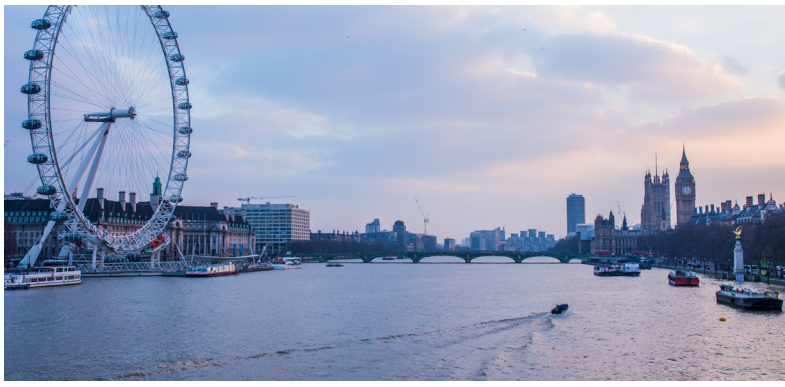
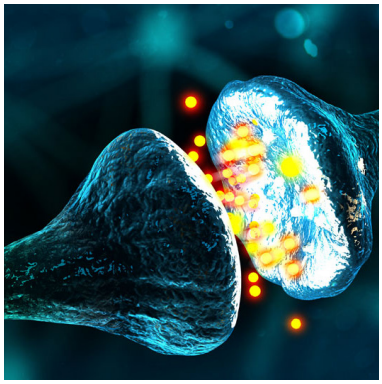
Scientific Tracks & Sessions
October 29, 2018

Nanomaterials 2018

International Conference on

Nanomaterials and Nanotechnology

October 29-30, 2018 | London, UK

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Two decades of commercializing nanotechnology for medical devices: Real products helping real humans

Thomas J Webster
Northeastern University, USA

There is an acute shortage of organs due to disease, trauma, congenital defect and most importantly, age related maladies. While tissue engineering (and nanotechnology) has made great strides towards improving tissue growth, infection control has been largely forgotten. Critically, as a consequence, the Centers for Disease Control have predicted more deaths from antibiotic-resistant bacteria than all cancers combined by 2050. Moreover, there has been a lack of translation to real commercial products. This talk will summarize how nanotechnology can be used to increase tissue growth and decrease implant infection without using antibiotics (while getting regulatory approval). Our group has shown that same nanofeatures, Nano-modifications, and nanoparticles can reduce bacterial growth without using antibiotics. This talk will summarize techniques and efforts to create nanofeatures for a wide range of medical devices and tissue engineering applications, particularly those that have received FDA approval and are currently being implanted in humans.

Speaker Biography

Thomas J Webster joined the chemical engineering department in fall 2012. The primary focus of our research is the design, synthesis and evaluation of nanomaterials for various medical applications. This includes self-assembled chemistries, nanoparticles, nanotubes and nanostructured surfaces. Medical applications include inhibiting bacteria growth, inflammation and promoting tissue growth. Tissues of particular interest are bone, cartilage, skin, nervous system, bladder, cardiovascular and vascular. There is also an interest in anti-cancer applications where nanomaterials can be used to decrease cancer cell functions without the use of pharmaceutical agents. There is also a large interest in developing *in situ* sensors which can sense biological responses to medical devices and respond in real time to ensure implant success. Lastly, there is an interest in understanding the environmental and human health toxicity of nanomaterials.

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Application of nanotechnology for the sustainable building materials

Yunhong Jiang
University of Bath, UK

Environmental and sustainability concerns have driven the building industry to develop new and more durable sustainable building materials. The development of nanotechnology and nanomaterials offers an opportunity for the development of innovative, durable and multifunctional building materials. This article gives an overview of current and near future applications of nanotechnology and nanomaterials in concrete and bio-based building materials aimed at achieving high-performance building for a more sustainable future. In this article the application of nanotechnology in building materials is focused on lighter and stronger structural composites, multifunctional properties of cementitious materials and enhanced hydrothermal properties of bio-based insulation material. Some of these applications are explained in detail, including self-healing and self-sensor concretes, self-cleaning and hydrophobic surface coating and fire protection. After presenting the significance of innovations of nanotechnology in concrete and bio-based materials, the potential environmental and health risks associated with the adoption of this technology are discussed and finally the ISOBIO project is presented as a case study. It proposes an innovative strategy to bring bio-based construction materials into the mainstream. The ultimate goal of the project is to optimize the construction process and create more energy-efficient buildings that will lead to a strengthening of the competitiveness of the European construction sector in the field of "green" construction technologies. The data here would be beneficial to both construction engineering education and research.

Speaker Biography

Yunhong Jiang obtained his PhD (2011) in Chemical Engineering from the University of Leeds, after his BEng (2003) and MSc (2006) from China. He has been working on nanomaterials and bio-based sustainable materials and have extensive research experience in nanomaterials synthesis, materials characterization, sustainable chemistry and functional nanostructure materials. He has published over 20 peer-reviewed journals (h-Index of 11) and one book chapters. He has been invited as a reviewer more than 30 times by 16 different peer-reviewed journals and has been awarded the outstanding contribution in reviewing for composites Part A (2017). He has been serving as an editorial board member of reputed journals.

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Antimicrobial polymer nanocomposites for the health-care sector

Carlos A Ávila-Orta
Centro de Investigación en Química Aplicada (CIQA), México

Copper nanoparticles have been studied as antimicrobial additives for polymers aiming to diminish hospital acquired infections. Different technological challenges have been tackled. On one hand, copper nanoparticles tend to oxidize rendering copper oxide which is highly toxic. Therefore, they usually are coated with amorphous carbon which hinders their antimicrobial effect. On the other hand, copper nanoparticles are not compatible with polymers due to their different surface energy, thus forming agglomerates preventing the dispersion of nanoparticles into the polymer matrices. To solve both problems, their surface is usually modified to make them more compatible with polymers, as well as the use of ultrasound in solution mixtures. Our research group has contributed to solve the above-mentioned challenges. On one hand, thermal decomposition and chemical reduction have been used to synthesize copper nanoparticles. In the case of chemical reduction allyl-amines ligands have been used resulting in copper nanoparticles coated with amine-based polymers. In both cases, a high antimicrobial activity has been obtained with low-toxicity and increases the compatibility with polymers. Besides, plasma polymerization of different gases on the surface of copper nanoparticles also increases their compatibility with different polymers. Finally, the use of ultrasound-assisted melt extrusion methods and ultrasound in the gas-phase help to break down agglomerates improving the dispersion. All the concepts have been used to produce textiles to be used in hospital environment based on core-sheath antimicrobial fibers against *S. aureus*, within a collaborative frame between México and the UK under ACT in Project.

Speaker Biography

Carlos A Ávila-Orta has completed his PhD at the age of 31 years from Centro de Investigación en Química Aplicada (CIQA), México. He had a postdoctoral position at the State University of New York at Stony Brook, USA. He served as the chairman of the Department for Advanced Materials at CIQA, México in the period of 2007-2014 and from 2017 up to date. He has over 80 publications that have been cited over 1800 times and his publication h-Index is 24. He has contributed to 4 book chapters in the fields of X-ray scattering analysis and nanotechnology.

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Nanoscopic metal fluorides: A new world of fluoride-based materials

Erhard Kemnitz
Humboldt-Universität zu Berlin, Germany

The lecture will focus on nanoscopic metal fluorides and hydroxide fluorides prepared via a recently explored fluorolytic sol-gel synthesis approach. Metal fluoride phases obtained via this route exhibit distinctly different properties as compared with their classically prepared homologues. Due to their unique optical and catalytic properties nanoscopic metal fluorides are of great interest for several applications in optical materials, photonics, catalysis, ophthalmology, ceramics etc. An essential pre-condition for their use in these fields is their homodispersed particle sizes on a low nanometer scale. MFn-materials fitting these requirements can be obtained according the so-called "fluorolytic" sol gel synthesis:

M-OR + HF →M-F + ROH (fluorolysis)

These nanoscopic metal fluorides exhibit particle sizes below 10 nm, high specific surface areas ranging from 200 up to 600m^2g^{-1} due to an extremely high degree of structural disorder and hence, show chemical and physical behaviour distinctly different from their classical counterparts. Based on such nano-metal fluorides, excellent catalytic performances have been achieved in several reactions for the synthesis of fine chemicals; corundum ceramics with improved mechanical and optical properties, antireflective layers with almost 100% transmission and new inorganic-organic composite materials can be obtained.

Speaker Biography

Erhard Kemnitz has received his doctoral degree in 1977. In 1988 he became an assistant professor and received a full-time tenure track in 1994, from both at the Humboldt-Universität zu, Berlin. His main research interests cover the synthesis and characterisation of nanoscopic metal fluorides for applications in the field of heterogeneous catalysis, optics, ceramics, surface coating etc. He published about 450 papers, 11 review articles, 12 books and/or book chapters, and filed more than 20 patents. His h-index is 41 and he has been serving as an editorial board member of several reputed Journals.

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Target silica spheres for water purification

Inna Melnyk
Institute of Geotechnics of SAS, Slovak Republic

Current research unites the efforts of the scientists in the synthesis of tailored functionalized silica-based materials, physicochemical characterization of their surface binding properties with valuable experience of their implementation in ecology and nanomedicine. The proposed report is set up to mobilize synergy effects within development of silica materials with predetermined characteristics for successful solution of problems associated with water and soil remediation and public health. The purpose of the present research is to develop smart functional silica materials for water purification (from organic and inorganic pollutants). The specific choice of silica materials is explained by their structural rigidity, mechanical and thermal stabilities (provided by inorganic component) in addition to specificity and selectivity (attributed to organic component). Moreover, the usage of one-pot synthesis makes it possible to regulate the porosity and the nature of the surface layer of such materials to meet the requirements of each application. We used several approaches to regulate the sorptive capacity of materials produced during the synthesis: Regulation of matrix porosity, variation in the functional groups content, incorporation of extra groups with different properties. It was shown that the changes in the synthesis temperature can affect the morphology and zeta-potential of the obtained particles, the content of groups, and the adsorption properties. We studied the adsorption properties of the functionalized silica spheres in relation to copper (II) ions and organic dyes from aqueous solutions. Furthermore, antimicrobial performance of the amine-containing materials that were synthesized was also analysed.

Speaker Biography

Inna Melnyk received her phd in chemistry in 2003 from chuiko institute of surface chemistry, national academy of science of ukraine (kyiv, ukraine). She is a visiting researcher at Institute of Geotechnics of Sas (Kosice, Slovak republic). She has over 70 publications including 2 in journal of material chemistry, 1 in scientific reports, 2 in RSC advances, 1 in separation and purification technology, 1 in journal of colloid and interface science, 1 in progress in solid state chemistry, 4 in microporous and mesoporous materials, 1 in beilstein journal of nanotechnology, 1 in adsorption, 1 in applied surface science etc. Her scientific interests are silica spherical particles, magneto-sensitive adsorbents, surface chemistry, sol-gel techniques and heavy metals adsorption. She is a regular reviewer in reputable scientific journals of elsevier, springer and RCS publishers.

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Hybrid nanomaterials for the next generation energy efficient spintronics

Yongbing Xu
Nanjing University, China

The discovery of novel materials has often propelled progress and breakthroughs in IT industries, which change our everyday lives. Since the discovery of giant magnetoresistance (GMR) effect in metallic nanoscale multilayers (Nobel Prize in Physics, 2007), the first-generation spintronics has already generated huge impact to the mass data storage industries. The next-generation spintronics, on the other hand, focuses on the integration of the magnetic and semiconductor materials and so to add new capabilities to the future energy efficient and fast microelectronics/nanoelectronics. In this talk, I will report recent progresses of the research on a selection of hybrid nanomaterials including those based on ferromagnetic metal (FM) and alloys, half-metallic materials and two-dimensional (2D) materials. FM and alloys have spontaneous magnetization and usually high Curie temperature (Tc), half-metallic materials possess high spin polarization near the Fermi level (EF), and the 2D materials have unique band structures such as the Fermi Dirac cone and valley degree of freedom of the charge carriers. Enormous progress has been achieved in terms of synthesizing the epitaxial hybrid spintronic materials and revealing their new structures and properties emerging from the atomic dimensions and the hetero-interfaces. Apart from the group-IV, III-V and II-VI semiconductors and their nanostructures, spin injection and detection with 2D nanomaterials such as graphene, transition-metal dichalcogenides (TMDs) and topological insulators (TIs) has become a new trend and a particularly interesting topic due to either the long spin lifetime or strong spin-orbit coupling induced spin-momentum locking, which potentially leads to dissipationless electronic transport.

Speaker Biography

Yongbing Xu, director of the Nanjing-York Joint Center in Spintronics and Nano Engineering, Nanjing University, China; chair in Nanotechnology, also heads the Spintronics and Nanodevice Laboratory, The University of York. He was an EPSRC advanced research fellow in Cavendish Laboratory, Cambridge University. His research interests are in the areas of nanomaterials, spintronics and nanofabrication. He has published more than 300 refereed papers in leading academic journals including physical review letters, nature communications, nano letter, advanced materials, ACS nano, scientific reports, applied physics letters and IEEE journals and given many invited talks/seminars at major international conferences including MRS, WUNSPIN, EMN and Intermag. He was editor-in-Chief of "Handbook of Spintronics" by springer and edited the very first spintronics book "Spintronic Materials and Technology" by CRC Press. He had interviews with BBC News24 and new scientists.

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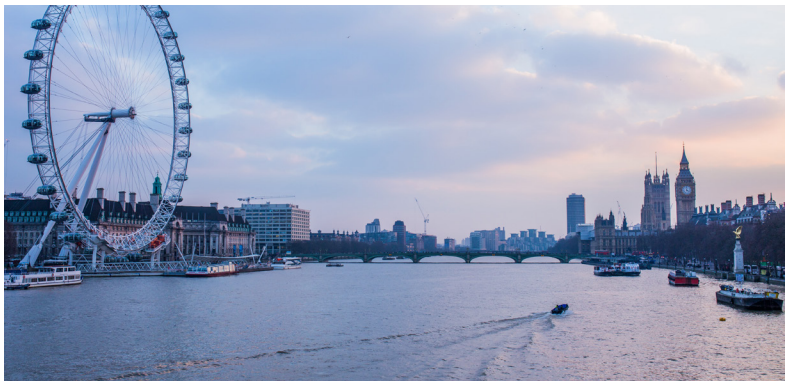


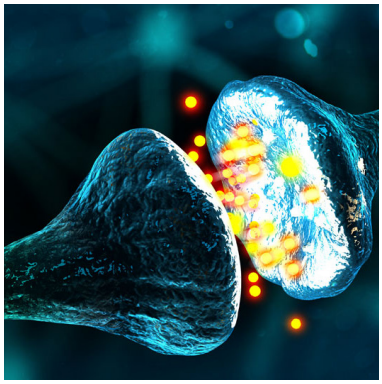

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Synthesis of Al_2O_3-SiO_2 core shell nanomaterials for development of stable nanofluids for thermal energy storage applications

Udayashankar Nithiyanantham
CIC Energigun, Spain

Nowadays, nanomaterials have great revolution for improving the efficiency of different types of renewable energies, which have been identified as a unique source to fulfil the present and future energy demand as well as to contribute to global warming problem. With this regard, concentrated solar power (CSP) technology was considered as a promising solution due to its higher dispatchability thanks to the incorporation of a cost-effective thermal energy storage (TES) system. Currently, the TES system is based on the two-tank-storage technology by using the binary $NaNO_3$-KNO_3 (60:40 wt.%) molten salt, so-called solar salt, as storage media. In the last years, the development of nanofluids, by the addition of minor percentage of nanoparticles to base salt, with enhanced thermophysical properties was investigated. Although nanofluids with enhanced heat capacity and thermal conductivity were achieved when SiO_2 and Al_2O_3 nanoparticles were used, their stability still not yet demonstrated due to the separation with time of nanoparticles from the salt. However, the experiment work made in our facilities demonstrated different behaviours of these nanomaterials where a settle down of SiO_2 nanoparticles and a floating of Al_2O_3 nanoparticles were observed, which may due to the density difference between liquid molecules and nanoparticles. However, the development of advanced mixed nanoparticles becomes of high importance in order to improve the nanofluid stability. The present research work is focused on development of stable nanofluids based on inorganic salts, by the addition of advanced Al_2O_3-SiO_2 core shell nanomaterials with different densities obtained by changing the alumina to silica ratio. The formation of the core shell structure was initially confirmed by TEM and FTIR analyses. The nanofluids thermophysical properties enhancements were studied by DSC, LFA and rheometer techniques. Finally, their stability was investigated by TGA and long-term stability tests in the furnace.

Speaker Biography

Udayashankar Nithiyanantham is pursuing his PhD degree in Physics at University of Basque Country (UPV/EHU). The research work of his PhD, which is under development at CIC Energigune, is focused on to the synthesis, characterization of inorganic molten salts based nanofluids and their potential applications in medium and high temperatures thermal energy storage applications.

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Graphene based point of care diagnostics and therapeutics

Jacob Mitchell
Swansea University, UK

Graphene is a 2D material with unique electrical and mechanical properties. Graphene devices and sensors promise to be a disruptive technology in next generation electronics and sensors - due to graphene's exceptional electronic properties and aptitude for chemical modification. Novel graphene sensor technology used to develop sensors, based on chemically functionalised graphene microchannels, and their application in lab-on-chip POC (Point-of-Care) diagnostics will be presented. There are several advantages of graphene sensors over alternative sensor platforms such as carbon nanotubes (CNTs) or silicon nanowires (SiNWs). The main benefits of graphene for sensing applications will be highlighted in a comparison with other materials. Important considerations for processing of samples using microfluidics and lab-on-chip technology will be discussed. The latest developments in integration of diagnostics with therapeutics, "theranostics", will be presented – including microneedle sensors. Microneedles (MNs) are tiny microscopic needles, much smaller than conventional hypodermic needles, that can be used to deliver pharmaceutical drugs or vaccines through the skin into the body in a minimally invasive manner. Targeted delivery to the layers just beneath the outer surface of the skin (the stratum corneum) can be used to achieve much more effective drug or vaccine delivery. We are now combining diagnostics with therapeutic MNs. The pros and cons of different MN materials, fabrication techniques and designs will be reviewed. The sharpness of the MN tips is critical to their effective skin penetration. A novel "bevelled tip" MN design is presented which allow sthe MNs to penetrate the skin with lower insertion forces. In addition, hollow MNs have been developed – which can be used to inject significant volumes substances into the skin, compared to coated solid MNs. A review of vaccines, drugs and other entities that can be injected into skin will be presented, along with a discussion of MNs in diagnostic, therapeutic and cosmetic applications.

Speaker Biography

Jacob Mitchell is currently pursuing his PhD in Swansea University, United Kingdom.

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