymes naturally overexpressed in tumor tissues. A recognized enzyme suitable for this method is plasmin, a serine protease. A combination of the two approaches can enhance the cancer treatment because, under the influence of an external magnetic field, it is possible to orient the magnetic nanoparticles to the tumor site and concentrate the drug in the ill tissue. In this perspective our project aimed at optimizing this approach, planning a superparamagnetic probe based on SPIONs and conjugating a fluorescent tag through a tripeptide linker. This peculiar system has been designed to be cleaved by plasmin with the resulting release of the fluorescent tag. Therefore, this original system could find applications either in the imaging diagnostic or in the drug delivery fields (figure 1).

Herein, we present the synthesis and the characterization of the two components (SPIONs and the tripeptide linked to a fluorescent tag) and the study of their conjugation. Furthermore, we present the preliminary results of the enzymatic cleavage, as proof of concept of our project.

Biography:

Silvia Villa was educated at the University of Genoa (Italy) where she received her Bachelor and Master Degree in Chemical Sciences in January 2012 and October 2013, respectively. During her master thesis she worked on magnetite nanoparticles under the supervision of Prof. Fabio Canepa and Dr. Paola Riani. In March 2014, she began a fellowship on iron oxides NPs as MRI contrast agents at the Italian Institute of Technology (Pisa, Italy). From November 2014 she is involved in a Ph.D. course at the University of Genoa (Italy) working on magnetic nanoparticles for advanced applications.
Laser-Induced Reversion of Precipitates in an Al-Li Alloy by Pulsed Laser Atom Probe Tomography

Muna Khushaim1,2, Ryota Gemma3 and Talaat Al-Kassab1*

1Division of Physical Sciences and Engineering, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia
2Department of Physics, Faculty of science, Taibah University, PO Box 344, Medina, Kingdom of Saudi Arabia
3Department of Human development, Tokai University, Kanagawa 259-1292 - Japan

Atom probe tomography (APT) technique has been improved significantly, making it a well-established nano-analysis tool in the field of material science. It has been extensively applied to the investigation of different types of materials due to its ability to map the distribution of single atoms in a material in real space on a nearly atomic scale. In this paper, we investigate the details of the laser pulse mode APT analyses, in particular the laser induced specimen-heating effect using an interface reaction in an Al-Li alloy as a model system. This alloy is known to have a low-temperature, metastable, miscibility gap. It has been shown that under classical conditions of ageing of this alloy, including solution treatment, fast quench to room temperature and thermal ageing at intermediate temperatures (e.g., 100–200°C), the precipitation behavior was dominated by the presence of the metastable phase with an L12 structure. The influence of the laser power on the morphology, the composition, and the diffusion of the constituents of the precipitates in the aluminum-lithium-based alloy is identified during an APT analysis. Prior to the laser exposure all sample were prepared by ageing an Al-2wt.%Li binary specimen at 190 °C for 3h to produce comparable initial state of precipitates with an average diameter of (14.2±3) nm and a number density of (10±0.1) x1022 m-3 as confirmed by APT-voltage pulsing analysis. A simple model is used to explain the observed experimental behavior and to estimate the corresponding tip-apex temperature for various laser energies.

APT analyses by using laser pulse mode with various laser pulse energies were performed to monitor the effect of thermal processes induced by laser on the morphology and composition of the phase. A series of reconstructed volumes of the tips analyzed by laser pulses at the following laser energies: 10, 30, 40, 50, 60, 80, and 100 pJ was obtained. The results show that the spherical precipitates in the microstructure are clearly visible in the range of laser energies from 10 to 60 pJ. Conversely, the precipitates begin to lose their distinctive shapes at 80 pJ. At an even higher energy of 100 pJ, precipitates are no longer detected as individual particles. Using the simple law of mass conservation and an Arrhenius-type relationship for the diffusion together with the experimental APT measurements allowed us to obtain different numerical values for different parameters such as: the average diameter d of the precipitates, their number density Nv, their volume fraction f, their average Li compositions within the precipitates cp, the Li composition of the matrix ct , the diffusion lengths L , the effective diffusion coefficients D for the Li atoms and the corresponding temperatures T at each laser pulse energy. In this study, atom probe tomography presented a series of snapshots during in-situ reversion of (Al3Li) initiated by laser irradiation, using different laser energies. In addition, the attempt shown in this study might provide a method to investigate real sample temperatures during laser-APT analyses using an interface reaction itself as a probe.

Biography:

Dr Muna Khushaim is an Assistant Professor in the Physics Department of Taibah University, Saudi Arabia. Dr Khushaim completed her PhD at KAUST in 2015 in material science and engineering. During her research at KAUST, Dr Khushaim became exposed to many sophisticated analytical techniques and is an expert of atom probe tomography techniques in the Arab Gulf States region. Dr Khushaim graduated with a Master’s Degree in Theoretical Nuclear Physics from King Abdul-Aziz University in 2007 and completed her undergraduate degree in 2002 in science and Education from Saudi Arabia’s college of Education.
Design of cobalt (II)-cerium (III) metal coordination polymer as heterogeneous catalyst precursor for Fischer-Tropsch synthesis

Haiquan Su*, Fenghua Bai, Yajie Gao, Hui Li, Wenzhuo Wang and Xiaoming Li
Inner Mongolia Key Laboratory of Chemistry and Physics of Rare Earth Materials, School of Chemistry and Chemical Engineering, Inner Mongolia University, Hohhot, Inner Mongolia, 010021, China

Fischer-Tropsch synthesis (F-T synthesis) has continuously regained interest during the last decade as a means of liquefaction of syngas \((\text{CO}, \text{H}_2)\) to hydrocarbons as the most promising source of chemicals and fuels from non-petroleum-based supply such as coal and natural gas. Hetero-metallic coordination polymers (HMCPs) including one-dimensional chains, two-dimensional layers and three-dimensional networks as new type of catalyst precursors have potential applications in fields of homo-heterogeneous catalytic processes. The catalyst based on the HMCPs supplied uniform dispersion of active nano-metal particles over the surface of support, thus better catalytic activity in the reaction could be achieved.

In this paper, a new type of Co-Ce hetero-metallic catalyst was designed and prepared by using Co-Ce HMCPs with one-dimensional zigzag chain (Fig.1). Catalytic performance of the catalyst was studied for the F-T synthesis. The results indicated that the configuration of the polymer framework could control the congregation shape of metal particles of the catalyst under F-T reaction condition (Fig.2), which further affected the catalytic performance.

Fig. 1 1-D chain of polymer 1 viewed along the c axis. (pink Ce; green Co; grey C; red O; blue N).

Fig. 2 TEM images of the Co-Ce/γ-Al2O3 catalyst after F-T reaction: chain shape of the congregated metal particles.

Acknowledgement
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Biography:
Dr. Haiquan Su currently serves as a professor with major in inorganic chemistry in School of Chemistry and Chemical Engineering, Inner Mongolia University. He received his Ph. D degree in 2000 from Changchun Institute of Applied Chemistry, Chinese Academy of Sciences. His main research interests include nanomaterials for energy, claymaterials and biomaterials for environmental applications.
Design of photocatalyst based on the niobium and tantalum nano-materials and its application in remediating water environment contaminates

Xiaojing Wang*, Huayu Gu, Guanjie Xing, Huimin Gu and Zhanli Chai
School of Chemistry and Chemical Engineering, Inner Mongolia University, Hohhot, Inner Mongolia, 010021, China

Nitrobenzenes derivatives (NB) are extremely harmful to human and environment while the reduced product of them, aminobenzene derivatives exhibit low toxicity and better biodegradability. Moreover, aniline compounds are usually used as a number of important reactions intermediate in organic chemistry manufacturing such as the production of dyes, pharmaceuticals and agricultural chemicals. So it is very meaningful to reduce nitrobenzenes derivatives to the corresponding anilines. From the viewpoint of unprecedented practical applications, it is highly necessary to explore noble-metal-free and highly active catalysts and comprehend the underlying chemistry and physics. This work will report on the preparation of a series of noble-metal-free and highly active catalysts based on niobium and/or tantalum nanomaterials toward to the reduction of nitrobenzenes, such as TaO$_x$N$_y$, Ca$_2$Nb$_2$O$_7$, NiNb$_2$O$_6$, and CeO$_2$@Ag/Ag$_2$Ta$_4$O$_{11}$.

We found that nitridation of a silent Ta$_2$O$_5$ substrate led to the formation of a series of TaO$_x$N$_y$ hollow nanocrystals which exhibited outstanding activity toward catalytic reduction of nitrobenzenes under ambient conditions. We also reported the work NiNb$_2$O$_6$ nanoparticles which showed superior catalytic activity and stability toward reduction of 4-nitrophenol due to a unique photo-synergistic catalytic mechanism that relies on a synergy between thermal active sites and photogenerated electrons in NiNb$_2$O$_6$ nanoparticles. We assembled a novel catalyst CeO$_2$@Ag/Ag$_2$Ta$_4$O$_{11}$ via an in-situ catalytic process toward 4-nitrophenol reduction. The results showed the elementary substance Ag was produced from Ag$_2$Ta$_4$O$_{11}$ after the circular reduction reaction and homogeneously deposited on the surface of Ag$_2$Ta$_4$O$_{11}$ nanoparticles, which was wrapped by octahedron-shaped CeO$_2$. The as-prepared nanocomposites exhibited extremely accelerated catalytic activity toward the efficient reduction of 4-nitrophenol compared to pure CeO$_2$ and Ag$_2$Ta$_4$O$_{11}$ nanoparticles.

Our researches proved that tantalante (or niobium) nano-materials were very effective photo-catalysts for the redox of nitrobenzenes due to their higher band potential and wide band gap. The underlying mechanism is completely different from those previously reported for metallic NPs. The band gap (light absorption) and catalytic activities can be regulated via doping which can produce the impurity band and defects. This work may provide new possibilities for the development of novel catalytic systems including many electron transfer reactions.

Biography:
Xiaojing Wang, Born in 1963, Professor. She received her Ph.D from Department of Material Chemistry, Tohoku University of Japan at 2003. Since 2004, she got a scholastic profession in Inner Mongolia University of China as a Professor. Her main research interests include the design and preparation of nanomaterials, the photocatalysis and its application in environment pollution.
Amaltas Silver Nanoparticles and their enhanced action against some bacterial strains

Samin Mushtaq, Farah khan Zaryab Khalid, Kiran Zahid, Syeda Shehwar Zehra, Syeda Hina Bukhari and Ayesha adeeb
Lahore College for Women University, Pakistan

Amaltas (Senna occidentalis) is an Ayurvedic medicinal plant which is well known because of its Qehwa which is a traditional medicine for the treatment of various diseases. It belongs to family Fabaceae. Currently nanoparticles are considered as one of the best green tools to eliminate the infectious microorganism. The green silver nanoparticles synthesized by Senna occidentalis and simple extracts of plants were analyzed and compared for the antibacterial activity. Two sets of leaf extracts of Senna occidentalis were prepared using crumbling dry leaves in water, methanol and n-hexane. Silver nitrate was added in one set of extracts and kept overnight. Nanoparticles were characterized visually by observing change in color from yellow green to dark brown as well colorimetric detection of silver nanoparticles was observed by the spectrophotometric analysis. Antibacterial activity of biosynthesized silver nanoparticles was analyzed against Escherichia coli (G-) and Pseudomonas aeruginosa (G-) by agar well diffusion method. The result revealed that Silver nanoparticles were best synthesized by using methanol as a solvent as well as they showed highest antibacterial response than the control i.e. simple plant extracts. The antibacterial activity was greatly affected by the size of nanoparticles. This eco friendly novel bio synthesis is a facile, rapid method which may be used for large scale production of metallic nanoparticles from plants resources.
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Posters
Template synthesis and study of intermetallic (Co-Sn, Ni-Sn, Co-Ni) nanoparticles and their carbon-containing nanocomposites

University of Chemical Technology and Metallurgy, 8, Kl. Ohridski Blvd., Sofia 1756, Bulgaria

Intermetallic (Co-Sn, Ni-Sn, Co-Ni) nanoparticles have been synthesized through a borohydride reduction at room temperature and atmospheric pressure with NaBH₄ in a mixture of aqueous solutions of the relevant chloride salts of Co, Ni, and Sn at a ratio between the metallic components chosen according to the phase diagram of the corresponding binary (Co-Sn, Ni-Sn, Co-Ni) systems, respectively Co: Sn=35:65, Ni: Sn=45:55, Co: Ni=50:50. These nanoparticles have been also obtained through the template technique using a carbon-containing support. As a result, nanocomposite materials have been in-situ obtained. Graphite has been used as a carbon-containing support. To avoid the nanoparticle aggregation β-cyclodextrin has been added to the reaction solutions. The morphology, elemental, and phase composition of the synthesized intermetallic nanoparticles have been investigated by the help of SEM, EDS, and XRD respectively. The nanoparticles are different by shape and in size and exhibit a tendency to aggregation due to the unsaturated nanoparticle surface and the existing magnetic forces. The nanoparticle’s morphology is typical for the alloyed materials. The formed phases are in accordance with the respective binary system phase diagrams: phases of CoSn and CoSn₂ for the Co-Sn (Co: Sn=35:65) nanoparticles, phases of Ni₃Sn₄, Ni₃Sn₂ and Ni₃Sn for the Ni-Sn nanoparticles (Ni: Sn=45:55), phases of Co and Ni for the Co-Ni nanoparticles (Co: Ni=50:50). The obtained alloyed (Co-Sn, Ni-Sn, Co-Ni) nanosized powders and their carbon-containing nanocomposites have been studied by FTIR spectroscopy in a mid-IR region from 4000 to 400 cm⁻¹. On the basis of the collected FTIR spectra, respectively bands of absorption with peaks at the relevant frequencies the kind of vibrations (symmetric or asymmetric stretching and bending) of the created chemical bonds in different atom groups such as COH, CH₂, OH, H₂O, C=O, COOH, BO₃, BO₄, Me-O (Me=Co, Sn, Ni) have been determined.

Biography:
Scientific interests in the area of the synthesis of metallic/intermetallic nanoparticles and their carbon-containing nanocomposites through a borohydride reduction with NaBH₄ in aqueous solutions of metallic salts including applying the template technique using a support; characterisation the nanomaterials with physical-chemical investigation methods; FTIR spectroscopy method for study the nanosurface phenomena. Teaching (Lecture courses) in Semiconductor materials, Magnetic materials, Nanomaterials, Deep purification of the materials for microelectronics, Membrane technologies.
Polyethyleneimine and Chitosan -based precursor liquid crystalline system with in situ gelling for buccal drug delivery systems

Marlus Chorilli¹, Francesca Damiani Victorelli¹, Lívia Nordi Dovigo², Giovana Maria Fioramonti Calixto¹  
¹Faculdade de Ciências Farmacêuticas, UNESP—Universidade Estadual Paulista, Campus Araraquara, Departamento de Fármacos e Medicamentos, Araraquara, SP, 14800-850, Brazil  
²Department of Restorative Dentistry, School of Dentistry, UNESP - Universidade Estadual Paulista, 1680 Humaitá Street, Araraquara, SP 14801-903, Brazil

The buccal route is very attractive for the drug administration because the buccal mucosa is permeable and robust allowing the rapid recovery after stress or damage besides presents an excellent blood supply and absence of the first pass effect, avoiding the drug pre-systemic metabolism by the gastrointestinal tract. Despite its advantages, the buccal mucosa has some limitations, mainly due to the continuous secretion of saliva (0.5 to 2 L/day), which may lead to dilution and possible ingestion of the drug and, lastly, to the unintentional removal of dosage form [2]. Precursor lyotropic liquid crystalline system (PLCS) represents a promising buccal drug delivery system because it can be presented as liquid, facilitating the formulation administration, for example, by syringe. However, upon contact with the buccal environment, the PLCS has the ability to incorporate water from saliva, becoming a viscous liquid crystalline system (LCS), which can promote the drug controlled release and provide a great drug substantivity at the action site. Polyethyleneimine (PEI) is a water soluble polymer with high cationic charge density at physiological pH which has been investigated to promote cellular uptake of drugs [4]. Chitosan (CS) is a cationic polymer that can improve the adhesion of PLCS by the buccal mucosa through the molecular forces by electrostatic interactions with the saliva that is negatively charged. Therefore, the aim of this work was to develop a precursor liquid crystalline system consisting of oleic acid as the oily phase, Procetyl® AWS as surfactant and dispersion of PEI 0.25% wt. and CS 0.25% wt. as the aqueous phase, to characterize by polarized light microscopy (PLM), small angle x-ray scattering (SAXS) and evaluate the in situ gelling property with saliva. Based on the results obtained, it was possible to develop a PLCS with those above components; moreover, PLCS could become a viscous LCS with the saliva addition that was proved by PLM and SAXS. Thus, the results presented here provide a novel LCS for buccal drug delivery systems.

Biography:  
Marlus Chorilli holds Pharmacist, M.Sc. (2004) and PhD (2007) degrees in Pharmaceutical Sciences from São Paulo State University. He is presently an Assistant Professor at the School of Pharmaceutical Sciences of Araraquara of São Paulo State University, where he teaches Pharmacotechniques and Pharmaceutical Technology. He leads the research group “Research and Development of Nanotechnology-based Drug Release Systems” (CNPq – Brazil) and is a Reviewer of Journals in the field of Pharmaceutical Sciences and a scientific adviser to Brazilian and International research funding agencies (CNPq – Brazil, FAPESP-Brazil and FONDECY-Chile).
Hybrid bi-stable memory device based on CdSe/ZnS quantum dots embedded in aluminum oxide nano-cluster


School of Electronics Engineering, College of IT Engineering, Kyungpook National University, 1370 Sankyuk-dong, Bukgu, 702-701, Daegu, Republic of Korea

The proposed memory device based on CdSe/ZnS quantum dots (QDs) was fabricated by using spin coating. The quantum confinement effect observed in QDs provide the hysteresis characteristics in I-V curve [1]. Especially, the charge storage layer (CSL) of fabricated memory device was formed using QDs and aluminum oxide nano-cluster. The nano-cluster can sustain the trapped charge at the core of QDs for a longer time compared to only QDs used memory device. Also, to improve the retention time characteristics and stability, PEDOT:PSS and ZnO layer was also formed. The PEDOT:PSS layer increased the hole injection from ITO to core of QDs and ZnO layer protect the lower QDs layer. The schematic diagram of fabricated memory device was shown in figure 1, the band diagram was shown in figure 2. The hole was injected from ITO to QDs by tunneling with the proper positive voltage, by applying proper negative voltage, the trapped charge was extracted from QDs to ITO, which provide the hysteresis in I-V curve. Compared to QDs only used memory device, the nano-cluster used memory device have the higher on/off ratio and longer retention time.

Biography:

Sae-Wan Kim, received the B. S, M. S degrees in the School of Electronics Engineering, College of IT Engineering from Kyungpook National University, Daegu, South Korea in 2012 and 2015 respectively. He is currently working toward the PhD degree in Prof. Shinwon Kang’s group at Kyungpook National University. His current research is focused on the study of nanomaterials and memory device.
Comparative study of three different graphene oxide synthesis methods

Prajakta A. Barve¹, Satyawati S. Joshi*
Department of Chemistry, Savitribai Phule Pune University, Pune, India

Graphene oxide is oxidized form of graphite in planer structure having sp² hybridized carbon atoms. It has honeycomb like structure and can be easily synthesized via Hummer’s method or modified hummers method. Graphene oxide is hydrophilic and its surface can be easily modified with a host of biocompatible material. It possesses properties such as electrical (e.g. high carrier mobility and capacity), electrochemical (e.g. high electron transfer rate), mechanical (e.g. robust and flexible) and optical (e.g. high opacity, ability to quench fluorescence). Theoretically, quenching efficiency of graphene oxide can be as high as 10³. Graphene oxide is widely explored for its applications in various fields like medicine, environment, electronics etc.

Graphene oxide was synthesize using three methods, aiming maximum oxidation of graphite in minimum time requirement and the reaction would result comparatively less amount of toxic byproducts. The synthesized products were characterize and confirmed by FTIR, XRD and RAMAN spectroscopy and TEM microscopy.

Synthesized graphene oxide was confirme by XRD and Raman analysis. The characteristic XRD peak at 2q=10° indicates the presence of oxidized graphene. Raman spectrum showed D band at 1355cm⁻¹ and G band at 1604cm⁻¹. From TEM, interlayer distance obtained was 0.42nm.

The comparison in three methods will help to synthesize graphene oxide with maximum purity in minimum time requirement.

Biography:
Prajakta A. Barve, Research student (Ph.D) department of Chemistry, Savitribai Phule Pune University, Ganeshkhind Road, Pune 411007.
Satyawati S. Joshi, Professor, department of Chemistry, Savitribai Phule Pune University, Ganeshkhind Road, Pune 411007
Potential Nano-biotechnology approaches for early diagnosis of lung cancer

Shital Vishnu Sable\textsuperscript{2}, Satyawati Joshi\textsuperscript{1} and Suvidya Ranade\textsuperscript{1}

\textsuperscript{1}Department of Chemistry, Savitribai Phule Pune University, Pune 411007, India
\textsuperscript{2}Department of Technology, Savitribai Phule Pune University, Pune 411007, India

Nanobiotechnology is the emerging field for new possibilities in the early diagnosis of lung cancer. Lung cancer is the prime cause of mortality from cancer among men and women worldwide. Although the new techniques are available for early detection, the overall 5-year survival rate remains same. Therefore, for the lethal disease like lung cancer, it is necessary to diagnose and treat it at its early stages to increase the 5-year survival rate. To date no screening method has shown to decrease the disease specific mortality rate. In diagnostics, fluorescence property of nanoparticles can be used for early detection of cancerous cells, which are circulating in blood. Several chemotherapy agents are formulated with nanoparticles. In lung cancer, plasma novel biomarkers such as zyxin and micro RNA are detected using mass spectroscopy and ELISA in early stage of cancer. These methods are costly and time consuming. Ultimately, use of novel metal nanoparticles will allow rapid unique manner for early diagnosis. In this review, we describe the problems related to early lung cancer screening, which can be overcome using innovative ideas of Nano-biotechnology and an overview of the clinically applicable novel nanoparticles in oncology, with special attention on diagnosis of early lung cancer.
Simple Transformation of Hierarchical Hollow Structure by Reduction of Metal-Organic Frameworks and Their Catalytic Activity in Oxidation of Benzyl Alcohol

Kang Hyun Park*, Suhyun Ju‡, Hyuntae Kang‡, Soohee Kim*, Seongwan Jang* and BuHyun Youn

*Department of Chemistry, Pusan National University, Pusan 46241, Republic of Korea
‡Department of Biological sciences, Pusan National University, Pusan 46241, Republic of Korea

We presented a new approach to fabricate hollow structures through the reduction of Cu$_3$(BTC)$_2$. A series of reduced-Cu$_3$(BTC)$_2$ (denoted as RCB) was prepared by a hydrazine hydrate as a reducing agent in various conditions. The prepared RCBs showed a hierarchical structure with the appearance of numerous thorns growing on the surface of a hollow structure. We discussed the influence on the structure of Cu$_3$(BTC)$_2$ induced by hydrazine hydrate and discovered dynamic variation of the interior and exterior and oxidation state of Cu ion.

In addition, the prepared RCBs were found to have higher catalytic activity of benzyl alcohol oxidation assisted by TEMPO in comparison with other catalysts based on Cu$_3$(BTC)$_2$ due to the existence of a large amount of Cu(I). This significant improvement of catalytic activity is closely related to the initial oxidation state of the copper catalyst.

Scheme 1. Schematic illustration of preparation for RCB.

Biography:
Kang Hyun Park received his Ph.D. in 2005 under the supervision of Y. K. Chung and worked on the synthesis of transition metal nanoparticles and their application in organic reactions. He did his postdoctoral work with Professor Seung UK Son at Sungkyunkwan University in 2006–2007. In 2008, he was named an Assistant professor and Associated professor at Pusan National University and was appointed as a professor in 2017. His research interests include the development of new transition metal-nanoparticles catalyzed reactions.
Synthesis and characterization of magneto responsive nanocomposites of monodisperse superparamagnetic iron oxide nanoparticles homogenously dispersed in a poly(ethylene oxide) melt

Agnes Weimer¹, Artur Feld¹,², Rieke Koll¹, Lisa Sarah Fruhner³, Margarita Krutyeva³, Wim Pyckhout-Hintzen³, Christine Weiß³, Hauke Heller¹, Christian Schmidtke¹, Marie-Sousai Appavou⁴, Emmanuel Kentzinger⁵, Jürgen Allgaier³ and Horst Weller¹,²,⁶,⁷

¹University of Hamburg, Institute of Physical Chemistry, Grindelallee 117, 20146 Hamburg
²The Hamburg Centre for Ultrafast Imaging, University of Hamburg, Germany
³JCNS-1 and ICS-1, Forschungszentrum Jülich GmbH, Leo-Brandt-Straße, 52425 Jülich, Germany
⁴Jülich Centre for Neutron Science (JCNS) at MLZ, Germany
⁵Jülich Centre for Neutron Science JCNS and Peter Grünberg Institut PGI, JARA-FIT, Germany
⁶Centre for Applied Nanotechnology, Grindelallee 117, 20146 Hamburg, Germany
⁷Department of Chemistry, Faculty of Science, King Abdulaziz University, Saudi Arabia

B lending of soft polymer matrices with nanocrystals (NC) displaying high surface-to-volume ratios has led to nanocomposites with exceptional properties and therefore have a large potential for applications in materials science. However, synthesis of homogeneous polymer-NC nanocomposites is still one of the biggest problems, because of the immiscibility of the inorganic NC with an organic phase. Several approaches to overcome this difficulty exist, especially by grafting polymer chains on the particle surface of the same chemical nature as the matrix polymer. However, phase separation has to be prevented by introducing a robust ligand shell.

Micellar encapsulation is based on the hydrophobic part of amphiphilic polymers (diblock copolymers) intercalating with the hydrophobic ligand shell of the particle while the hydrophilic part is reaching into the aqueous solution. The hydrophilic part often consists of poly(ethylene oxide) (PEO). The stability of the micelles can be further increased by crosslinking the hydrophobic part and this is a crucial parameter for the homogenous distribution of the NC within the polymer matrix. The crosslinking of the polymer shell by covalent bonds provides maximum stability during mixing step with the host matrix and results in uniform hybrid SPIONs homogeneously dispersed in a poly(ethylene oxide) matrix. Small angle X-ray scattering (SAXS) and transmission electron microscopy (TEM) investigations demonstrate the presence of mostly single particles and a negligible amount of dyads.

The combination of advanced synthesis and encapsulation techniques using different diblock copolymers and the thiol-ene click reaction for crosslinking the polymeric shell results in homogenous magneto responsive nanocomposites.

Biography:
Agnes Weimer is a PhD candidate at the University of Hamburg and works in the department of physical chemistry in the research group of Prof. Dr. Horst Weller. Her work now focuses on development and optimization of advanced contrast agents for MRI and new tracers for magnetic particle imaging (MPI) based on shape- and size controlled iron oxide nanoparticles. Furthermore, she is working on the phase transfer of nanoparticles and the synthesis of multifunctional nanohybrids with adjustable surface properties. Agnes earned a bachelor of science and master of science in chemistry from the University of Hamburg.
Evaluation of Cu-coated graphite compacts prepared by pulsed current activated sintering process

Jun-Ho Jang\textsuperscript{a,b}, Hyun-Kuk Park\textsuperscript{a}, Jung-Han Lee\textsuperscript{a}, Jae-Won Lim\textsuperscript{b}, Ik-Hyun Oh\textsuperscript{a}

\textsuperscript{a}Korea Institute of Industrial Technology, Korea
\textsuperscript{b}Chonbuk National University, Korea

Cu-coated graphite powder for weight reduction and a high thermal conductivity was fabricated using a chemical reaction process. First, 4 g of graphite powders, which was treated using an activation and wetting process, was added to an aqueous solution of copper (Cu) sulfate; also, zinc (Zn) powders (such as 35, 40, 45, and 50 wt.%) was added as a transposition solvent to the aqueous solution and stirred for 1 hr for a transposition reaction. After the addition of the fabricated powders mixture to a 75 wt.% DI water : 10 wt.% H3PO4 : 10 wt.% H2SO4 : 5 wt.% mixture, tartaric acid was added to the aqueous solution to produce a passivating oxide film, followed by a drying for 24 hrs. The particle size of the fabricated powder, which is coarser than the initial graphite powder, is approximately 3 µm to 4 µm, and the low-intensity oxide peak of the XRD pattern of the fabricated powders is due to the low Zn powder content. With the use of the Cu-coated graphite powder, Cu-coated graphite sintered bodies were fabricated using a pulse current activated sintering (PCAS) process. The Cu-graphite sintered bodies were sintered with heating rate of 60, 100 and 150 o C/min, respectively. The Cu-coated graphite powders and compacts were evaluated using FE-SEM, EDS, XRD, a particle analysis, and the Archimedes method.

Biography:

2012. 07 ~ Korea Institute of Industrial Technology(KITECH), Researcher
2015. 03 ~ Ph.D. Course Work from Chonbuk national Univ. (Advanced Material Engineering, KOREA)
2012. 09 ~ 2015. 02 Graduated master degree from Chonbuk national Univ. (Advanced Material Engineering, KOREA)
2005. 03 ~ 2012. 08 Graduated from Chonbuk national Univ.(Advanced Material Engineering, KOREA)
Preparation of cation and anion exchange membranes for reverse electrodialysis by radiation-induced grafting method

Shin-ichi Sawada¹, Masahiro Yasukawa², Mitsuru Higa², Yasunari Maekawa¹

¹National Institutes for Quantum and Radiological Science and Technology, Japan
²Yamaguchi University, Japan

Reverse electrodialysis (RED) is a promising eco-friendly technology to produce electricity from natural salinity gradients between sea and river water. The RED cell is composed of many sets of a cation and anion exchange membrane (CEM and AEM), which transport Na⁺ and Cl⁻ from the seawater to river water side, respectively. These ionic movements are converted to an electron current at the electrodes of the cell to generate power. To achieve high output power, CEMs and AEMs with low ionic resistance, sufficient chemical stability, and mechanical strength are strongly required.

In this study, we prepared the CEMs and AEMs for RED system by a radiation-induced grafting method. In these CEMs and AEMs, graft chains possessing cation and anion exchange groups are covalently bonded to mainchains of the polymer film used as a base material. The base polymer parts steadily maintain the mechanical strength of the prepared CEM and AEM, which makes two things possible: (i) thinning of membranes; and (ii) increasing of an ion exchange capacity.

The base 50-μm-thick ethylene-co-tetrafluoroethylene (ETFE) film was irradiated with 10-kGy γ-rays. After irradiation, a CEM was prepared by grafting of styrene monomer into the ETFE film and subsequent sulfonation, while an AEM was prepared by grafting of chloromethylstyrene (CMS) into the ETFE film and subsequent quaternalization. The area resistance of the CEMs and AEMs immersed in a 0.6 M NaCl aqueous solution was measured by a two-probe AC impedance technique.

Depending on the amount of the introduced graft monomers (styrene or CMS), the ion exchange capacity of the graft-type CEMs and AEMs were controlled in the range of 0.9-2.0 mmol/g and 0.4-1.3 mmol/g, respectively. Fig. 1 shows the relationship between the area resistance and ion exchange capacity for the CEMs and AEMs. Area resistance dramatically decreased with the ion exchange capacity. The minimum value in CEMs is 0.39 Ω cm² at 2.0 mmol/g (75 μm thick), while that in AEMs is 0.90 Ω cm² at 1.3 mmol/g (75 μm thick). These values are excellently lower than the resistances of the commercial CEM (CMX, 168 μm thick, Astom Co. Japan) and AEM (AMX, 156 μm thick, Astom Co, Japan). This was due to both thinness of membranes and high ion exchange capacity. As a future work, we will conduct RED experiment by using our original graft-type CEMs and AEMs.
Insecticidal properties of nanoencapsulated essential oil extracted from
Artemisia sieberi on Xanthogaleruca luteola

Maryam Vahabi¹, Saeid Moharramipur², Maryam Negahban³

¹MSc student, Department of Entomology, Tarbiat Modares University, maryamvm88@yahoo.com
²Associate Professor, Department of Entomology, Tarbiat Modares University
³Assistant Professor, Daya Nanotechnologists Co.

In recent decades, extensive researches have been established on various botanical pesticides in order to achieve safe and effective alternatives to chemical pesticides. To replace these compounds with chemical insecticides, it should be achieved to effective and new formulation technologies to overcome limitations of essential oils. Nowadays, in urban landscape, leaf elm beetle (ELB) Xanthogaleruca luteola (Muller) (Coleoptera: Chrysomelidae) is considered as a serious pest of elm. Larvae feed on the lower leaf surface and the upper part and veins are left intact but adults create small irregular but discrete holes in the leaves. Sagebrush Artemisia sieberi Besser is a native medicinal plant to Iran that is considered by researchers due to its insecticidal activities. In this study, contact toxicity of nanoencapsulated formulation of A. sieberi essential oil was investigated on eggs, third instar larvae and adults of ELB at different concentrations. Therefore, the formulation of nanocapsules was sprayed on leaves containing eggs, larvae or adults. Experiments were conducted at 25 ± 2 °C, 65 ± 5% relative humidity and photoperiod of 16:8 h (L: D). The results showed that mortality was increased as concentration and exposure time increased. LC50 value of the formulation 24 h after application was 1010, 1131 and 837 ppm active ingredient for eggs, larvae and adults, respectively. Based on findings, nanoencapsulated formulation of sagebrush with controlled release capability could be considered for effective control of ELB.

Biography:
Maryam Vahabi Mashhoor has her expertise in improving the safe pesticides. She believes that the usage of botanical pesticides, due to the deleterious effects of chemical pesticides on non-target organisms, beneficial insects and the environment, would be a safe and suitable method for the pest control. As her opinion, Nanoformulated botanical pesticides can be a good option to be replaced with chemicals. She has investigated on contact toxicity, repellent activity, nutritional indices and damage assessment of Artemisia sieberi Besser essential oil on Xanthogaleruca luteola (Muller) before and after Nanoencapsulation and now she is studying on the new effective nanoformulated pesticides that can be used for urban landscape pests. She is skilled about application of new pesticides on the urban trees pests and now she is studying on a new effective Nanoemulsion Formulation of Some Plant Extracts on Physiology of The Elm Leaf Beetle. This formulation can control this pest successfully and she believes it can be a suitable alternative to chemical insecticides.
Advanced synthesis of barley nanoparticles during its in vitro growth

Syeda Shehwar Zahra, Farah khan, Zaryab Khalid Sial, Samin Mushtaq, Syeda Hina Bukhari
Molecular Genetics and Plant Biotechnology Lab, Lahore College for Women University, Jail road, Lahore, Pakistan

The Potassium nanoparticles were synthesized from field and in vitro grown Hordeum vulgare L. For this purpose different concentrations of Plant Growth Regulators i.e. 2, 4- Dichlorophenoxy Acetic Acid and Benzyl amino purine were used in MS basal medium at 24±2ºC with 5.7 pH and 30% sugar. Greenish yellow callus appeared after 12 days of inoculation. Potassium nitrate solution was used for the synthesis of Potassium nanoparticles from both types of plant tissue i.e. field grown and in vitro grown. The current study concluded that in vitro grown Hordeum vulgare L. produced larger amount of Potassium nanoparticles as compared to field grown barley which was further confirmed by the results obtained from UV- Vis Spectrophotometric analysis. Potassium nanoparticles have great utilization in composite epoxy materials industry. In vitro proliferated tissues may be a better source of synthesis of green nanoparticles in future.

Biography:
Syeda Shehwar Zahra is a fresh graduate pursuing her post graduate program at Lahore College for Women University (Pride of Asia) in Botany. She has been working on green synthesis of nanoparticles from plants grown in different conditions and studied the difference in their amounts produced.
Controlled Synthesis of Photodetector Nanowires of Bismuth Selenide

Imtiaz Madni, Wen Lei, Lorenzo Faraone
University of Western Australia, Western Australia

The unique physical and chemical properties of 2D materials have made a significant impact on research and development of modern electronics, spintronics, photonics, and energy technology. Recently, the layered V-VI binary compounds Bi$_2$Se$_3$, Bi$_2$Te$_3$, Sb$_2$Te$_3$ and their ternary compounds were discovered as topological insulators, which are considered as a new class of materials revealing new phases of quantum matter, possessing conducting surface states while showing bulk insulating properties. Ultrathin nanosheets of Bi$_2$Se$_3$ have been successfully employed for the photocurrent studies.

Motivated by these advantages, we investigated the vapor-solid growth of nanowires of Bi$_2$Se$_3$ on Si substrate. Here we demonstrate the photoresponse of Bi$_2$Se$_3$ nanowires grown by a facile and high-yield vapor deposition method with well-aligned orientation, and controlled length. Significant photocurrent response was observed when nanowires were illuminated with visible light lamp. The photocurrent dynamics of the nanowires were characterized for cyclic exposure of visible light to study the stability and repeatability of the photocurrent. The crystalline quality and surface morphology of the as grown Bi$_2$Se$_3$ nanowires were investigated by using XRD, high resolution transmission electron microscopy (HRTEM), scanning electron microscopy (SEM), and atomic force microscopy (AFM). High photoresponsivity was observed in Bi$_2$Se$_3$ nanowires, which is 4-5 orders of magnitude higher than the photoresponse of nanoplates of Bi$_2$Se$_3$. The efficient generation-recombination mechanism in nanowires can be attributed to quantum confinement effects, and larger aspect ratio.

Biography:

Imtiaz Madni is an early career researcher at The University of Western Australia, where he is working on epitaxial growth and characterization of semiconducting materials. His specialties are in exploring new and innovative materials for applications in future generation electronics. Imtiaz is working on revolutionary Quantum confined, low-dimensional materials to develop infrared detecting devices and topologically protected super-highways for electronics. He is currently working as a doctoral scholar at University of Western Australia. Before taking this position in Australia, he was working as a post-graduate researcher at Chinese Academy of Sciences in China.
Nanostructured ZnO-based devices for the effective photoelectrochemical splitting of water

Martyn E Pemble¹, Jan Kegel¹ and Ian Povey²

¹University College Cork, Cork, Ireland
²Tyndall National Institute, University College Cork, Ireland

The use of renewable, unlimited solar energy to produce power via conventional photovoltaic technologies or water splitting is now beyond compelling- it is a necessity. When one also considers another critical facing approximately half of the global population- namely the issue of clean water supply- then the development and deployment of efficient solar water splitting devices which can in principle address both the power and water challenges facing humanity, emerges as a key technological priority.

In our laboratories we are studying the development of water splitting devices based not on solar-driven electrolysis; rather we have focused our attention on the optimization of photoelectrochemical water splitting devices that essentially are capable of converting sunlight into $\text{H}_2$ and $\text{O}_2$ in a single photo-driven process. While some researchers have focused on the development of efficient oxygen or hydrogen evolution reaction catalysts for such photoelectrochemical cells, we have focused on the optimization of the initial step in which sunlight energy is absorbed creating excitons which then provide the holes needed for oxygen evolution and the electrons needed for hydrogen evolution.

We have chosen to utilize a cheap, earth abundant material as the photoanode used in this step, namely ZnO. We grow highly oriented arrays of ZnO nanorods from solution and then deposit protective layers of TiO$_2$ over these rods using atomic layer deposition. We show that post-deposition rapid thermal annealing (RTA) at moderate temperatures (350 °C - 550 °C) can be used to create defects that exhibit intense, orange emission. From PL and related analysis, we deduce that an oxygen vacancy-zinc interstitial defect complex ($\text{VO}_\text{Zn}$) is responsible for this luminescence. Furthermore we show that this bulk donor-type defect is found to act as a trap state for photo-generated electrons prolonging the charge carrier lifetime and separation in the bulk of the material. As a result the photo-current density under simulated sunlight is found to increase by 200 % over as-grown samples. The potential use of this defective material in applications such as solar water splitting is outlined.

Biography:

Martyn Pemble received his BSc and PhD degrees from the University of Southampton in 1976 and 1981 respectively. After postdoctoral studies at the University of California at Irvine and the University of East Anglia in 1984 he became a Lecturer at the University of Manchester Institute of Science and Technology. In 1995 he was appointed to the Chair of Physical Chemistry at the University of Salford. In 2004 he joined the Tyndall National Institute, University College Cork (UCC) and in November 2008 was appointed as the Stokes Professor of Materials Chemistry at UCC. He has published ca. 300 papers covering surface spectroscopy, electrochemistry and a wide range of thin film materials growth systems and applications.
Nanotechnology and modern Computational Science play a key role in the energy sector. In the last decades energy demand has risen dramatically. New material, in terms of efficiency and reliability, have been studied and improved. Industry has an important role, not only in prototyping new devices, but also making their development and introduction in the market, on large scale, in sustainably way possible. This presentation focuses on the analysis of the impact of Nanotechnology in strategic energy sectors: nuclear, solar, storage. We will give also some results about recent studies, by mathematical and numerical modeling, of plasmons technology.

Biography:
Dr. Pietro Santagati(Ph.D in Mathematics for Technology), now is Computational Scientist, and Parallel Architecture Specialist, at Amec Foster Wheeler, Clean Energy Europe. He got his M.Sc. in Aerospace and Aeronautics Engineering at Polytechnic of Turin, M.Sc. in Applied Mathematics and Ph.D. in Mathematics for Technology at University of Catania. He has been working in different fields of applied engineering in particular, transport process in nano- and micro-structred materials and reliability analysis in nano-electronics. Currently he is involved in projects on computational applications of modern energy production systems.
Unmanned and uncontrolled: The commingling theory and the legality of unmanned aircraft system operations

Ronald I C Bartsch  
*University of Sydney, Australia*

In 2002 Australia became the first nation to promulgate certification standards for the commercial use of drones or unmanned aircraft systems (UAS). Since that time the Australian Civil Aviation Safety Authority (CASA) has played a key role both domestically and internationally through the International Civil Aviation Organization (ICAO) in assisting to develop technical guidance materials that will enable contracting states to develop UAS regulations. An arduous component of this task is the fact that all existing aircraft are capable of being unmanned. Moreover, given the unbounded nature of aircraft operations, UAS regulations necessarily require international harmonisation. But the objective of developing universal UAS standards is still far from being finalised while the accelerating pace of UAS technological development continues to challenge traditional regulatory regimes and legal systems throughout the world. This paper considers the broader legal issues associated with civilian UAS operations and their integration into unsegregated civilian airspace. The Australian UAS regulatory experience is examined with some unique constitutional limitations identified in relation to the application of the so-called ‘commingling theory’. It is contended that such limitations may render void existing UAS regulation in certain situations – many of which are related to the operation of small UAS and may have significant privacy and security implications. In particular this paper finds that the regulations purporting to control the operation of systems that are not capable of commingling with aircraft operating within navigable airspace are ultra vires and hence of no legal effect. In concluding this paper strongly asserts that if the commercial benefits attendant to UAS operations is to be fully realised then their risks to society must be controlled through domestic legislation that is harmonised and consistent with internationally agreed guidelines promulgated by the ICAO.

**Biography:**

Ron Bartsch has over 30 years’ experience in the aviation industry in a variety of senior legal, regulatory, safety and operational roles. As former head of safety and regulatory compliance at Qantas Airways Limited and a senior manager with the Australian Civil Aviation Safety Authority Ron has been admitted as a barrister in 1993 and has regulatory experience across all sectors of the aviation industry. Ron is also a member of the Administrative Appeals Tribunal as an aviation specialist. As Chairman of AvLaw Ron has provided highly complex technical and legal aviation consultancy services in over 20 nations throughout the world and provided advice on aviation regulatory matters including airlines, airports and aviation safety to the governments of Papua New Guinea, Timor-Leste, Republic of South Africa, Vanuatu and Indonesia. Ron is a Director of Regional Express Holdings Limited and Chair of the Board Safety and Risk Management Committee and a Director of the Australia Association of Unmanned Systems and Director of one Safe Pty Ltd. As an experienced pilot, Ron has in excess of 7,000 flying hours, a current Air Transport Pilot License and ratings on over 30 aircraft types including command endorsements on the Beechjet and Boeing 717. Ron is familiar with both the operational aspects of the aviation system in Australia and internationally and also the legal and regulatory regimes. He also has formal qualifications and degrees in law, education, science and the arts and undertaking PhD studies. Admitted as a Barrister to the High Court of Australia in 1993 Ron has also consulted throughout the world and in the Asia-Pacific region. A former high school mathematics and science teacher, Ron has for the past 20 years been a Senior Lecturer at the University of NSW and is author of numerous publications including the best-selling Aviation Law in Australia (4th Ed), contributing author for the aviation title of Halsbury’s Laws of Australia and author of International Aviation Law.
Synthesis of Ge and Er nanoclusters with superior resistance in harsh environments

David Barba¹, Chao Wang¹, Adrien Nelis², Guy Terwagne², Yiqian Wang³, Federico Rosei¹

¹INRS: Énergie, Matériaux et Télécommunications, Varennes J3X 1S2, Canada
²LARN: Université de Namur, B-5000 Namur, Belgium
³Qingdao University, Qingdao 266071, People’s Republic of China

The operability and durability of erbium and germanium doped fused silica components in harsh environments are limited by thermal diffusion, responsible for structural changes that induce irreversible material degradation and failure. An alternative solution for improving both the thermal and the radiation resistance of these compounds consists of synthesizing Si-, Ge- and Er-based nanoclusters. This technique enables to control atom diffusion, using chemical trapping effects induced by silicon dangling bonds and the pinning of nanoaggregates by silicon nanoparticles during high temperature annealing. Our experimental approach and methodology combine the fabrication of advanced materials by the use of single or multiple ion implantations, with subsequent advanced characterizations by Raman/photoluminescence spectroscopy, transmission electron microscopy, X-ray photoelectron spectroscopy and nuclear analysis. Our work shed light on the nucleation processes of group-IV nanocrystallites, as well as on the formation of nanocavities in Ge-based materials. The nanoclustering of mixed Si/Er and Si/Ge materials is also found to extend the lifetime of near infrared Er light sources exposed to cosmic radiations, and prevent Ge desorption, more than several hundred degrees above heating conditions where drastic outgassing effects occur. High resolution imaging supported by Monte-Carlo simulations and Rutherford Backscattering Spectroscopy measurements shows how the size, the homogeneity, the depth-distribution, as well as the composition and the crystallinity of the formed nanoclusters can be set as a function of the fabrication parameters, in order to design components with specific properties and superior resistance.
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