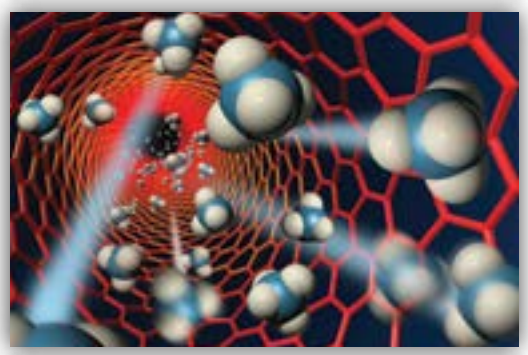
20th International Conference on

Advanced Nanotechnology

September 11-12, 2017 Amsterdam, Netherlands

Posters






Liraz Kutashi et al., Nano Res Appl 2017, 3:3
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Dyes degradation by using M° nano particles incorporated in SiO_2 matrix

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In recent years, with the growth of population and the development of social economy, the discharged amounts of various pollutants are also growing rapidly. Especially, the pollutants caused by textile dyes and other industrial dyestuffs on water pollution have severe implications on aquatic environment and human health. Therefore, it has begun to pay more attention to the problem of water pollution, and prevention of water deterioration and the protection of water resources have become a common human goal. In this work, the sol gel synthesis route has been utilized for the preparation of SiO_2 matrices embedded with Ag^0 and Au^0 nanoparticles for their application as heterogeneous catalysts in the reduction of Methyl Orange (MO) as a model pollutant compound. The M^0-NPs were prepared by reduction of silver nitrate or gold (III) chloride trihydrate with $NaBH_4$ during the sol-gel process. Different preparation procedures were examined in order to determine the preferred method for obtaining a suitable matrix for the catalysis. Our purposely synthesized supported noble metal nanoparticles degrade methyl orange by sodium borohydride satisfactorily and the efficiency of our catalysts is not differed through first to fifth use.

Biography

Liraz Kuztashi completed her BSc in Chemical Engineering department at Ariel University (2015). Her research is focused on nanoparticles and development of new processes for wastewater treatment.

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Notes:

Azam Anaraki Firooz et al., Nano Res Appl 2017, 3:3
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Fabrication of highly selective sensor based on Mn-doped ZnO nanostructures

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1mol% of Mn -, Fe- doped and single phase hexagonally plate ZnO have been synthesized by a simple low temperature hydrothermal method using D-ribose as a template. The influence of the doped specious on structural, optical and sensing property was studied by X-ray diffraction (XRD), scanning electron microscopy (SEM), UV–vis spectra, photoluminescence (PL) and gas sensor characterization system. The results show that the doped specious have significant effect on morphology, crystallite size, photoluminescence and sensing properties. Mn-doped ZnO sensor shows selective response to acetone in presence of CO and ethanol while, Fe-doped ZnO does not show considerable response to CO, ethanol and acetone gases. Probably, the crystal defects are detected by photoluminescence account for the different sensing behaviors. A possible mechanism of how a doped ZnO-based sensor response to the target gas is also proposed by density functional theory (DFT) calculations.

Biography

Azam Anaraki Firooz received MSc and PhD degrees in Inorganic Chemistry from Tarbiat Modares University in 2005 and 2010, respectively. She jointed Shahid Rajaee Teacher Training University in Tehran in 2011. Her research interests include the effect of morphology and additives on sensing and photocatalytic functions of oxide nanostructures.

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Masoumeh Ghalkhani, Nano Res Appl 2017, 3:3
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Electrochemical sensor based on multi-walled carbon nanotubes – boehmite nanoparticle composite modified electrode

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A sensitive electrochemical sensor was developed for the analysis of dobutamine (Dob) using a glassy carbon electrode modified with multi-walled carbon nanotubes – boehmite nanoparticle composite (BNP-MWNTs/GCE). Scanning electron microscopy (SEM) was used for the characterization of synthesized BNPs and the morphology of BNP-MWNTs on the surface of GCE. Under the optimized experimental conditions, the BNP-MWNTs/GCE exhibited higher peak current than bare GCE due to synergetic effect of BNPs and MWCNTs on the electrochemical oxidation of Dob. The effect of various experimental parameters such as pH, scan rate, accumulation time on the voltammetric response of Dob was studied and optimized. A wide linear range from 0.005 to 1.0 μM with a low detection limit of 8.9 nM was found for voltammetric quantification of Dob. The prepared sensor exhibited the acceptable repeatability, high reproducibility along with good stability which makes it appropriate candidate for determination of Dob in pharmaceutical preparations.

Biography

Masoumeh Ghalkhani received her MS degree in 2005 and PhD degree in 2010 from Sharif University of Technology (SUT) with specialization in the preparation and application of chemically modified electrodes. At present, she is an Assistant Professor of Chemistry at Shahid Rajaee Teacher Training University, Tehran, Iran. Her current research interests include electroanalytical chemistry, bio-electrochemistry, and sensors and mainly focused on fabrication and application of modified electrodes and biosensors.

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Study the nickel concentration effect in electro deposition solution on performance of nano Pt-Ni/Ni electrodeposited electro catalyst for methanol oxidation reaction in alkaline media

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Nowadays, methanol fuel cell systems have been attracted research activities to investigate for facilitating methanol oxidation reaction. One of activities is concentrated on improving electro catalysts. Platinum is widely used as an electro catalyst. Nickel is also due to cost and availability, as well as good catalytic activity can be used as an electro catalyst. In the present study, the simultaneous presence of nickel and platinum as the electro catalyst for methanol oxidation reaction was investigated. First for fabricating of electrodes, nickel particles was deposited on carbon paper by cyclic voltammetry (potential range: -0.850 V to 0.3 V vs. Ag/AgCl, scan rate 50 mV s^{-1}, cycle number 30, room temperature) as the electrochemical deposition method in three electrode half-cell system. Then, platinum and nickel particles simultaneously was deposited on prepared nickel layer by cyclic voltammetry (potential range: -0.850 V to 0.650 V vs. Ag/AgCl, scan rate 50 mV s^{-1}, cycle number 30, room temperature). At electro deposition processes the nickel concentration was varied 10 up to 60 mM and platinum concentration was fixed at 1 mM. The fabricated electrode was investigated for methanol oxidation reaction in three electrode half-cell system by the electrochemical methods like as linear sweep voltammetry, cyclic voltammetry and impedance spectroscopy. Accordance SEM results, the electro catalysts are formed as nanostructure on carbon paper. The fabricated electrode has been shown good electro catalytic activity for methanol oxidation reaction in alkaline media. Based on electrochemical analysis of prepared electro catalysts, the optimum concentration of nickel in electro deposition solution was determined at 50 mM.

Biography

Rasol Abdullah Mirzaie received PhD degree in Physical Chemistry from Tarbiat Modares University in 2003. He joined Shahid Rajaee Teacher Training University and currently he is the Head of the Faculty of Science. He is the Head of the Fuel Cell Research Laboratory of Shahid Rajaee Teacher Training University (Tehran, Iran). His research interests include Electrochemistry, Gas Diffusion Electrodes, Fuel Cell and Batteries and Chemistry Education.

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Identification and estimation of nonlinearity in nano metrology system resulting from target velocity

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In the present study, we investigate the structure of Developed Three-Longitudinal Mode Heterodyne Interferometer (DTLMI). Then, the output relations of each part are obtained considering Polarizing Beam Splitter (PBS) leakage. According to this computational study, the identity of error in phase measurement is examined through simulations. According to these investigations, the error is as frequent changes around the real value and its amplitude is proportional to the leakage of Polarizing Beam Splitter (BPS). The results reveal that 2% leakage causes 3.18 nm and 2.05 nm errors at high and low target speeds, respectively. Target speed is also a determinant factor in the generated error type, so that in the speeds higher than a particular limit, 45 degree shift is seen in the periodic error and the amount of error will be larger.

Biography

Saeed Olyaee received his BSc degree in Electrical Engineering from University of Mazandaran, Babol, Iran, in 1997 and MSc and the PhD degrees in Electrical Engineering specializing in Optoelectronics from Iran University of Science and Technology (IUST), Tehran, Iran, in 1999 and 2007, respectively. He has established the Nano-photonics and Optoelectronics Research Laboratory, NORLab, in 2006 and currently, he is the Head of NORLab and Dean of Electrical and Computer Engineering Faculty, Shahid Rajaee Teacher Training University SRTTU), Tehran, Iran. He presented and published more than 100 scientific conference and journal papers, book, and book chapters, and currently, he is Technical Manager of Journal of Electrical and Computer Engineering Innovations (JECEI) and member of scientific committee of several national and international conferences. His main research interests include "Nano-displacement measurement, optical instrumentation and photonic crystal fibers".

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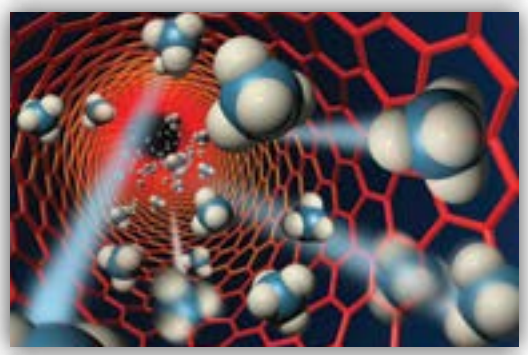
e-Poster






Elisa Piccoli et al., Nano Res Appl 2017, 3:3
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Study of nanoparticles in a few rivers in North East Italy

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The use of NPs has increased in these years. It is used in many fields: industrial and commercial sectors. The large use may compromise the human and the ecosystem health, because it doesn't know the fate/damages/consequences of NPs in the environment. SP-ICP-MS is a fast method and it can be used for a screening of environmental samples, it combines high sensitivity with analytical speed. This is a water surface study. We collected water surface in a few rivers in the North East of Italy. 3 liters of surface water were filtered with a vacuum pump with membrane with 0.22 µm pore. The filter was put into a test tube with 30 ml of water ultrapure and it was sonicated for 20 minutes. The analysis was performed on SP ICP MS NexION 350 D Perkin Elmer using Syngistix software. Transport efficiency and particle calibration were performed with standard gold nanoparticles of 30 nm, 60 nm and 90 nm. For the test, five replicates of water ultrapure were analysed and LR was calculated. The recovery test was made on water surface spiked and un-spiked and it appeared to be between 94% and 97%. Considering the high dilution of NPs in environmental complex matrix, this study evaluated the efficiency of the concentration via filtration for SP-ICP-MS analysis of nanoparticles of ZnO CeO_2 TiO_2 Ag. The results showed that the analysis in SP-ICP-MS combined with the filtration allowed to lower the sensitivity of detection and characterization of nanoparticles of two orders of magnitude.

Biography

Elisa Piccoli graduated from University of Chieti, Italy in 2002. Since 1997, she has worked in the Environmental field, with a specialization in ICP-MS and inorganic micro pollutants. She has published some papers, regarding metal analysis in groundwater, atmosphere and bioaccumulation in bryophyte.

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Notes:

Sergey M Afonin, Nano Res Appl 2017, 3:3
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Structural-parametric model of electro-elastic actuator for manipulators in nanotechnology

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For nanotechnology, nanobiology, power engineering, microelectronics, astronomy for large compound telescopes, antennas satellite telescopes and adaptive optics equipment is promising for use nano- and micromanipulators with electromechanical actuator based on electro elasticity (piezo effect). Piezo actuator – piezo mechanical device intended for actuation of mechanisms, systems or management based on the piezo effect, converts electrical signals into mechanical movement or force. By solving the wave equation using the Laplace transform and taking the equation of the piezo effect, the boundary conditions on loaded faces of piezo actuator, the strains along the coordinate axes, it is possible to construct its structural parametric model. Decision wave equation, structural-parametric model, transfer functions of electro elastic actuator are obtained. Effects of geometric and physical parameters of the electro elastic actuator and external load on its dynamic characteristics are determined. For calculation of the nano- and micromanipulators the generalized parametric structural schematic diagram Figure 1 and the transfer functions of the electro elastic actuator are obtained. Static and dynamic characteristics of piezo actuator are determined. The generalized structural-parametric model of the electro elastic actuator provides the determination of its transfer functions and calculation of its static and dynamic characteristics. The parametric structural schematic diagrams, transfer functions piezo actuator for transverse, longitudinal, shift piezo effects are determined from the structural-parametric model of the piezo actuator.

Biography

Sergey Mikhailovich Afonin is an Associate Professor of Department of Intellectual Technical Systems of National Research University of Electronic Technology (Moscow Institute of Electronic Technology MIET). He completed his Graduation and PhD from National Research University of Electronic Technology MIET.

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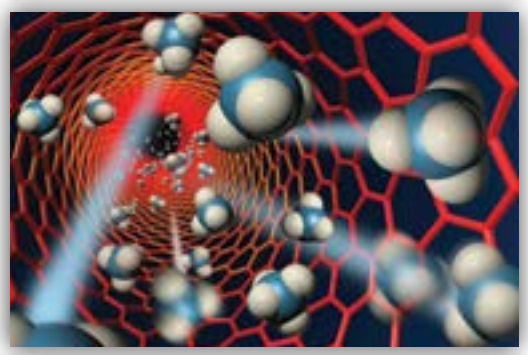
Accepted Abstracts






Electrostatic plasma charge interactions and their influence on film and nano-pillar growth

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Electrostatic effects are not commonly considered during plasma film growth, however we have recently shown attractive electrostatic interactions between regions of positive charge in RF plasmas and the negative charge of metal wetting layers can strongly influence film morphology. By placing a grid between a remote plasma and the substrate, the potential seen by GaN and InN films could be controlled to either allow the growth of metal rich nano pillars using a positive grid potential, or films with RMS roughness of less than 2 nm with the grid grounded. For these experiments the plasma was remote, so that the grid was not for ion flux control: the interactions seen were due to electrostatic potential, or charge. Using a negative bias on the grid we also found that residual carbon and hydrocarbon species, left over from the decomposition of trimethyl gallium (TMG), could be removed during GaN growth. Impurity determination by SIMS, UV-Vis film transmission measurements, electrical and visual observation of films is provided. The films were grown at approximately 650 degrees C using a nitrogen plasma source and TMG.

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Green preparation of highly active nano-metal catalysts for renewable fuel production

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As the fossil resources utilization escalates significantly CO_2 levels in the atmosphere, the renouncing of the fossil fuels reliance is getting increase. This drives researcher either inventing biofuels or discovering new and improved catalytic processes and technologies that focus on environmental prevention rather than remediation. Reducing negative environmental impact calls for utterly new catalysts which are more active and selective which is continuing challenge in nanoscience and nanotechnology, demanding an ability to design new catalytic materials. Through the knowledge of the activity determining factors of the catalyst, one will be able to design catalysts in atomic- scale. Our results show that applying the same natural reductant on different metal precursors will produce different size and shape of metal nanoparticles. From our investigation with transmission electron microscopy (TEM) and high resolution of transmission electron microscopy (HRTEM) we found that the metal with different shapes such as nano-dendrites, nanoflakes and multi various shapes were produced after the synthesis process. The NPs were deposited on the support material by using thermo-destabilization of microemulsion and then tested first with hydrogenation reactions such as hydrogenation of Alpha Methyl Styrene, Methyl Crotonate and Levulinic acid. Among those hydrogenation reactions, Levulinic Acid (LA) hydrogenation is the most challenging one. Levulinic acid is one of the top bio-based platform molecules that can be converted to renewable fuel such as γ-valerolactone (GVL). LA hydrogenation normally is carried out at high pressure and high temperature. Yet with our unoptimized Pt nanocatalysts, we are able to carry out that reaction at a very mild reaction condition (1.3 bar and 70 oC) with 100 % GVL selectivity at 94% conversion. The produced nanocatalysts are very active due to the anisotropic structure of the nanomaterials which is engineered by using weak green reductant. These engineered nanomaterials not only are prepared in a greener way, but also shows potential to be applied in a green catalysis.

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Multi polarization dynamic light scattering of non-spherical nanoparticles in solution

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Application of dynamic light scattering (DLS) for sizing of non-spherical nanoparticles using co polarized and cross-polarized components of the scattered light is limited by the difficulties of measurement of very weak cross-polarized light intensity and problems with inverting of the scattering data into direct prediction of nanoparticles size parameters. Here we propose the new technique, called multi polarization DLS, based on time-resolved measurements of the scattered light intensity at different angles between the incident and scattered light polarizations. The physical model giving the relation between particle's translational and rotational diffusion coefficients and intensity autocorrelation function (ACF) for the arbitrary angle between the incident and scattered polarizations is developed. Numerical algorithm for the inverse problem of calculating the diffusion coefficients from the family of ACFs is introduced, and a semi empirical approach for length and diameter estimation of quasi-cylindrical nanoparticles from the diffusion coefficients is proposed. The application to Au and Fe2O3 Nano rods, in particular to monitor the selective etching-induced size changing, is described. In comparison with depolarized DLS, the method allows one to avoid measurement of the very weak cross-polarized component of the scattered light, and gives more data for solving the inverse problem of size parameter reconstruction from the scattered light intensity.

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Mesenchymal stem cells differentiation into cardiac linage on modified nanofiber scaffold

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The cardiovascular disease and death has led researchers to look beyond pharmaceutical standards of care to new cell-based therapies that may benefit patients. Annually in the United States alone 600,000 people die of heart disease. The innovation is to use the modified nanofiber scaffold and (hBMSC) human bone marrow derived stem cells as a regenerative medicine strategy to replace damaged cardiac tissue after traumatic events such as a heart attack . The induced pluripotent stem cells (iPSCs) allows the development of beating cardiac tissue in vitro. Recent research has demonstrated two advances in hBMSC therapy for cardiac healing: first, priming the cells in vitro for eventual transplantation aides cell survival and terminal differentiation once deposited to the cardiac niche and second, paracrine factors produced by hBMSCs while differentiating in culture. These discoveries lead us to develop the modified nanofiber scaffold based hBMSc to differentiate in to cardio myocytes to repair the damaged heart. Cell-based therapies as treatment for MI (Myocardial Infraction) have demonstrated safety in vivo but mixed efficacy. We developed an adjustable rat model of MI (Myocardial Infraction) to test the therapeutic effectiveness of intracardiac injections of hBMSCs primed on protein- and small molecule-coated nanoscaffolds which has demonstrated increased cardiac biomarker expression and decreased canonical WNT signaling. Myocardial infraction (MI) rat model to mimic the human MI conditions is created by subcutaneous administration of isoproterenol resulted in dose dependent myocardial damage. After intracardiac injections, hBMSCs combined with nanofiber scaffold engrafted within the heart and provided increased EF in animals given low and medium/ high cardiac damage, compared to sham operated rats. These results demonstrate stem cells based therapies are not conducive to all levels of MI severity, and future stem cell trials will be aided by standardizing definitions of cardiac improvement.

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Preparation of hydroxyapatite from industrial waste phosphogypsum by hydrothermal method; its application in waste treatment

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Phosphogypsum (PG) is an industrial waste derived from the production of phosphoric acid wherethe phosphate ore is dissolved in sulfuric acid. About 5 tons of phosphogypsum are produced for every ton of P2O5 manufactured. Worldwide PG production is huge, and it is estimated that 200.000tons are produced annually in phosphoric acid plants. In fact, 85% of the worldwide production remains at present stored into piles near the factory that occupy considerable land resources, or completely discharged into water, which lead to serious contamination. In consequence, valorizing and minimizing the negative effects of this hazardous waste increasingly grab the attention of researchers all around the world. In the present work, the conversion of an industrial sub-product phosphogypsum (PG) into hydroxyapatite (H-Ap) was investigated. Hydrothermal synthesis was applied by reacting PG with a salt at different times, temperatures, while adjusting pH using sodium hydroxide solution NaOH (1M). The obtained H-Ap exhibited a hexagonal structure, a high purity and nanorod- like shaped of 44nm x 12nm.. The prepared nano-hydroxyapatite was characterized by X-ray diffraction (XRD), Fourier transformed-infrared spectroscopy (FT-IR), transmission electron microscopy (TEM) and scanning electron microscopy (SEM). The findings showed that PG recycling could be accomplished using an easy synthesis route with relatively cheap reactants in order to produce nano-crytalline H-Ap. The elaborated hydroxyapatite powder was used as en effective adsorbent of organic dyes/heavy metals from wastewater.

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Bio-inspired synthesis and self-assembly of few layer graphene

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The future development of advanced materials depends on several aspects, which are first of all linked to synthesis and then exploitation of the materials in an efficient way. This concerns also the graphene based materials and despite the huge number of efforts devoted to the synthesis of graphene and few layer graphene (FLG) there is still luck of the methods allowing their high scale production together with environment respect. Their efficient use in composites, polymers and films in order to provide or enhance graphene-related properties such as high conductivity, transparency, flexibility, mechanical resistance will depend on the way these “nano” materials are arranged in the macroscopic media. Herein, the bio-compatible, high yield production of solution processable FLG is presented (patent)1 together with a new approach of bio-inspired FLG self-assemblies into fractal like patterns (presently under patent application). Such FLG self-assemblies reduce the percolation threshold between FLG flakes allowing the percolation at lower amount of FLG for a given surface if compared to the random arrangement (fig. below).2 This can find the application in transparent conductive films (TCF), where the FLG self-assemblies patterns can be optimized in order to achieve variable transparency-conductivity properties according to the TCF final use. This interesting finding recalls the natural tendency of Matter to self-organize into functional systems. The fractal like, branched structures are commonly observed in numerous natural systems being in charge of transport function, such as river beds, trees or neural system.

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Polymer Nanoparticles with Tunable Shapes and Internal Structures

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Block copolymer assemblies have attracted great attention due to their potential applications in the fields of drug delivery, targeting therapy, medical diagnosing and imaging. 3 dimensional (3D) confinement, which can break the symmetry of a structure, has proven to be a powerful route to tailor the morphologies of block copolymer particles. Particle shape and internal structure can thus be tuned by using the supramoelcular strategy or tailoring the interfacial interaction of the particles with the dispersed medium.1-3 We will introduce the generation of the nano-objects with well tunable shapes by taking advantage of 3D confined assembly and supramolecular chemistry. Particles with various internal structures can be obtained due to the 3D soft confinement in emulsion droplets. Moreover, we will show that selective disassembly of the structured particles will give rise to mesoporous particles or nano-objects with unique shapes.

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Multiphase change materials for nanostructured energy storage technologies - NEST

Jo Darkwa
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The building sector is currently responsible for approximately 40% of final global energy consumption and CO_2 emissions. One promising technology that has emerged as a significant method by which energy consumption could be reduced is through the use of phase change materials (PCMs). However, commercially available PCMs are only able to function at fixed phase transition temperatures and therefore unable to be tuned to different melting temperatures, which limit their flexibility for multiple applications. This research was therefore intended to develop novel microencapsulated multiphase change materials (MCMs). The initial approach covered characterization of appropriate core PCMs and shell materials for the fabrication of the MCMs. The fabrication process was based on in-situ polymerization method as well as other processes covering synthesis of pre-polymer solution, preparation of oil-in-water (O/W) emulsion and formation of shells. Melamine-formaldehyde (MF) solution was used as shell monomers, nano- silicon dioxide hydrosol as emulsifier for reducing interfacial tension in the O/W emulsion and ammonium chloride as a nucleation agent for reducing the pH level and thus enabling the PCMs capsules to be crossed-linked with the MF polymer. Finally, the van der Waal interaction process was applied to produce the MCMs. Characterization of the developed samples were carried out through particle size analysis, differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) and scanning electron microscopy (SEM). It is believed that the technology could significantly reduce the material content, cost, size and ultimately payback period of integrated nanostructured energy storage components for other sectors such as pharmaceutical and the electronic industries.

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Applications in pharmaceuticals and pollutants analysis of Nano-structure materials

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The Nano-structure materials were used as a modifier and for pollutants removal. The work aimed to synthesis, characterize and applying a Nano-materials in modification of carbon paste electrode and removal of pollutants Carbon paste electrodes (CPEs) which consists of a mixture carbon (graphite) with organic liquid, was used as a working electrode for selective and sensitive determination of some pharmaceuticals and pollutants. To enhance the sensitivity, the carbon paste electrode was modified using different additives such as fatty acids, nanostructure materials and others were added to the paste. This specific area of applied analytical chemistry offers extraordinary wide employment of CPEs and MCPEs using nanomaterials to determine drugs, pollutants and anions. On using Volta metric procedures, different compounds accumulated and adsorbed on the electrode surface and reduced or oxidized giving a peak current corresponds the concentration of investigated analytic. The methods were applied to determine pharmaceuticals and pollutants indifferent media, a detection limit of about 1 x 10 -10M was achieved in some cases.The prepared Nano materials were added to media containing some pollutants and good results were obtained in which up to 80 % of some pollutant was removed.

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A 2.3 (GHz) single electron transistor low noise amplifier for microwave applications

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This work presents an endeavor to simulate a cascode Microwave–LNA using Single Electron Transistor (SET), which operates at a frequency of 2.3 (GHz). This LNA is adequate for many miniaturized microwave applications. However, in order to facilitate the simulation process of this SET–LNA a Verilog Analog and Mixed Signal (Verilog–AMS) SET behavioral model that is based on a modified SPICE model was implemented. This realization has input and output voltage reflection coefficients of –12.628 (dB) and –8.053 (dB) respectively while consuming a power of 0.383 (μW). It also has low noise figure of 0.278(dB).

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Microfluidic one-step preparation of magnetic PVA microspheres with magnetic hyperthermia effect and magnetic resonance imaging

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Poly (vinyl alcohol) (PVA) microspheres are a kind of vascular embolic materials commonly used in clinic for the interventional therapy of tumor. The drug loaded magnetic PVA microspheres would be combined with chemoembolization and magnetic mediated hyperthermia, which also could be seen under magnetic resonance (MR). In this paper, PVA microspheres encapsulated in situ-forming superparamagnetic iron oxide nanoparticles (SPIO NPs) have been prepared by one step using a T-junction droplet-based microfluidic device. Herein, PVA aqueous solution containing Fe2+/Fe3+ salt was used as dispersed phase and liquid paraffin containing surfactants was used as a continuous phase. The PVA droplets containing Fe2+/Fe3+ salt formed in the microchannel were dripped into NaOH solution. Wherein, SPIO NPs were formed by the reaction of Fe2+/Fe3+ with OH-, and the in situ synthesized SPIO NPs acted as a cross-linking agent for PVA to form PVA microspheres. The obtained magnetic PVA microspheres had regular morphology with uniform size (~320 μm). Under external alternating magnetic field, the temperature of the microspheres dispersion was elevated more than 8 □ and the magnetic microspheres could be detectable under the magnetic resonance imaging (MRI). The results of cytotoxicity test showed that microspheres had good biocompatibility. While the cytotoxicity of the doxorubicin-loaded microspheres under 42 □ was more than that under 37 □, which indicated that the hyperthermia therapy and chemotherapy had synergetic effect to kill the tumor cells. Thus, the one-step prepared magnetic drug-loaded PVA microspheres integrated interventional chemoembolization therapy, hyperthermia therapy and MR visualization.

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Nano-encapsulation properties and withstanding biological environment of the modified natural rubber

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Hybrid Natural Rubber NR-X is a potentially attractive material for biomedical applications due to its flexibility, renewability and biocompatibility. This lecture will describe the nano-encapsulation properties of the Natural Rubber through the incorporation of calcium phosphate particles into a polymeric matrix as well as the stability of the material in biological environment. CaP crystalline phases were synthesized by the sol–gel method and the polymeric matrices were produced using natural rubber extracted from latex of the Hevea brasiliensis. The organic-inorganic interface features of the NR-CaP were investigated by Vibrational and Electronic spectroscopies techniques. Polymeric nano-encapsulation properties and withstanding biological environment of the NR have emerged as a promising hybrid material for medical applications.

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Synthesis, structure and adsorption study on a Cu-succinic metal organic framework

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Metal Organic Frameworks (MOFs) have obtained great consideration as carbon dioxide adsorbents, due to their particularly high pore volume and the possibility to shape their pore structures [1-3]. Even though, MOFs can be unstable [4]; hence, the purpose of the reported research was the synthesis of a relatively thermally stable Cu-succinic metal organic framework (Cu-Su-MOF), their structural characterization and the investigation of their adsorption properties. The questions to be answered were the elucidation of their structure, thermal stability, and the relation between framework expansion during high pressure adsorption and the structure of the degassed material. The as-synthesized and degassed materials were studied with scanning electron microscopy, energy dispersive X-ray analysis, diffuse reflectance infrared and Raman spectrometry, thermo-gravimetric analysis, X-ray diffraction, magnetic measurements and low and high pressure carbon dioxide adsorption.

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Nanotechnology and concrete construction

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Super tall buildings such as one kilometer high Kingdom Tower are constructed with concrete as a structural material. Such tall buildings are made with so called high performance concrete, which can have strength 5 times that of conventional concrete. The development of high strength concrete is a result of our understanding of particle packing, rheology and microstructure engineering. Concrete is a critical material for infrastructure; the world wide consumption of concrete is about 2 tons for every living human being. However, its continuing use will require improving its sustainability. Nanotechnology is playing an increasing role in making concrete more sustainable. Some examples are given. One approach to making concrete more sustainable is to replace Portland cement (and its significant carbon foot print) with fly ash, a waste material from burning coal. When fly ash is replaced with Portland cement, the rate of strength development slows down which is not desirable. Addition of Nano particle such as Nano silica accelerates the chemical reaction by providing nucleation sites .In addition, characterization of Nano structure of calcium silicate hydrate by Nano indentation, AFM, FTIR and NMR shows beneficial Nano scale modification. Concrete is a brittle material, prone to cracking. Concrete structures are reinforced by see bars at a millimetre scale. However, flaws in cement paste are in Nano scale. To reinforce concrete at Nano scale addition of carbon Nano tube is studied. The key challenges include dispersion and rheology. Recent studies have demonstrated that adding a very small amount (0.05%) of well dispersed CNT has a profound effect on performance: mechanical properties, piezo-resistivity, transport properties as well as corrosion reinforcing steel. Such multi functionality is probably related to altered Nano structure of concrete.

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High emission efficient and tunable room temperature phosphorescence arising from Pd-porphyrins entrapped in Gemini surfactant micelle hybridized supramolecular gel

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Poly (vinyl alcohol) (PVA) microspheres are a kind of vascular embolic materials commonly used in clinic for the interventional therapy of tumor. The drug loaded magnetic PVA microspheres would be combined with chemoembolization and magnetic mediated hyperthermia, which also could be seen under magnetic resonance (MR). In this paper, PVA microspheres encapsulated in situ-forming superparamagnetic iron oxide nanoparticles (SPIO NPs) have been prepared by one step using a T-junction droplet-based microfluidic device. Herein, PVA aqueous solution containing Fe2+/Fe3+ salt was used as dispersed phase and liquid paraffin containing surfactants was used as a continuous phase. The PVA droplets containing Fe2+/Fe3+ salt formed in the microchannel were dripped into NaOH solution. Wherein, SPIO NPs were formed by the reaction of Fe2+/Fe3+ with OH-, and the in situ synthesized SPIO NPs acted as a cross-linking agent for PVA to form PVA microspheres. The obtained magnetic PVA microspheres had regular morphology with uniform size (~320 μm). Under external alternating magnetic field, the temperature of the microspheres dispersion was elevated more than 8 □ and the magnetic microspheres could be detectable under the magnetic resonance imaging (MRI). The results of cytotoxicity test showed that microspheres had good biocompatibility. While the cytotoxicity of the doxorubicin-loaded microspheres under 42 □ was more than that under 37 □, which indicated that the hyperthermia therapy and chemotherapy had synergetic effect to kill the tumor cells. Thus, the one-step prepared magnetic drug-loaded PVA microspheres integrated interventional chemoembolization therapy, hyperthermia therapy and MR visualization.

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Application of nano carbon materials on producing metal matrix composites

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In recent years, nano carbon materials such as carbon nanotubes and graphene nanoplatelets have become popular as reinforcement material for metal matrix composites due to their unique mechanical and physical properties. In this study, aluminum matrix composites containing carbon nanotubes were produced via semi powder metallurgy. Aluminum and carbon nanotubes powders were compacted in graphite mold at 600 °C with a 50 Mpa pressure in hot-press system. Also, all specimens were sintered at 600 °C at for 1 hour. Hardness tests were performed to understand mechanical effect of CNTs on aluminum. Corrosion tests were also carried out by electrochemical and immersion analysis. Results show that mechanical performances of aluminum were improved with the addition of CNT. However, CNT accelerates the corrosion rate of aluminum.

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Optical property improvement of reactive BAPC/DAP blends with the aid of nano-silica coated titania

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In the past few years, the application of nano-titanium dioxide (nano-TiO2) on catalysis and ultraviolet (UV) shielding has attracted much attention. At the same time, the usage of nano-TiO2 as a UV absorber is limited in many practical areas because of the photocatalytic activity. In order to utilize nano-TiO2 as UV absorbers in a safe and effective manner, the silica coated nano-titanium dioxide (nano-TiO2@SiO2) was prepared by sol-gel process. The nano-TiO2@SiO2 was added into reactive bisphenol-A polycarbonate/diallyl phthalate (BAPC/DAP) blends and its effect on the reaction-induced phase separation and properties of the composites were investigated. The results showed that the nano-TiO2@SiO2 could affect the phase morphology of the BAPC/DAP/nano-TiO2@SiO2 composites by lowering the phase separation rate. The higher the content of nano-TiO2@SiO2, the more difficult of the phase separation proceeding in the composites, which would lead to a rougher fractured surface of the composite film, much higher UV absorption ability and the transmittance of visible light. Meanwhile, the composites with proper content nano-TiO2@SiO2 had highest glass transition temperature, i.e., 0.5 wt% compared with 0.1 wt% and 1 wt%.

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Optical property improvement of reactive BAPC/DAP blends with the aid of nano-silica coated titania

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Halloysites are a kind of aluminosilicate clay with a morphology of a nanotube.1 The inner wall of halloysite is positively charged and the external surface is negatively charged.2 In this work, we propose a simple and facile method to prepare Ag NPs loaded in the lumen of halloysite nanotubes (HNTs). Herein, N-acetyl-L-cysteine modified silver nanoparticles (Ag NPs) with negative charges spontaneously and stably resided in the lumen of HNTs via electrostatic interactions. The images of transmission electron microscopy and scanning transmission electron microscopy showed that Ag NPs with a size of ~2.6 nm were uniformly distributed in the lumen of HNTs. The obtained Ag NPs/HNTs composites show excellent catalytic activity when they were used as catalyst. The catalytic activity of the Ag NPs/HNTs composites was evaluated by the reduction reaction of 4-nitrophenol (4-NP) as a model reaction. When the molar ratio of Ag and 4-NP was set at 0.008, the rate constant of the reaction was found to be 0.91 min-1, 2 times higher than that of Ag NPs adsorbed on the external surface of HNTs. Additionally, no Ag NPs were found in the supernatant after the Ag NPs/HNTs suspension was stirred for 30 min. Such structural stability implies good reusability as a catalyst.

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Metallosis: The battle of the five armies

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Metals and their alloys have been widely used as implantable materials such as artificial joint prosthesis; internal fixation nails, plates and rods; dental implants and stents. Metallosis including adverse reactions to metal debris (ARMD) in hip arthroplasty is an aseptic fibrosis, local necrosis, inflammation, or loosening of an implanted device secondary to metallic corrosion and release of wear debris. The mechanism of inflammation in metallosis is controversial due to the complexity of the morphology, composition of the wear particles and cell/tissue responses involved. Metal allergy can partially explain some clinical cases but the causes of many are still unknown. We have recently analyzed 285 cases of metallosis from hip replacement. It is identified that five key factors have played an important role in metallosis: (1) wear metal nanoparticles; (2) metal corrosion products; (3) macrophages; (4) master cells; and (5) lymphocytes. In the cases of hip arthroplasty, there are distinct differences between wear metal particles and metal corrosion products, both are recognized as foreign body invasion and induce a battle led by host macrophages, master cells and lymphocytes. Macrophages respond to both types of metal materials by phagocytosis and engulfment in all cases with metallosis. Master cells are seen in some cases and located between macrophages/metal particles and blood vessels. Lymphocytes are dissociated with metal particles but with more severe clinical manifestation following their infiltration. Consequently, it results in large area of cell apoptosis and necrosis, inflammation, fibrosis or pseudotumor formation and failure of the implants.

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Large single crystal graphene manufacture

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Large single crystals of graphene were made by using a solvent-catalyst of nickel metal. Both solid and liquid processes were experimented with graphene single crystals of mm demonstrated. The carbon so graphene has phenomenal properties, such as with 100X mechanical strength of steel, 100X of electrical conductivity of copper. However, these superb attributes belong to intact honeycomb lattice (sp2) of carbon atoms. Unfortunately, both natural and man-made graphene products are defects ridden. They are also limited by the honeycomb size (la) of carbon lattice. Hence, the graphene single crystals available are nanometers across, such bacteria sized graphene is best used as additives, such as strengthening agent for polymers, or for corrosion retardant of coatings. Although CVD methods claim to have large areas of graphene deposition on metal foils (e.g. Cu), but the bombardment of pyrolytic carbon atoms on substrate is an irreversible (nonequilibrium) process, so most carbon atoms may land in the wrong position and incapable to move to the equilibrium sites. As a result, single crystals with defects density commensurate to silicon wafer in the order of 10 thousands per centimeter are also smaller than one micron; like that those exfoliate from natural graphite. The sublimation of SiC single crystal to form graphene surface suffers the non-equilibrium process in reverse. The reconstitution of remaining carbon atoms, although nearby is kinetically slow at the sublimation temperature. Consequently, the so called graphene wafer is not made, and SiC single crystal wafer itself is expensive and source may be solid or gas. For example, green house effected carbonaceous gas could be used to strip carbon in forming large crystals of graphite that would be a source for making precious graphene.

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