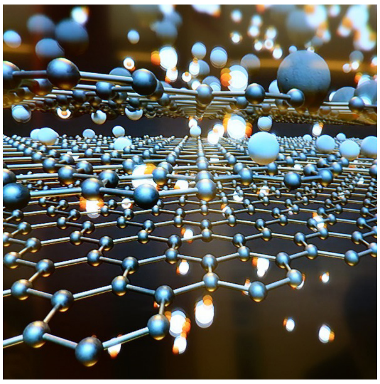
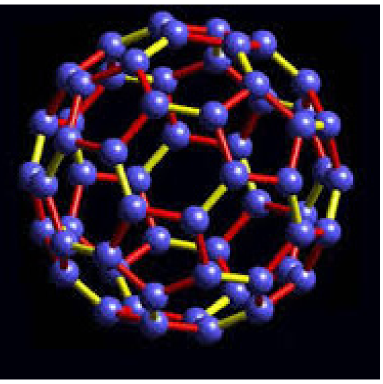
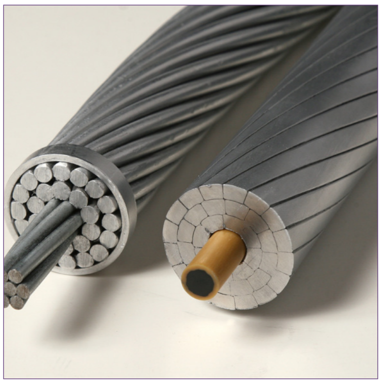
Keynote Forum
March 20, 2019

Materials Chemistry 2019







2nd International Conference on

Materials Science and Materials Chemistry

March 20-21, 2019 | London, UK

Ian Walker

Clemson University, USA

Continuum robot trunks and tentacles

This talk will provide an overview of research in biologically inspired continuous backbone "trunk and tentacle" continuum robots. Continuum robots are an emerging form of robot structure, featuring smooth backbones. These structures can be formed using a variety of materials and actuation techniques. Often inspired by structures in biology including the trunks of elephants and the arms of octopuses, these robots are inherently compliant. This allows them to adapt to their environments and to penetrate congested spaces where traditional robots cannot.

Continuum robots have found application in a variety of medical procedures. However, their modeling, sensing, and control present novel, interesting, and significant challenges. In the talk, continuum robots inspired by octopus arms and plants (vines) will be discussed. Use of these robots for novel inspection and manipulation operations, targeted towards Space-based operations, will be discussed.

Speaker Biography

Ian Walker received the B.Sc. in Mathematics from the University of Hull, England, in 1983 and the M.S. and Ph.D. in Electrical and Computer Engineering from the University of Texas at Austin in 1985 and 1989. He is a Professor in the Department of Electrical and Computer Engineering at Clemson University, USA. He is a Fellow of the IEEE and an Associate Fellow of the AIAA.

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Leon L Shaw

Maziar Ashuri and Qianran He

Illinois Institute of Technology, USA

Coating as a potent method to enhance the specific capacity, charge rate and cycle life of cathodes for next-generation Li-ion batteries

$LiCoO_2$ is the major cathode material for Li-ion batteries (LIBs) since 1992 because it excels in many electrochemical properties. However, recent research efforts have been devoted to the development of $Li(NixMnyCoz)O_2$ where x + y + z = 1 (NMC) because of the high price of Co and the high specific capacity from NMCs. In spite of their cost and capacity advantages, NMCs exhibit significant capacity decay during charge/discharge cycles. It is found that most of the capacity decay mechanisms start at the particle surface. As a result, proper coatings can improve the cycle stability of NMCs. With this in mind, we have investigated a new wet-chemical method to coat nano-$LiCoO_2$ (LCO) particles and micro-$Li(Ni_{0.5}Mn_{0.3}Co_{0.2})O_2$ (NMC532) particles. In this newly-developed wet-chemical method, $Al(NO_3)_3$ is used as the Al source to form Al_2O_3 and $LiAlO_2$, whereas $LiNO_3$ is used as a sacrificial agent to protect LCO and NMC particles and at the same time to form $LiAlO_2$ by reacting with Al_2O_3. Addition of $LiNO_3$ into the $Al(NO_3)_3$ coating solution suppresses the unwanted formation of Co_3O_4 during the coating process and leads to a thin (5–10 nm) and continuous $LiAlO_2/Al_2O_3$ coating. $LiAlO_2/Al_2O_3$-coated nano-LCO exhibits an unusually high initial specific capacity of 225 mA hg^{-1}, while micro-LCO can only deliver a specific capacity of 145 mA hg^{-1}. For NMC532, the initial specific capacity has been increased from ~160 mA hg^{-1} to above 200 mA hg^{-1}. In addition, the charge/discharge cycle stabilities of both LCO and NMC532 have been improved substaintially. Furthermore, the rate capabilities of both LCO and NMC532 have been enhanced as well. The unusually high specific capacity and superior capacity retention for long cycle life at high rates for both $LiAlO_2/Al_2O_3$-coated LCO and NMC532 are attributed to the effectiveness of $LiAlO_2/Al_2O_3$ coating in preventing capacity decay during battery soaking as well as during cycling. The principle and methodology of this newly-developed wet-chemical coating method are applicable to other layered transition metal oxide cathodes and can open up new opportunities to obtain superior electrochemical properties from these advanced cathodes in the near future.

Speaker Biography

Leon L Shaw is Rowe family endowed Chair Professor in sustainable energy and professor of Materials Science and Engineering at Illinois Institute of Technology (IIT), Chicago, USA. His main research interest is in nanomaterials synthesis and processing for energy storage and structural applications. In the arena of energy storage, his research team has worked on various anode and cathode materials for Li-ion batteries, Na-ion batteries, supercapacitors, and hybrid redox flow batteries over the last decade. He has authored and co-authored more than 290 archival refereed publications with 8,000 plus non-self citations (according to Google Scholar). He is a Fellow of ASM International, a Fellow of the World Academy of Materials and Manufacturing Engineering, Poland, and a member of the Connecticut Academy of Science and Engineering.

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Vladan Koncar

University of Lille, France

Smart textiles and their applications in different areas

Smart textiles, encompassing electronics combined with textiles also called textronics or e-textiles, have a very promising realm in science and technology nowadays because of commercial viability and public interests. Smart textiles play a significant role as well in the European textile sector and assist the textile industry in its transformation into a competitive knowledge driven industry. Numerous materials and systems are available together with devices for sensing and actuation, but they are not compatible with a textile or with the textile production processes. They could be transformed into a textile compatible structure or even in a full textile structure.

Smart textiles can be defined as textiles that are able to sense and respond to changes in their environment.

They are able to detect different signals from the environment (temperature, light intensity, pollution...), to decide how to react and finally to act using various textile based, flexible or miniaturized actuators (textile displays, micro vibrating devices, LED, OLED...). The "decision" can be taken locally in case of embedded electronic devices (textile electronics) to smart textile structures or remotely in case the smart textile is wirelessly connected to clouds containing data base, servers with artificial intelligence software etc. and may be a part of Internet of Things (IoT) concept.

This study focusses on research results concerning:

-e-textiles for medical applications (Actinic Keratoses Photo Dynamic Therapy and ECG monitoring and diagnostics in real time),

-Flexible displays based on electrochromic reaction for car dash boards,

-New generation of meta materials for energy harvesting and data transmission and on

-Fibrous sensors embedded to composite structures for Structural Health Monitoring in real time, in situ.

Speaker Biography

Vladan Koncar is Distinguished Professor at ENSAIT (Ecole Nationale Supérieure des Arts et Industries Textiles) an engineering institute in Roubaix, France – at University of Lille. He obtained his PhD in 1991 at the University of Lille in Villeneuve d'Ascq from November 2009 to November 2015 he was Head of Research at ENSAIT and Director of GEMTEX research laboratory. Koncar was AUTEX (Association of Universities for Textiles) President from June 2007 to June 2010. Koncar has also been Director of ENSAT International Relations from 2007 to 2009. He still serves as an elected member of ENSAIT Governing Board. He has been promoted Doctor Honoris Causa of the University of Iasi, Romania in January 2010. Koncar is author of more than 250 scientific articles (ISI Web of science referred, book chapters, conference proceedings and patents). His research interests cover the area of flexible textile sensors and actuators, smart textile structures and modelling and control of complex systems.

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Notes:

Magnus Willander

Linköping University, Sweden

Materials science for chemical sensing and renewable energy

Converting mechanical energy to electrical energy will be discussed from piezoelectric and triboelectric point of view. I will talk on our material synthesis as well as our devices and their applications we have developed. In these areas a strong progress has been going on for 5 to 10 years mainly because development of different nanomaterials. A second topic is electrochemical and photochemical creation of hydrogen and hydrogen peroxide as future energy fuels. Finally, chemical sensors based on different nanomaterials and substrates is discussed.

Speaker Biography

Magnus Willander has a PhD from Royal Institute of Technology, and has been chair professor in Gothenburg University and Linköping University. He has been visiting professor/visiting scientist in many countries. He has also been working in big companies like Philips etc with developing new technologies. He has started up several entrepreneur companies. He has given numerous invited/keynote talks around the world. Willander has around 20 000 citations, H-index=60 and more than 1000 scientific paper (Google Scholar). Also Magnus Willander has supervised 55 students to their PhD degrees.

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Patricia de la Presa

Complutense University of Madrid, Spain

Magnetic nanoparticles for hyperthermia cancer treatment: A review on the most recent advances

The magnetic nanoparticles can act as local nano-heaters for hyperthermia cancer treatment under a contactless action of a radiofrequency field. Though the concepts of magnetic fluid hyperthermia (MFH) were originally proposed over 50 years ago, the technique has yet still several challenges to overcome before it can be successfully translated into a routine clinical application. Among the challenges to be addressed is the determination of the optimal fields and frequencies that maximize the treatment and diminish the side effects. This optimal radiofrequency field strongly depends on the physicochemical properties of the nanoparticles such as composition, size, shape, magnetic properties, aggregation degree, coating, media viscosity, among others. In this talk it will be discussed on the current state of the art of MFH, the advances in the design of the nanoparticles, the most promising materials so far, and some of the most important results made in-vitro cell experiments.

Speaker Biography

Patricia de la Presa has completed her PhD at the University of La Plata, Argentina. After six years as assistant researcher at the Universities of Goetting and Bonn, Germany, she moved to the Instituto de Magnetismo Aplicado at the Complutense University of Madrid (UCM), Spain. At present, she is professor at the Department of Materials Physics (UCM) and works on physical properties of magnetic nanoparticles for technological applications. She has over 70 publications that have been cited over 1100 times with H-index of 18 and has supervised several PhD theses besides Master theses from worldwide students.

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Notes:

Miho Yamauchi

Kyushu University, Japan

Inorganic nanocatalysts for efficient power storage into liquid

Establishment of an efficient method for distribution of electric power is a key to realize a sustainable society which is driven with renewable-energy-based electricity. We demonstrate highly efficient power storage using an alcohol/carboxylic acid redox couple. Glycolic acid (GC), a monovalent alcoholic compound and oxalic acid (OX), a divalent carboxylic acid, are focused as a redox couple due to their stability and transportability as energy-storage media. We achieved high Faradaic efficiencies for the production of GC from OX on ubiquitous TiO_2 catalysts under mild conditions. The most desirable characteristic of this electro-reduction is the suppression of hydrogen evolution even in acidic aqueous media. TEM-EELs mapping for TiO_2 catalysts revealed that whole grain of an active catalyst is composed only of an anatase phase whereas a rutile phase forms on the surface of an inactive one, which suggests that detailed structural control is significantly predominant in this process. Recently, we succeeded in the production of GC via the electrochemical reduction of OX with the help of renewable light energy and continuous GC production using a polymer electrolyte alcohol electrosynthesis cell (PEAEC) for the first time.

Speaker Biography

Miho Yamauchi received her PhD in 2001 from Tsukuba University, Japan. She is currently a professor and principal investigator of catalytic materials transformation division in WPI International Institute for Carbon-Neutral Energy Research (WPI-I2CNER), Kyushu University, Japan.

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Muataz Ali Atieh

Hamad Bin Khalifa University, Qatar

Nanofluids as an advanced heat transfer fluid

Heat transfer fluid is one of the critical parameters that affects the cost and size of thermal systems. Different research groups around the world have acknowledged the need to develop new classes of fluids with enhanced heat transfer capabilities. Many researchers have developed nanofluids using nanoparticles, and they have shown a significant enhancement in heat transfer. Due to their high thermal and physical properties, the addition of nanomaterials can remarkably improve the thermo-physical properties of a base fluid. Such a fluid contains suspended nanoparticles called "nanofluids". Nanofluids are a new generation of liquids used for heat energy transport and can be employed as heat transfer fluids in heat exchangers in place of pure single-phase fluids. The most important reason for enhancing nanofluids' heat transfer is to accommodate high heat fluxes and then reduce the size and cost of thermal systems, thus conserving energy and materials. In the last several years, many researchers have attempted to develop heat transfer enhancement methods. Many nanomaterials, such as Cu, CuO, Al_2O_3, SiO_2, CNTs and graphene have been used to improve the heat transfer properties of the base fluid. Carbon nanomaterials have gained significant attention over the last decade where the most eye-catching features of these structures are their thermal properties, which can permit future applications in thermal science and engineering. CNTs and graphene nanoparticles have unusual heat transfer properties. In the lengthwise direction, they show excellent heat transfer performance. They also possess remarkable thermal properties with ultra-high thermal conductivity (2000–3000 $Wm^{-1}K^{-1}$), which is much higher than those of metallic nanoparticles. CNTs and GN can be dispersed homogenously in conventional heat transfer fluids. Recent research has demonstrated that there is a substantial increase in the thermal conductivities of different CNT nanofluids in comparison to their base fluids. In general, research on CNTs and GN nanofluids has blossomed in many different directions and has attracted a great deal of attention.

Speaker Biography

Muataz Ali Atieh is a Full Professor at Colleague of Science and Engineering (CSE), Hamad Bin Khalifa University (HBKU) and Senior Scientist at Qatar Environment and Energy Research Institute (QEERI), Qatar Foundation. He received his Ph.D in Chemical Engineering from University Putra Malaysia in 2005. His research focuses on the production of different types of Micro and Nano materials using physical and chemical techniques for different applications. These materials is used in different applications that include, water treatment, membrane fabrications, heat transfer, nanocomposite, polymerization reaction and Nanosensors. He is the inventor of 14-awarded USA patents. He published more than 113 peer-reviewed ISI articles, and 50 conference proceedings with total citations of about 3400 and 31 h-index.

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Notes:

Shahrom Mahmud

Universiti Sains Malaysia, Malaysia

Biological photo-toxicity of nanomaterials towards unwanted living cells

Potential applications of nanomaterials in biomedicine are based on their biocompatibility and inherent nature of selective cytotoxicity against unwanted living cells such as hazardous bacteria, cancer cells and pathogenic fungi, whereby healthy human cells should not be harmed. In order to protect human cells from being harmed, most in-vitro studies reported that uncoated nanomaterial concentration of less than 5 mM is the required concentration that can cause major cell injury towards hazardous bacteria. In recent years, there has been great interest in using light-sensitive nanomaterials with unique optical properties that offers much better toxicity efficacy under a specific light wavelength irradiation at a low applied power. This photo-toxicity effect offers a special flexibility and selectivity by causing a serious cell damage only when the nanomaterials are localized in the unwanted living cells and then illuminated with a suitable wavelength without affecting surrounding normal tissue. Exposing light-sensitive nanomaterials under localized light irradiation with specified wavelengths in the biological micro-environment can induce strong photo-catalysis that produces immense photo-generated charges (negative electrons and positive holes). These photo-generated charges promote a series of photo-chemical reactions that generate a highly cytotoxic reactive oxygen species (ROS) that can kill the targeted unwanted cells. ROS and dissolved metals ions are known to cause cell injury including destruction of cell integrity, damage of cell wall/membrane and destruction of cellular components (lipids, DNA and proteins). The present session will cover a review of photo-toxicity of nanomaterials, probable toxicity mechanisms and future trends, and some sharing of a research experience on animal and human studies relating to light sensitive-ZnO nanomaterials.

Speaker Biography

Shahrom Mahmud obtained a BSc. degree in Materials/Ceramic Engineering from Iowa State University (Dec 1986) and MSc (2004) & Ph.D. (2008) degrees from Universiti Sains Malaysia. Having worked as an Engineer for a decade in MNCs (Thomson, Sumitomo, Nippon Steel, Acme, Rolnic, IBM), Mahmud was involved in the manufacturing, development and research of many products (about 1 billion electronic components & ceramics) including magnetic ferrite cores, MW filters, metal oxide varistors, CERDIP alumina substrates and ceramic tiles. As an academic, he has taught over 20 subjects on mathematics, science and engineering in many offshore degree programmes (Aussie, UK, American) and USM programmes (BSc, MSc, Ph.D.). His research areas are transdisciplinary involving nanomaterials, optoelectronics, bacteriology, anti-cancer, bio-composites and nano-fertilizers. Apart from publishing over 100 publications, Mahmud has received about two dozen awards in research & innovation and recently obtained one single-inventor patent. His research team, Zinc Oxide Research & Innovation (ZORI), has been actively engaging in transdisciplinary research in that ZORI team has published about 80 ISI papers with total IF>110 and produced three innovative products that won three gold medals. For six consecutive years, he has served as the Chief Judge of one international innovation competition.

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Ani Binti Idris

Ngadiman N H A** and **Yusof N M

Universiti Teknologi Malaysia, Malaysia

3D Biofabrication of polyvinyl alcohol/maghemite nanofiber scaffold for hard tissues

The development of scaffolds has been possible by adopting processing techniques such as electrospinning which is simple, versatile and has the capability to produce nanofibers. The spun nanofibers have submicron diameters structures that mimics the extracellular matrix (ECM) of natural human tissue. The limitation with electrospinning lies in the scaffold thickness and strength due to the nature of the process. Thus, in most cases a combination of two or more processes in series is adopted to overcome the problems. Processes such as fused deposition modelling (FDM), three-dimensional (3D) printing and vapor sintering are some of the options available. In some cases, the electrospinning collector is redesigned and modified, the cold plate collector is used instead of the rotating collector. In this particular study, polyvinyl alcohol (PVA) which has good mechanical, chemical and thermal stability is combined with maghemite nanoparticles whose function is to enhance cell growth. The fundamental corrugated shape was produced via fused deposition modelling (FDM) 3D printing using commercialized PVA (partially hydrolysed PVA) as the filament material which ultimately becomes the template for the next step. The formed template was then placed into the mould packed with the required fully hydrolydsed PVA/maghemite (γ-Fe_2O_3) solution. Upon solidification the whole structure was submerged in water where dissolution of partially hydrolysed PVA template occurred. The new 3D formed structure which takes the shape of the template was then further layered with electrospun PVA/maghemite (γ-Fe_2O_3) nanofibers by placing onto the rotating collector of electrospinning machine. The resultant final 3D scaffold possessed both milli and microporous internal structure with a nanoporous external structure due to the electrospun layer. Mechanical analysis revealed sufficient compressive strength greater than 75MPa and a Young's modulus of approximately 1.5 GPa, which satisfies the anticipated range for hard tissue engineering scaffolds. In vitro test revealed human fibroblast cells can grow well inside and outside the 3D scaffold indicating cell growth is facilitated as intended.

Speaker Biography

Ani Binti Idris is a Professor in the Department of Bioprocess and Polymer Engineering, Faculty of Chemical and Energy Engineering at Universiti Teknologi Malaysia and also holds a cross appointment as a Fellow in Institute of Bioproduct Development. She is also a founder of MEMTEC PLT a spinoff company of Universiti Teknologi Malaysia. She was awarded as Malaysia Top Research Scientist in 2015. She is a Chartered Chemical Engineer and also a Professional Engineer. She has published more than 140 impact factor journals relating to her research area, obtained over 2253 citations, H- index 26 and has 6 patents granted.

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Ting Yu

Nanyang Technological University, Singapore

Light-matter interactions in 2D Materials

Two-dimensional (2D) materials, such as graphene and monolayer transitional-metal-dichalcogenides (TMDs), have aroused great attention due to the underlying fundamental physics and the promising atomically-thin optoelectronic applications. Optical properties of these 2D materials are fundamentally interesting such as magneto-phonon resonance in graphene and strong excitonic emission in monolayer WS2. Meanwhile, development of practical optoelectronics based on 2D materials is very promising, which opens many opportunities for the next-generation light-emitting applications such as valley light-emitting diodes and on-chip vertical-cavity surface-emitting lasers (VCSELs). Here, we report observations of magneto-phonon coupling effects in graphene layers, wealthy excitonic emission states of monolayer WS2, and 2D semiconductor lasing from monolayer WS2 embedded VCSELs. Overall, our studies provide many new understandings on fundamental light-matter interactions in atomically thin materials and pave ways to develop industrially attractive light-emitting applications based on 2D semiconductors.

Speaker Biography

Ting Yu received his PhD in Department of Physics, National University of Singapore in 2003 and currently is a Professor in Division of Physics and Applied Physics, Nanyang Technological University, Singapore. His research interests cover fabrication of low dimensional, especially 2D materials and investigation of their optical, optoelectrical and electrochemical properties for developing novel electronics, optoelectronics and energy conversion/storage devices. Yu has published more than 260 SCI papers and received over 18,500 non-self-citations. His H-index is 75.

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Notes:

Huseyin Kursat Celik[1]

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A potential research area under shadow in engineering: Agricultural machinery design and manufacturing

Today, as a branch of global machinery industry, the agricultural machinery design and manufacturing or agricultural engineering industry has become one of the most important industries to be supported and focussed on in the era of hunger threats foreseen in the world's future. Increasing world populations can be considered as the key trigger on this issue. Global food/agricultural production has become vitally important as the current world population is rapidly increasing and is expected to reach 8.5 billion by 2030, 9.7 billion in 2050 and 11.2 billion in 2100. In order to produce sufficient volumes of food from current limited agricultural land, well-designed machinery and high technology-supported mechanisation of the agricultural production processes is a vital necessity. However, although novel improvements are observed in this area, they are very limited, it is seen lack of implementation of advanced engineering design and manufacturing technologies in this industry (relative to the other machinery industries) therefore agricultural engineering research area can be considered as a potential engineering research area under shadow. Most especially, this area suffers from a lack of professional leadership and management in modern machinery technology, and the ability to tackle problems in optimal design and manufacturing issues. This study aims to highlight the potentials, gaps, sector specific challenges and limitations of the agricultural engineering research area in macro level. In the study some of the key statistics related to agricultural production and agricultural machinery market in global range have been presented and focused on Turkey's current situation as this industry and research area in Turkey shows promise because of the agricultural production potential of the country. Under consideration of the sector specific indicators, the study revealed the major result: Insufficient level of sector-specific research on implementation strategies for up-to-date design and manufacturing technologies.

Speaker Biography

Huseyin Kursat Celik completed his BSc and MSc degrees at the Department of Mechanical Science Education in Kocaeli University (Turkey). He completed his Ph.D. study at the Department of Agricultural Machinery in Akdeniz University (Turkey). His main research interests are related to Computer Aided Design & Engineering, Engineering Simulations, Finite Element Method, Structural Optimisation, Material Testing, Experimental Stress Analysis, Design of Agricultural Machinery / Equipment, Reverse Engineering and Additive Manufacturing Applications. He has excellent professional/ practical experience in machinery design - manufacturing industry and academia for more than ten years. He has been certified as an advanced user for related engineering design and simulation software. He has taken part in funded scientific industry jointed research projects in Turkey and in the UK (Lancaster University) and he has more than 60 published papers in the peer-reviewed journals, congress/conference proceedings and industrial magazines both in national and international scientific arenas. He is a member of academic staff in Akdeniz University in Turkey and he has been a visiting researcher on a yearly basis at Lancaster University in the UK since 2009.

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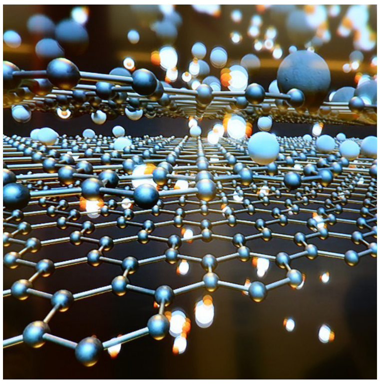

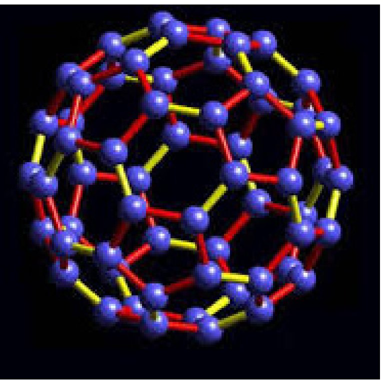

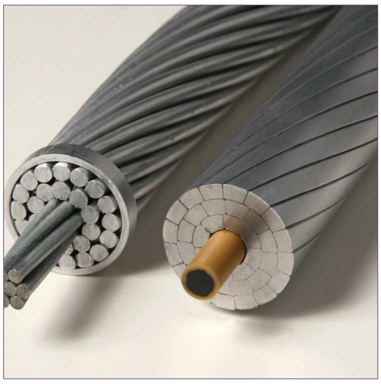

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Shuang Fang Lim

North Carolina State University, USA

Upconversion nanophotonics : Photophysics, simulations, and applications

Nanophotonics localizes an optical phenomenon with small metallic particles. The effect is largest at a plasmon resonance. Plasmonics use resonances of the density of surface electrons with an incoming field to locally enhance the electric field strength. This increases the optical interaction in that small volume of space where the resonance is taking place. These plasmon resonances can be tuned by particle size and shape, or by gold coating thickness. A key manner in which nanophotonics can control an optical interaction is that the metal increases the local photon density of states (LDOS), so photon transition rates are sped up while phonon (non-radiative) rates remain fixed.

Rare earth ion doped upconverting nanoparticles are excited in the near infrared (NIR) and fluoresce via anti-Stokes emission in the visible energy range (400-650 nm). The NIR light provides large penetration depth of excitation, while the particles exhibit no blinking, and high signal-to-noise ratio due to zero tissue autofluorescence. In addition, since upconversion is a two-photon fluorescence process, it has the same ability as other 2-photon fluorescence microscopies to resolve the 3-dimensional structure of objects. In the co-doped rare earth ion upconverter system studied here, the Ytterbium and Erbium dopant couple, the upconversion occurs through an energy transfer upconversion (ETU) process, where the Yb^{3+} ion transfers its energy to the Er^{3+} ion. Despite using a real rather than virtual intermediate state, the brightness and upconversion efficiency of these nanoparticles is not comparable to that of semiconductor nanoparticles and dyes. The down-scaling of particle size also leads to a rapid loss of brightness. This has been attributed to the low absorption cross-section of the rare earth ion dopants. That is because transitions to the inner 4f-shell levels in rare earth ions are only very weakly allowed; hence their absorption coefficients are very small, limiting their maximum emission intensities. Although that shortcoming is partially compensated by its zero background fluorescence and its non-blinking and non-bleaching properties, we show that plasmonics lead to 1) local field enhancements that increase the absorption and emission efficiencies, and 2) a large anisotropy in the fluorescence yield if illuminated with polarized light. The emission is dependent on the particle orientation and is also polarized and directional.

Upconversion nanostructures are optimized with predictive finite element modelling (derivation of the LDOS) and correlated structural and optical single nanoparticle spectroscopy is performed to explore the influence of the nanostructure orientation, and geometry on the time scale of the optical transitions. Isolation at the single particle level allow for establishment of quantitative relationships between the crystal architecture and orientation that control emission properties, to enable direct comparisons with other lasing systems and allow for rational engineering. The single particle results are also more consistent with finite element calculations, without having to correct for anomalies generated by ensemble measurements.

The optimized nanostructures can potentially be applied in an array format in a display, quantum computing or in solar harvesting devices.

Speaker Biography

Following completion of a Ph.D. at the University of Cambridge, UK, 2004, Shuang Fang Lim served in a postdoctoral Research Position at Princeton University from 2004-2008. Her work there focused on upconverting nanoparticlels (UCNPs) and the synthesis, photophysics and bio-applications of nanoparicles. Following this assignment, she then served as in a postdoctoral position for one year at NC State University and then in a Research Assistant professor position for three years before accepting a Professor appointment staring in the fall of 2012.

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Thomas J Webster

Northeastern University, USA

Two decades of commercializing nanomedicine: From medical devices to drug carriers to implantable sensors

Nanotechnology is revolutionizing the field of medicine. While several decades ago, there were not many nanotechnology-derived medical devices approval by regulatory agencies (such as the FDA), today there are over a dozen today. This keynote talk will cover reasons why one should consider using nanotechnology for medical devices to improve tissue growth, decrease infection and reduce inflammation- all criteria necessary for the next generation of improved medical devices. It will cover several examples of FDA approved materials. It will also look towards the future and describe how nanotechnology is being used in the generation of implantable nanosensors that can assess tissue responses to implants, send such information to a cell phone, and have an implant that responds on-demand to detrimental biological events.

Speaker Biography

Thomas J Webster's degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995) and in biomedical engineering from Rensselaer Polytechnic Institute (M.S., 1997; Ph.D., 2000). Webster has graduated/supervised over 189 students and has published over 583 peer-reviewed literature articles forming 11 companies with 5 FDA approved implants. Webster currently directs or co-directs 5 centers in the area of biomaterials and is a fellow of 6 academic societies. He has appeared on numerous news channels and the recent special "Year Million" TV series on National Geographic talking about the future of medicine and science.

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Haider Butt

University of Birmingham, UK

Printing nanostructures on contact lenses for wearable diagnostics

The key challenge for producing nanostructures based commercial healthcare applications is the scaling up of the fabrication process. We present the fabrication of dye based nanostructures by using the fast and commercially viable method of holographic laser ablation. In this method we use a single beam of a nanosecond laser, which after reflecting from a mirror self-interferes. This results in an interference pattern which can be used to ablate well-ordered gratings in thin films. The period of the grating is determined by the incident wavelength (λ) and tilt angle (θ) of the sample with respect to normal incidence. In this manner we recorded various holographic nanopatterns onto transparent substrates, such as glasses and commercial contact lenses. Using this quick, scale and economical method we produced several wearable contact lens sensors. 1,2 These contact lens based holographic sensors can be used for monitoring the eye curvature and pressure of glaucoma patients. The holograms can also be functionalized to sense glucose concentrations in the tears of diabetic patients. The findings have been reported in highly reputable journals 1,2 and have also received a lot of media attention. The approach was also extended into 3D patterning by ablating 3D assemblies of Ag nanoparticles within polymer media.3 Through laser ablation, ordered 3D geometries/patterns were written within the polymer layers. These reconfigurable geometries act as holographically recorded optical devices.

Speaker Biography

Haider Butt is a Senior Lecturer at the University of Birmingham, UK, where he is leading a nanophotonics group with particular interests in healthcare technologies. Previously he was a Henslow Research Fellow at the University of Cambridge, from where he also received his PhD in April 2012. He has published over 100 peer-reviewed journal papers and around 40 conference publications. His research work has received substantial recognition in the form of awards and media interviews. He has secured several prestigious research awards include Philip Leverhulme Prize.

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Notes:

Owen J Guy

Swansea University, UK

Development of graphene sensing platforms for real time diagnostics

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. Real time sensing using graphene Field Effect Transistors (FETs) will be presented. Important considerations for processing of samples using microfluidics and lab-on-chip technology will also be discussed, including developments in integration of diagnostics with therapeutics, "theranostics".

Speaker Biography

Owen J Guy, is the Head of Chemistry and Director of the Centre for Nanohealth (CNH) at Swansea University. CNH is a unique facility applying device fabrication & semiconductor processing to healthcare problems in collaboration with industry. His group has 15 years' experience in device fabrication (silicon, graphene & MEMS technology). He has developed graphene and microfluidics technology through EPSRC, Innovate UK and Marie Curie projects at Swansea,with a current £1M Newton fund project developing sensors for hepatitis. He has more than £17 million grant funding since 2012 and has published 60 papers and holds 2 granted patents.

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Fargin Evelyne

University of Bordeaux, France

Glass surface engineering by thermal poling: Chemistry under field and design of surface electro-activity and optical properties for sensing

Surface engineering of optical glasses has been performed by thermal poling and the correlation between the local modification of the glass composition and the local structure of the field-induced modified surface has been investigated and controlled. Surface mechanical properties and durability can be affected, as well as optical properties, leading to numerous potential applications for sensing. The original approach is to spatially control the glass surface electro-activation at the microscopic level. Such a method allows manipulation of high static electric fields implemented within the glassy matrix just below the surface using a designed micro-patterned electrode. Preliminary results demonstrate the capability of this thermo-electrical imprinting process to modify the sign and the strength of the surface potential of glass down to the micrometer scale. A modeling approach has been proposed enabling to tailor the geometry and distribution of the frozen-in electric field. These preliminary results are unique and open the way for an electro-active surface chemical engineering on materials of great interest for applications in the Visible-IR domain like GRIN lenses or. Bio-selective reactivity, for respectively optical and biosensing.

Speaker Biography

During 30 years in the University of Bordeaux, Fargin Evelyne has focused her research interests on - Nonlinear optical properties of glasses- Surface Glass structuring by poling - Heavy glass oxides for fiber applications- Laser-induced defects in glasses - Multiscale crystallization in amorphous transparent glass materials (over 120 publications, 3 patents, H-index=21). She has International Involvement on Research and Education programs in the University of Bordeaux as International Partnership Coordinator of the Lasers and Photonics Graduate School in Bordeaux EUR LIGHTST and Training Coordinator of the LaPHiA Center of Photonics.

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Eduardo A Brocchi

Pontifical Catholic University of Rio de Janeiro, Brazil

Synthesis by hydrogen reduction and characterization of nanoparticles content CuNiCo alloy

Metals and alloys are of great technological interest which may even increase if they are nanostructured and, then, it can be found in the literature many proposed chemical synthesis methodologies in order obtain different kind of nanoparticles content materials. Under this subject the main objectives of this work were to obtain a CuNiCo alloy by an alternative procedure, capable of generating nanostructured grains, followed by its preliminary characterization. The first part was carried out by dividing the process into two steps: the first one was the thermal decomposition of a nitrate solution [$Cu(NO_3)_2$, $Ni(NO_3)_2$ and $Co(NO_3)_3$] aiming to obtain a homogeneous co-formed metal oxides mixture. In the second step, these oxides are heated up to a desired temperature and kept in a reductive flow of hydrogen, leaving the CuNiCo alloy as final product. The applied reduction temperatures were in the range between 300°C and 900°C. The materials obtained after each step were characterized by Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray Detector (EDS). As result of the first step, it was found that oxygen, Cu, Ni and Co were, as desired, homogeneously distributed. The after reduction obtained material present different shape and particle size, depending on the applied reducing temperatures, as illustrated in Figure 1 to 300°C and 900°C. The more circular and greater size observed at 900°C confirms an increased sintering occurrence at higher temperature and the EDS results indicate the expected composition for Co, Ni and Cu. This alloy was also observed by Transmission Electron Microscopy (TEM) and have shown the presence of particles with spherical morphology and a homogeneous distribution of the elements, which are sharing the same crystal structure. Also, it was noted the presence of particles smaller than 100 nm in the CuNiCo alloy.

Speaker Biography

Eduardo A Brocchi is a Metallurgical Engineer from Rio de Janeiro, Brazil. He has completed his PhD at the Imperial College of Science, Technology and Medicine, London, UK, in 1983. Since then, he has been teaching, at the Pontifical Catholic University of Rio de Janeiro (PUC-Rio), Brazil, and, also, carrying out research in the field of high temperature processes dedicated to extractive metallurgy and materials synthesis. He has participated in the publication of more than two hundred articles in proceeding and periodicals as well as has been awarded some prizes. Brocchi became Titular Professor of the University (PUC-Rio) in 2015 and, at present, is the Head of the Department of Chemical and Materials Engineering.

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Notes:

Bin Zhu

China University of Geosciences, China

Semiconductors and semiconductor ionic hetero-structure composites for next generation energy conversion technology

Conventionally ionic conductivity has been developed by ionic conducting materials but challenge unsolved. Typically, solid oxide fuel cell (SOFC), yttrium stabilized zirconia (YSZ) electrolyte, which needs high operational temperature above 700°C to reach required ionic conductivity, for SOFC technology over several decades has not yet been commercialized. The same challenge is faced for next generation solid battery technologies. Semiconductor-ionic materials are new functional material family with superionic conduction developed by semiconductors or their heterostructure materials with wide energy applications.

The band structure, p-n junction and build-in-field have been discovered to facilitate fast ionic transport. Tuning semiconductors and heterostructures to ionic conductors is a very effective approach to develop superionic conductivities and novel energy devices. For example, fuel cells built on anode, electrolyte and cathode can now be constructed by semiconductor-ionic heterostructures to realize more efficiently the fuel cell hydrogen oxidation reaction (HOR) and oxygen reduction reaction (ORR) through band structure and alignment without using the electrolyte separator. The novel ceramic fuel cells based on semiconductor-based membranes instead of conventional electrolyte have been demonstrated with excellent power outputs at temperatures between 400-550ºC.

Numerous amounts of semiconductor-ionic materials have been explored and novel fuel cell technologies have been demonstrated. Some examples are bulk hetero p-n junction and Schottky junction for single layer fuel cells, designed by energy bands and alignments. New disciplines of Semiconductor-Ionics and Semiconductor Electrochemistry have been establishing not only for energy conversion, e.g. fuel cells, but also for energy storage devices like batteries.

Speaker Biography

Bin Zhu received M.Sc., in 1987 from University of Sci. & Tech. of China and PhD in 1995 from Chalmers University of Technology, Physics and Engineering Physics, Sweden and during 10/ 95-12/97 worked as Postdoc. in Uppsala University (in Ångström Lab). Since 1998, Zhu moved to KTH and in 1999 became associate professor in Dept of Chemical Engineering and Technology, and now in Dept of Energy Technology, KTH. He is visiting professor in Aalto University and Nanyang Technological University as well as in several Chinese universities to co-supervise research projects and PhD students. From 2018, Zhu has been appointed as visiting professor position in Loughborough University, UK. Zhu has more than 300 publications in nano-composites and new semiconductor-ionic materials for advanced fuel cells from material to device, technology for scaling up into polygeneration systems, e.g. in fuel cells, innovations made on low temperature, 300-600°C SOFCs, electrolyte (layer)-free fuel cell (EFFC), single layer fuel cells (SLFCs), semiconductor-based fuel cell as next generation high-efficient fuel-to-electricity conversion. He has also devoted to establish frontier disciplinary of Semiconductor-Ionics and Semiconductor Electrochemistry for fuel cells and other energy storage devices, e.g. solid batteries.

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Notes:

Seong Chan Jun

Yonsei University, South Korea

Doped nano-materials for supercapacitor

Besides multi-stacking or chemical vapor process, advanced doping issues to be resolved arise for high energy and power density storage with high stability and efficiency. The open space with the uniform nano grasses displayed a high areal capacitance, rate capability, energy density, and cyclic stability due to the nanostructure enhancing fast ion and material interactions, which are decorated porous three-dimensional graphitic carbon foam as a supercapacitor electrode. The assembled supercapattery (ASC) provides high specific capacitance (90 F g^{-1}), high energy density (24 Wh kg^{-1}) at power density 830 W kg^{-1}), and long cycle life (specific capacitance retention of 85% over 2000 cycles). The most charging/discharging reaction of supercapacitor or supercapattary only occurs at surface of electorodes. Doped nano materials induced by oxygen related vacancy improve a retention efficiency.

Speaker Biography

Seong Chan Jun is professor in mechanical engineering, Yonsei University, Seoul, Korea since 2008. He worked at Samsung Advanced Institute of Technology (SAIT) (2006-2008) and Nanoscale Science and Engineering Center (NSEC) at Columbia University, NY USA (2001-2005) after finish graduate study from Cornell University (Ithaca N.Y.), and Columbia University (New York, NY) for Ph.D. respectively. His specialty is "optimizing hybrid nano-structures for electronics, photonics, and energy electrodes", focused on physically and chemically modifying nano-structure for science and engineering. Especially graphene and nano-particles are implemented for high efficient devices.

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Ken Cham-Fai Leung

The Hong Kong Baptist University, Hong Kong

Novel dendritic and polymer hybrid nanomaterials towards drug delivery

Poly(vinyl)alcohol (PVA) has been employed as a chemoembolization agent. Herein, PVA hybridized iron oxide nanoparticles were used for magnetic resonance imaging and anti-cancer drug delivery towards liver cancers. Type III-B rotaxane dendrimers (T3B-RDs) are hyperbranched macromolecules with mechanical bonds on every branching unit. Here we demonstrate the design, synthesis, and characterization of first to third (G1–G3), and up to the fourth (G4) generation (MW > 22,000Da) of pure organic T3B-RDs and dendrons through the copper-catalyzed alkyne–azide cycloaddition (CuAAC) reaction. By utilizing multiple molecular shuttling of the mechanical bonds within the sphere-like macromolecule, a collective three-dimensional contract -extend molecular motion is demonstrated by diffusion ordered spectroscopy (DOSY) and atomic force microscopy (AFM). The discrete T3B-RDs are further observed and characterized by AFM, dynamic light scattering (DLS), and mass spectrometry (MS). The binding of chlorambucil, a drug for leukemia treatment, and pH-triggered switching of the T3B-RDs are also characterized by NMR spectroscopy.

Speaker Biography

Ken Cham-Fai Leung is an Associate Professor and Programme Director at the Department of Chemistry, The Hong Kong Baptist University (HKBU), Hong Kong SAR, P. R. China. He concurrently holds the Honorary Associate Professorship at the Faculty of Dentistry, The University of Hong Kong (HKU). He conducted a three-year postdoctoral research work in the laboratory of Nobel Laureate in Chemistry, Professor Sir J. Fraser Stoddart. He has published over 100 research papers in peer-reviewed international journals with over 4,500 times of citation and an h-index of 35.

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Claudia Ponce

Mexican Institute of Petroleum, Mexico

Polyvinyl alcohol films reinforced with functionalized cellulose nanoparticles

Nanocellulose is a widely studied material which has been used to reinforce different materials and polymers such as polyvinyl alcohol (PVA). Cellulose has many amorphous zones which were useful for functionalization; therefore, reinforcing polymer films with this material will lead to better mechanical properties in them. The objective of the present work was to obtain and functionalize cellulose nanoparticles to incorporate them into PVA films to improve mechanical properties and for a possible use in the food industry. There were 4 studied samples, PVA, PVA-R (PVA/Congo red), PVA-C (PVA/cellulose) and PVA-CR (PVA/cellulose/Congo red). Films containing Congo red and PVA had very good mechanical properties giving the Congo red a cross linking property that has not been studied yet and that was corroborated with other studies such as FTIR and XRD. Also, the addition of different components gives a better structure, which can be observed in the roughness parameters obtained by AFM (Ra between 1.86 and 17.2). The films showed a change in color when adding drops of lactic acid, suggesting that the Congo red is not covalently linked in the PVA matrix and it is not losing the property as pH indicator.

Speaker Biography

Claudia Ponce has completed her PhD at the age of 29 at Instituto Politécnico Nacional, Mexico City. She is a professor at Mexican Republic University and co-works with the National Institute of Petroleum. She has a lot of experience on Transmission Electron Microscopy (TEM) on biological materials.

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Ratnamala Chatterjee

IIT Delhi, India

Non-volatile resistive switching in novel bismuth based oxides

Non-volatile memory (NVM) can retrieve stored information even when power is switched off. Among various next-generation NVMs, Resistive Random Access Memory (RRAM) seems promising for future applications, due to its high-speed, high-efficiency, and energy-saving characteristics. In recent years, the performance of RRAM has been significantly improved through in-depth investigations in both materials and related switching mechanisms. Although silicon-based memory devices are being used since the last several decades for storage, these devices have limited scale-up ability to increase storage capacity. Thus, a continuous search for materials that exhibit better memory characteristics like low switching voltage, high stability, and low cost of fabrication is on-going.

In this regard, here we experimentally demonstrate non-volatile resistive switching (RS) in pulsed laser deposited $BiYO_3$ (BYO) and $BaBiO_3$ (BBO) thin films. The devices of these oxides are prepared in Au/oxide/Pt architecture for electrical measurements. Non-volatile resistance windows of ~10x (BYO) and ~8.5x (BBO) were achieved at room temperature. Detailed electrical and magneto-electrical measurements suggest that the advantage of Au/BYO/Pt devices for RRAM is its high thermal (10 K ≤ T ≤ 800 K) stability, while BBO devices are interesting for next generation non-volatile memories due to its magnetic functionality. The conduction mechanism of these devices is explained using space charge limited current (SCLC) and Ohmic conduction models.

Speaker Biography

Ratnamala Chatterjee has completed her PhD from Indian Institute of Technology Kanpur, India and her Post Doctoral training from Massachusetts Institute of Technology, USA. She is the professor of Indian Institute of Technology Delhi, India. She has over 200 publications that have been cited over 2500 times, and his/her publication H-index is 25.

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Notes:

Saïd El Kazzouli

Euro-Mediterranean University of Fes, Morocco

Synthesis and biological applications of dendrimers

Dendrimers are highly branched macromolecules with nanometer-scale dimensions and functionalized surface which help in the modification of their physicochemical and biological properties. In nanomedicine, dendrimers can be used for targeted delivery of biologically active agents or can be used as drug. In this presentation, we will discuss the advances made in dendrimers functionalization and biological applications. In addition, our recent results on the synthesis and biological evaluations of phosphorus dendrimers will be presented.

Speaker Biography

Saïd El Kazzouli was born in Beni Mellal (Morocco) in 1975. He received his Master's degree then his Ph.D. in chemistry from the University of Orleans in 2004 under the supervision of G Guillaumet and A Mouaddib. He worked then at the same University as a postdoctoral fellow with L Agrofoglio and with S Berteina-Raboin from 2004 to 2006. In 2006, he joined the National Cancer Institute (NCI) at the National Institutes of Health (NIH) in USA as a postdoctoral fellow for 3 years with V E Marquez. In 2009, he became a researcher (project leader) at INANOTECH, MAScIR Foundation in Rabat, Morocco.

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