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# Scientific Tracks & Abstracts

## April 04, 2018

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### *ChEMEN 2018*



Annual Spring Conference and Expo on

# Chemical Engineering: From Materials Engineering to Nanotechnology

April 04-05, 2018 | Miami, USA

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## Microfluidic synthesis supply new insights into properties and behavior of metal and composite nanoparticles

Johann Michael Koehler, Nikunj kumar Visaveliya, Xiang Li and Andrea Knauer  
Technical University of Ilmenau, Germany

**M**etal nanoparticles attract a lot of interest due to their electronic and optical properties, but uniform physical properties can only be expected if the size, shape and composition of particles are homogeneous. Microfluidic techniques allow to generating colloidal solutions of differently shaped and constructed nanoparticles with very high yield and homogeneity. The spectral properties of their colloidal solutions allow to improving the understanding of their physical properties and their growth and aggregation behavior. It was found that electrical charges, electrostatic interaction, electrochemical processes and mixed potential formation as well as self-polarization and enhanced charging and polarization due to attachment and mobility of poly ionic macromolecules play key roles in nanoparticle formation. In result, homogenous colloids of simple spheres, core/shell particles, nanorods, Nano cubes, nanotriangles of metals as

well as spherical, ellipsoidal, Dumbell like, branched, astragal- and flower-like polymer nanoparticles and different metal/polymer composite particle types have been obtained. The mechanisms of their formation and application in particle-based SERS-sensorics and flow catalysis will be discussed.

### Speaker Biography

J. Michael Köhler is the head of the Department of Physical Chemistry and Micro Reaction Technology at the Technical University of Ilmenau (Germany) since 2001. He studied Chemistry in Halle an der Saale and Jena, where he also habilitated in General and Physical Chemistry (1992). He led a research department at the Institute of High Technologies in Jena between 1991 and 2001. During this time, he also taught at the Universities of Wuppertal and Jena. Professor Koehler inter alias has edited books on microlithography, micro system technology and nanotechnology. His current research interests are focussed on nanotechnology, on application of droplet-based microfluidics in nanoparticle syntheses and bio screenings and on physicochemical aspects of sustainable chemistry.

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## Surface functionalization of nanotubes prepared by different means towards modification of their properties


Graham Dawson, Ruochen Liu, Ruoqi Qian and Edmund Morris  
Xi'an Jiaotong Liverpool University, China

Photocatalyst materials which are suitably stable often have large band gaps and can only be activated by UV light. Our recent research has involved the synthesis and modification of novel inorganic nanostructured materials in order to exploit their properties in visible light active photocatalytic systems. We have shown that self-assembled surface modification by organic molecules imparts trititanate nanotubes with stable, recyclable photocatalytic activity under visible light illumination. Using solid state NMR, XRD and Mass spec we have recently been looking into the arrangement of the organic molecules on the nanotube surface. We have also prepared titanium dioxide nanotube arrays by anodization for photoelectrochemical water splitting and modified them with Au and MoS<sub>2</sub> for comparison.

### Speaker Biography

Dr. Graham Dawson is currently a lecturer at Xi'an Jiaotong Liverpool University, Suzhou China, joining in March 2013. Before taking this position he worked at the Suzhou Institute of nanotechnology and Nanobionics (SINANO) as a postdoctoral research assistant then as an associate professor. During this time, Dr. Dawson was principal investigator of several provincial and national level projects. He completed his PhD studies under Professor Wuzong Zhou at the University of St. Andrews, Scotland and has presented his research at several national and international conferences and published papers in peer reviewed international journals. Dr. Dawson's research interests are in the area of nanomaterial synthesis towards applications in photocatalytic degradation and water splitting.

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# Chemical Engineering: From Materials Engineering to Nanotechnology

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## Engineering of semiconductor quantum dots for light emitting applications

Raffaella Signorini<sup>1</sup>, Francesco Todescato<sup>1</sup>, Ilaria Fortunati<sup>1</sup>, Alessandro Minotto<sup>1</sup>, Jacek J Jasieniak<sup>2</sup> and Renato Bozio<sup>1</sup>

<sup>1</sup> University of Padova, Italy

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One of the emerging applications exploring the potentialities of fluorescent nanomaterials is related to light emitting technologies. In particular for the realization of practical light-emitting diodes and large-area displays, semiconductor nanomaterials may overcome many issues of such challenging technologies. A critical aspect of semiconductor nano scaled materials is related to the large Coulomb interaction between electrons and holes, and their strong spatial confinement, with respect to their bulk analogues. When the size is reduced to levels smaller than the exciton Bohr radius, size-dependent absorption and emission properties develop. Upon formation of excitons within quantum dots (QDs) through optical or electrical processes, Coulomb interactions play a key role in subsequently determining their radiative and non-radiative decay rates, fluorescence quantum yields, multi-exciton generation and its decay. Appropriate engineering of QDs, through the colloidal synthesis of core/shell heterostructures, has emerged as the most facile manner to gain control of these Coulomb processes. The strong electronic coupling between the core and shell in core/shell QDs ensures that the electronic structure, composition and thickness of the shell must be considered in parallel with the properties of the core in order to predictably manipulate the electron and hole probability densities to obtain the desired optoelectronic characteristics. This spatial control of carriers affects the direct Coulomb interaction between electrons

and holes, but also influences the rate and carrier selectivity of trapping at surface and, possibly, interface defects. The latter is highly dependent on the core/shell structure, for which lattice mismatch between materials must be carefully managed to avoid defect formation stemming from excessive interfacial stress. The above structural and electronic factors define the dynamics of single and multi excitons in QDs, which directly influences aspects such as recombination lifetimes, luminescence efficiency and optical gain properties. Considering the importance of each of these properties for light emitting applications, in this presentation we compare different approaches for the enhancement of light emission quality in terms of high fluorescence efficiency, high color quality, enhanced photostability under prolonged irradiation and easy implementation of solution processable methodologies. All these excellent features make the use of QDs materials a promising way for the realization of optically and electrically pumped light emitting devices.

### Speaker Biography

Raffaella Signorini Since October 2015 working as an Associate Professor in Physical Chemistry at the Department of Chemical Sciences of the University of Padova. Her major research interests focus on non-linear optical spectroscopies and nanomaterials. The research activity spans from the NLO characterization of chromophores, including reverse saturable absorption, two-photon absorption and emission, to the realization of compact devices, like optical limiters and integrated lasers, and micro-fabrication

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## Effect of surface properties of the UV laser irradiated steel cords on adhesion

Satilmis Basan<sup>1</sup> and Erol Sancaktar<sup>2</sup>

<sup>1</sup>Hittite University, Turkey

<sup>2</sup>University of Akron, USA

Steel cords like nylon or polyester cords are one of the most important component of tire in industry. The adhesion strength between these cords and the rubber depends on the surface properties of the cords which is the main component of tyres. Adhesion property can be varied by various modifications of surface of steel cords. One of various modifications of surface is roughen of the cord surface by irradiation. In our previous study, it has previously investigated the effect of surface properties of the UV-laser irradiated nylon cord on adhesion. In this study, steel cords which are the most important additives, are irradiated with UV excimer laser with different pulses and fluences and roughened with the effect of laser beam on the surface. The presence of the shaginess was examined via optic microscopy and then, adhesion properties of the natural rubber tyre after adding UV Laser beamed steel cords was

observed via measuring their tensile strengths. Maximum elongation load, stress at break, elongation at break, change of modulus properties with pulse and fluence are examined. The results showed that the load, stress, elongation and tension at break point is increased up to 300 pulse, and then decreased. Also modulus decreased up to 300 pulse and then increased.

### Speaker Biography

Satilmis BASAN has completed his PhD at the age of 35 years from Hacettepe University and postdoctoral studies from Glasgow University, Department of Chemistry and Akron University, Department of Polymer Engineering. He is the Head of Department of Chemical Engineering, Hittite University, the Founder Dean of Faculty of Engineering, Hittite University, Editor in Chief, Journal of the Turkish Chemical Society, Section B: Chemical Engineering. He has published more than 26 papers in reputed journals.

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## Photoinduced bending of azobenzene-based [2] pseudorotaxane crystals

Shao-Chi Cheng

National Tsing-Hua University, Taiwan

This study presents photoresponsive dynamic pseudorotaxane crystals comprising of azobenzene and ferrocenyl groups in an axle component threaded through dibenzo [24] crown-8 ether rings. These pseudorotaxanes are synthesized by mixing dialkylammonium axle molecule tethered with azobenzene with/without methyl-substituent and the ring molecule with/without bromo-substituents in dichloromethane. Single crystals of the pseudorotaxane exhibit bending motions caused by cis-trans photoisomerization of the azobenzene group using alternating 360 nm and 445 nm lasers. These bending motions are reversible and repeated more than 200 times. The bending motions of the crystals are significantly varied by the substituents. Single-crystal X-ray crystallography of the pseudorotaxanes reveals the details of the initial molecular structures. A crystal of pseudorotaxane without substituents exhibits small degree of bending within 0.3 second by 360 nm

irradiation, because of multiple  $\pi$ - $\pi$  interactions in azobenzene groups. Contrary, the crystals of pseudorotaxanes with bulky substituents show large displacement in bending within 7-30 seconds induced by 360 nm irradiation. Distorted  $\pi$ - $\pi$  interactions of the azobenzene groups facilitate twisting of the axle molecule. In addition, all crystals exhibited very fast cis-to-trans backward process within 0.3 second, which is much faster than typical azobenzene crystals.

### Speaker Biography

Shao-Chi Cheng joined Dr. Horie's materials synthesis group in 2013 when he was an undergraduate student at Department of Chemical Engineering, National Tsing-Hua University, Taiwan. He is now a PhD student and his research interest is synthesis of azobenzene-containing supramolecular pseudorotaxane crystals for potential use in microscale molecular machines.

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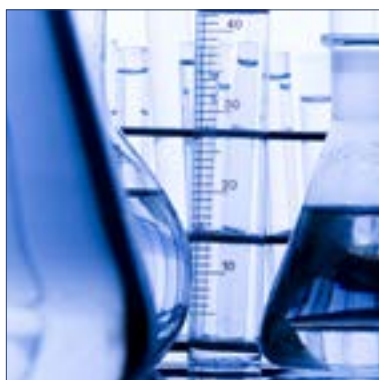
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## Proposed link between the periodic table and the standard model

John Owen Roberts  
England


The patterns of stable quantum states in the Periodic Table are inverted and extended to infinity in both directions to accommodate spatial variation relative to the nucleus. The upper end leads to a cut off point for white matter. The lower end represents quantum states in plasma. At  $10^{-15}\text{m}$  to  $10^{-20}\text{m}$  the interaction between weak strong and gravity forces results in suitable boundary conditions for the production of elementary particles. Chemical classification of the elements requires convergence of chemical properties and quantum states. By defining GROUP NUMBER as the maximum number of electrons in any one shell, Hydrogen and Helium are moved to the first set of  $2(1)^2$  states first proposed by Janet. The atomic numbers are adjusted and mass number removed as it is an average of isotopes of each element produced in every supernova. This produces the Roberts Janet Nuclear Periodic Table which proposes two zero states,

a cut off and start point, of the electric field in attractive then repulsive modes. By symmetry of these fields energy states emerge in plasma with the counter intuitive property that the nearer the nucleus the greater the number of energy states. Fusion results and the consequential recycling implies a more rapid collapse than supernovae given sufficient energy density that could create an as yet unobserved interaction at  $10^{-50}\text{m}$  to  $10^{-65}\text{m}$  between the strong and gravity forces. String theory and extra dimensions may be required to explain such mechanisms and multiverses.

### Speaker Biography

John O Roberts graduated in 1969 with a BSc (Hons) Physics from The University of Liverpool. He has been an Open University Tutor for 30 years and a private tutor of Math and Science. He is the author of the book Those Infinities and the Periodic Table

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## Concurrent energy harvesting and charge storage using conducting polymer composites

**Arash Takshi**

University of South Florida, USA

Given the sustainable, clean, and abundant nature of solar energy, studies on photovoltaic devices for energy conversion to electric energy have been extensive. However, due to large variation of the solar energy availability in a day, energy storage is required in many applications when solar cells are used. Conventionally, the harvested energy is stored in an external device (i.e. batteries or supercapacitors) which adds substantially to the costs of solar energy systems, requires additional charging circuitry, and needs regular maintenance and replacement. The result is a relatively expensive and bulky system that is not ideal, particularly for portable, off-grid applications. Recently, we have found that a combination of a conducting polymer (PEDOT:PSS) and a photoactive material can be used as an electrode in a photoelectrochemical cell to generate electric charge from solar energy and store the charge in the device. The structure of the device is very similar to a supercapacitor, while the conducting polymer-dye composite film behaves like a photoactive electrode. The device is able to generate up to 0.49 V under the open circuit conditions upon AM1.0 solar

radiation. A charge stability (in dark) of more than 2 hours has been achieved after charging the device with light for 20 min. The organic photoactive supercapacitor can deliver currents up to 0.12 mA/cm<sup>2</sup>. The electrochemical study suggests a photoelectrochemical reaction at the composite film. Hence, the charge storage is likely due to the change in the polymer oxidation state.

### Speaker Biography

Dr. Arash Takshi is an Associate Professor of Electrical Engineering and a faculty affiliate in the Clean Energy Research Center (CERC) at the University of South Florida. Before joining USF, Dr. Takshi was working as a Research Assistant at the University of Maryland, where he collaborated with a research group to develop an energy harvesting system for wireless sensors. From 2007 to 2009, he was a Research Scientist at the University of British Columbia, working on the development of Organic/Bio photovoltaic devices. Dr. Takshi has more than forty publications in scientific journals and ten pending and granted patents. Dr. Takshi's research group at USF was established in fall 2010. His group is active in the field of advanced energy materials, using conducting polymers, nanomaterials (Ag NW, Zn O NW, TiO<sub>2</sub> nanoparticle, graphene), and biomaterials (i.e., proteins) for energy conversion and storage in electrical devices such as solar cells and supercapacitors. His research activities cover from materials synthesis/process to device fabrication/characterization/optimization.

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