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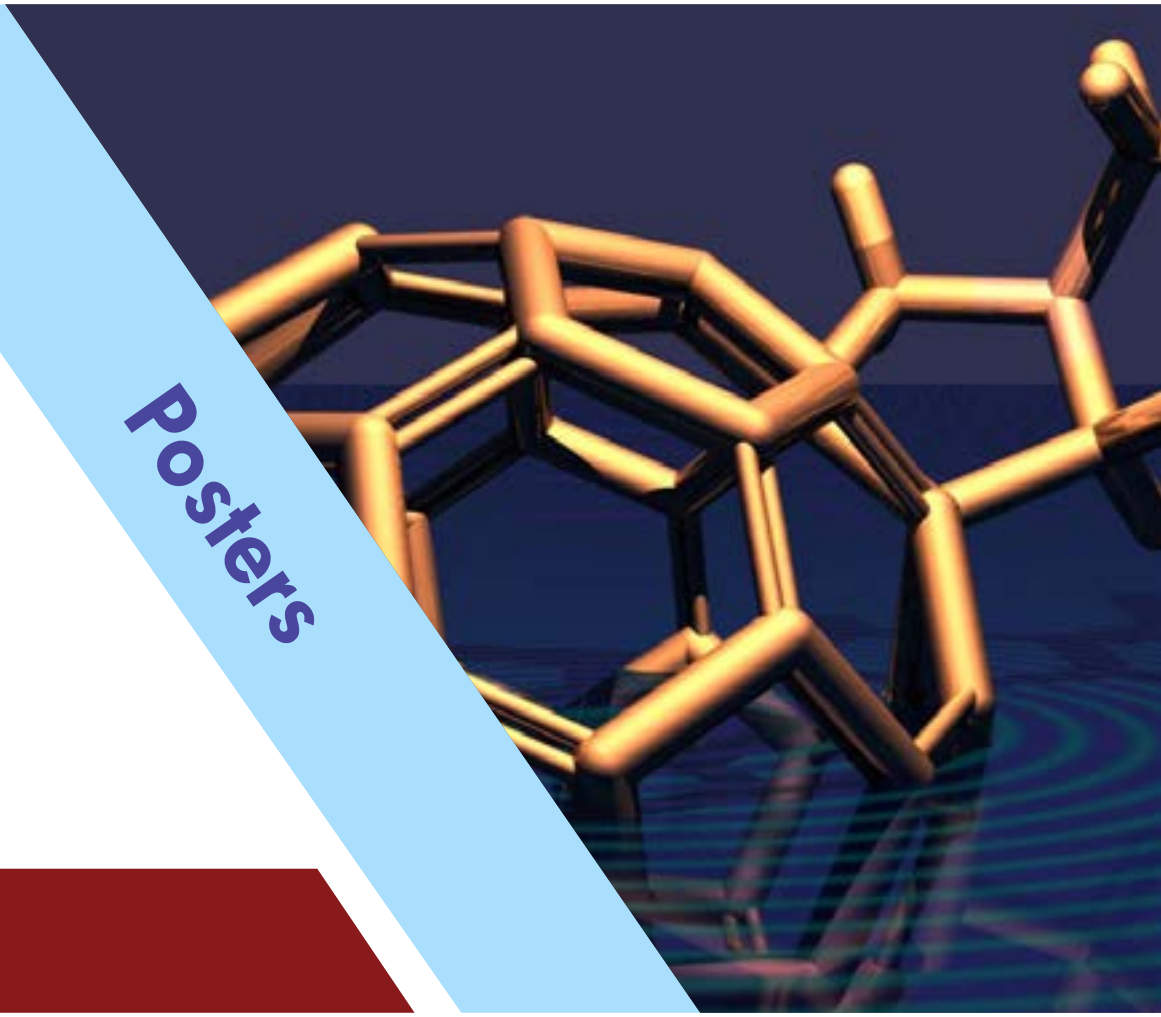




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Xiaoxue Zhang et al., J Nanomed Nanotechnol 2016, 7:6 (Suppl)
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Deposition of silver nanoparticles/poly (amidoamine) dendrimer/graphene oxide nanohybrids on sensor surface for anti-biofouling

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Surface fouling, which leads to a decrease in sensitivity and life-time of sensors, has been considered as a severe problem in sensing system. Therefore, there is an urgent demand for finding suitable anti-fouling materials in order to protect against or minimize the fouling on surface of sensor. It has been found that Graphene Oxide (GO), Silver Nanoparticles (Ag NPs) and Poly (amidoamine) (PAMAM) dendrimers exhibit strong antibacterial and anti-biofouling behaviour. Moreover, the highly branched and well defined PAMAM dendrimer has shown promising advantages on controlling the shape, size, stability, and solubility of metal nanoparticles due to its uniform compositions and structures. In this work, a nanohybrid, comprising silver nanoparticles within third-generation NH2-terminated PAMAM dendrimer which grafted onto GO, was applied on the surface of sensor by dip coating. The content of PAMAM grafted on GO was determined by a Thermal Gravimetric Analyzer (TGA). The structure of this nanohybrids was characterized by Fourier transform infrared spectroscopy (FT-IR) and Raman spectroscopy. The morphologies of Ag NPs with different size, which synthesized and deposited on GO/PAMAM, were investigated by Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). Furthermore, the anti-biofouling properties of the nanohybrid was also investigated by SEM and TEM after inserting control sensor and sensor with coating surface into closed-containment aquaculture systems for eight weeks.

Biography

Xiaoxue Zhang has completed her master at the age of 25 years old from Soochow University. She is the PhD candidate of department of chemistry at Norweigian University of Science and Technology now. Her project is coating nanomaterials on the surface of sensor to protect against or minize fouling.

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A Pooja Shukla, J Nanomed Nanotechnol 2016, 7:6 (Suppl)
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First-principles study of electronic transport and thermoelectricity in grain-boundary nanostructures for device applications

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Grain boundaries are quasi-one-dimensional structures comprising different types of polygons that maintain the periodicity in the ordered state. These are usually observed in graphene due to its polycrystalline nature. However, Grain Boundary (GB) nanostructures can also be observed in the hexagonal analogues of silicon and germanium, known as silicene and germanene. GBs, formed between single crystal regions, often offer an opportunity to tune the local electric and thermal properties via defect engineering to realize new functionalities. A recent study shows that the carrier concentration gets enhanced significantly, once grain boundaries are embedded in ordered nanostructures. Since high carrier concentration is essential for better electronic applications, a systematic study of grain boundaries out of different nanostructures can be useful for better understanding the device mechanism towards nanoelectronic applications. GBs being topological defects with largely a disordered character can potentially influence the thermoelectric properties as well, since disorder scatters phonons more effectively than electrons. The aim of the proposed work is hence to study the charge transport, electron-photon interaction and thermoelectricity in several grain-boundary nanostructures of technological interest.

Biography

A Pooja Shukla is pursuing her PhD from SRM University and completed her MTech in Nanotechnology from SRM University. She is working as Research Scholar in SRM Research Institute. She has published two papers in reputed journals and also achieved awards for best project in Nanotechnology.

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Nitrogen doped double gyroidal mesoporous carbon material for oxygen reduction reaction synthesized from pyridine containing precursor, hydroxymethyl-3-hydroxylpyridine

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The Oxygen Reduction Reaction (ORR) is a key reaction for fuel cells. Nitrogen-doped carbon materials show high electro-catalytic performance for the ORR. They are thus among the most promising candidates as alternatives to high-cost Pt catalysts for the cathode of fuel cells. One of the active sites of the nitrogen-doped carbon materials for the ORR was was pyridinic nitrogen. Hence, nitrogen-doped carbon materials containing high concentration of pyridinic nitrogen could be a promising cathode for ORR. In our recent efforts, nitrogen-doped double gyroidal mesoporous carbon material (N-DGMC) was synthesized from the structure-directing tri-block terpolymer poly(isoprene)-block-poly(styrene)-block-poly(ethylene oxide) (ISO) with pyridine containing precursor, hydroxymethyl-3-hydroxyl pyridine, as a nitrogen source and phenol-formaldehyde resol as a carbon source. The total nitrogen contents and relative concentration of nitrogen species were obtained from XPS measurements indicating higher concentration of pyridinic nitrogen than other carbon materials in which nitrogen are doped by an ammonia treatment method. Furthermore, N-DGMC has double gyroidal structure; therefore, it has a large surface area as well as lots of pores, which enable N-DGMC to have high catalytic performance.

Biography

Fumiaki Matuoka has completed his MS from Osaka University School of Engineering Science. He is a Visiting Scholar at Cornell University, Department of Material Science Engineering. His research interest includes “Synthesizing double gyroidal mesoporous template for meta-materials”.

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A comparison analysis on nanotechnology policies of the US and Korea

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After nanotechnology was considered a key technology for the future of industry, several countries has established national nanotechnology development plans. As the importance of nanotechnology for creating innovation has increased significantly, leading countries in nanotechnology also have invested much in the transformation of nanoscience into commercialization. The US is a leading country in the nanotechnology area while Korea is one of the upcoming countries. In this study, we carried out a cross-country comparative study on R&D and commercialization trends of the two countries in the nanotechnology area by analyzing national nanotechnology budgets of the US and Korea. Through the comparative analysis, we expect to find out what roles the US and Korea governments will play to become world leaders in the nanotechnology area. We also expect to promote relevent policies and strategic positioning of both countries in the nanotechnology area. Additionally, we propose R&D directions for Korea's nanotechnology policy based on this study.

Biography

Kyunghye Lee has completed her PhD from School of Computing, Soongsil University. She is working as a Research Fellow at National Nanotechnology Policy Center, Korea Institute of Science Technology Information.

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Self-powered biosensor for direct detection of cysteine using functionalized BaTiO3 nanoparticles

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Jeju National University, South Korea

Cysteine being an essential amino acid, source of sulfide, biomarker and a precursor has vital role in homeostasis. Abnormality in cysteine levels leads to chronic diseases such as rheumatoid arthritis, Parkinson's disease, cardiovascular disease, Alzheimer's disease and adverse pregnancy outcomes. Various cysteine detection techniques have been developed based on fluorometry, electrochemical voltammetry and fluorescence-coupled HPLC techniques involving tedious procedures limiting their practical applications. Self-powered nano sensors are gaining interest due to its own merits such as battery less operation, portability, point of care diagnosis, implantable applications and so on. First of its kind, direct detection and facile fabrication of cysteine responsive film based self-powered device has been reported. NH_2 functionalized $BaTiO_3$ NPs (BT- NH_2 NPs) suspended in a 3D matrix of Agarose film (Ag) serves as the sensing element for cysteine detection. The change in surface charge properties of the film with respect to cysteine concentrations were determined using I-V technique. The current response increased with increase in cysteine concentrations (linear concentration range is 10 μM to 1 mM). The composite's properties invoked interest in developing Piezoelectric Nano-Generator (PNG) which eventually lead to the fabrication of self-powered cysteine sensor (PNG's output voltage was used for driving the sensor). The potential drop across the sensor was measured as a function of different cysteine concentrations in self-powered cysteine sensor. Real time analysis was performed using urine samples. The proposed sensor has good selectivity and detection limits down to 147 nM.

Biography

Sophia Selvarajan is currently pursuing her PhD in Department of Advanced Convergence Technology and Science at Jeju National University, South Korea. She completed her Master of Technology in Nanotechnology at Karunya University, India and Bachelor of Technology in Biotechnology at Centre for Plant Molecular Biology and Biotechnology, Tamil Nadu Agricultural University, India. Her research areas of interest include "Nano-biosensors, self-powered systems for theranostics and drug delivery system.

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Development of paint-type dye-sensitized solar cell using carbon-nanotube- paint and evaluation of its painted electrodes for efficient power generation

Yuki Matsunaga, Takahide Oya
Yokohama National University, Japan

We propose "paint-type" Dye-Sensitized Solar Cells (DSCs) using Carbon-Nanotube (CNT) paints. Recently, solar power generation has been focused because of current environmental problems. The DSC that is one of solar cells consists of semiconducting and metallic electrodes facing each other. The semiconducting electrode is attached dye. When an electrolyte is placed between two electrodes and the cell is irradiated by light, it starts power generation. In this study, we develop and use semiconducting- and metallic-CNT paints for electrodes of our DSC. The semiconducting-paint contains the dye. Therefore, we can obtain the paint-type DSCs by only painting any objects. As a first study, we used ordinary papers as substrates to paint the CNT paints for two electrodes and found our DSC had power generating ability. However, its efficiency of power generation was not so high. We are now studying to improve the efficiency by controlling parameters of paints, electrolytes, and kinds of dyes. We here focus on conductivity of the paint on substrates because it influences the efficiency directly. We prepared some painted electrodes that had different conductivity and evaluated their properties. As results, we found that controlling conductivity must be needed to obtain high efficiency of power generation, i.e., we must control the concentrations of the CNT and other contents in the paints. In near future, we will study and find suitable parameters of electrolytes and the dyes. Finally, we will develop the high efficient paint-type DSC, we believe.

Biography

Yuki Matsunaga was received the B.E. degree from Yokohama National University, Kanagawa, Japan in 2014. He is now 2nd year of a master course student of Graduate School of Engineering, Yokohama National University. His current research interests include development of unique applications using carbon nanotubes (CNTs), i.e., of paint-type DSC using CNT-paints.

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Transparent indium zinc oxide transistor using pre-annealed sol-gel semiconducting layer

Sung-Jin Kim and **Fei Shan**
Chungbuk National University, Korea

Low-temperature, high-performance solution-processed metal oxide thin-film transistors such as zinc oxide, zinc tin oxide, amorphous indium gallium zinc oxide and indium zinc oxide (IZO) have been studied extensively to develop active-matrix devices by using TFTs liquid crystal displays, organic light emitting diodes and electrophoretic paper display. In this study, we report on thin-film transistors with indium zinc oxide (IZO) channel layers were fabricated via a pre-annealing process at various temperatures. The research is based on a thermal-annealing process in order to ensure achieve high performance of the transparetn IZO thin-film, meanwhile, devote to the fabrication of low-cost and large size electrical devices. The solution-processed IZO semiconductor matched well with the pre-annealing at the low temperature as low as 120°C, and it showed good performance: a field-effect mobility of 7.9 cm2/Vs, a threshold voltage of 1.4 V, a subthreshold slope of 0.48 V/dec., and a current on-to-off ratio of 2.9 X 107.

Biography

Sung-Jin Kim received the Ph.D. degree in the School of Electrical and Computer Engineering from Seoul National University, Seoul, Korea, in 2006. In, 2007, he was a Postdoctoral Research Scientist with the Department of Electrical Engineering, Columbia University, New York, NY, where he was initially engaged in research on the application of nano technology and new processing strategies for highly integrated systems. In 2008, he joined the School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA, as a Postdoctoral Fellow working on solution-processable nano structured devices. His current research interests include the nano devices, flexible nano printing electronics, and energy harvesting nano applications.

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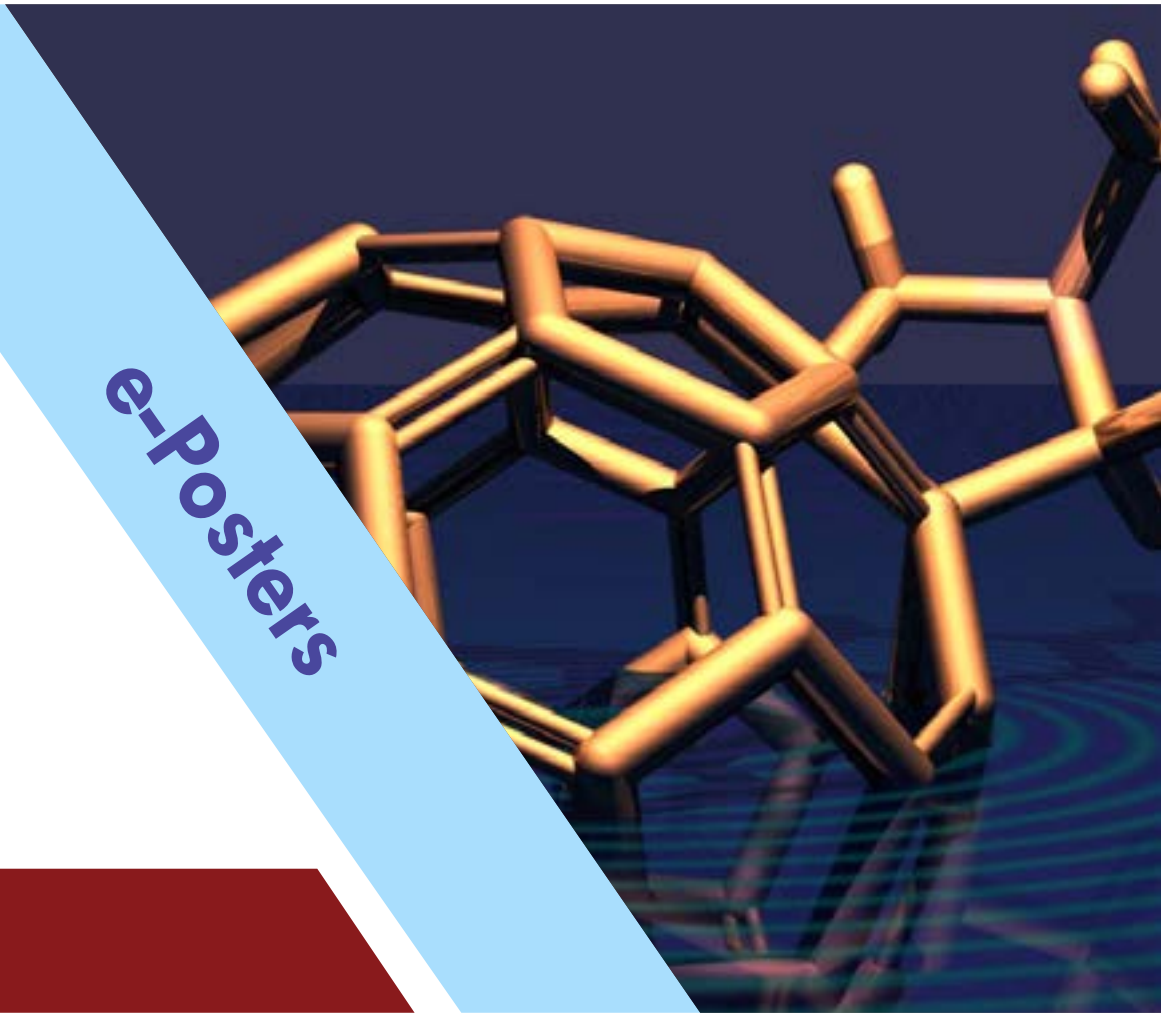

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Nada Najafzadeh et al., J Nanomed Nanotechnol 2016, 7:6 (Suppl)
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Preparing the nanoparticles of chitosan to modify hydrolyzed polyester

Nada Najafzadeh[1], **Sima Habibi**[1] and **Mohammad Reza Allah Quli Ghasri**[1]
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Considering the vital role of nanotechnology in various industries, the role of mentioned technology in the textile industry can not be ignored. Finishing textile industry is one of the sectors that are very important to pay attention and to update it. The use of nanotechnology in the textile industry can create new features in textile fibers used in the textile industry, especially polyester fiber have an effective chemical and physical properties and particular importance. One of biocompatible polymers with biodegradability and non-toxicity properties is chitosan. Chitin and chitosan, a natural amino polysaccharides, due to characteristics such as multi-dimensional and high-performance and its much attention in the medical and textile industries in particular have attracted. The surface will be coated with small amounts of the substance. Several other methods for modifying surfaces such as textiles corona, plasma, sol-gel are used before. Facing paper reviews, the preparation of chitosan nano particles to modify the polyester product is hydrolyzed. In this study, after the modified alkaline hydrolysis of polyester, the surface was coated with nano chitosan particle provided by method of chemical hydrolysis with different percentages. To prepare the nano-chitosan, chitosan was hydrolyzed in acidic medium to medium molecular weight and particle size by TEM and SEM confirmed. X-ray diffraction crystalline particles by chitosan was investigated. To investigate the link between chitosan and polyester functional groups of FTIR spectroscopy was distinguished by infrared.

Biography

Neda Najafzadeh has completed her Master's degree in Textile Chemistry and Color Engineering from Islamic Azad University of Imam Khomeini. Her thesis was focused on "Preparing the nanoparticles of chitosan to modify hydrolyzed polyester to dying polyester with reactive dye".

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The study of the cell membrane of blood lymphocytes in patients with diabetes mellitus using atomic force microscopy

Radik Khayrullin, Olga Stolbovskaya and **Rinat Bakhtiyarov**
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Atomic Force Microscopy (AFM) is a nanotechnological study method of cell membranes and makes it possible to study the structural changes in the cell membranes of living human blood lymphocytes. With using AFM, we studied Young's modulus, adhesion strength and roughness of the cytoplasmic membrane of living blood lymphocytes in patients with diabetes. Peripheral blood lymphocytes of patients with insulin-dependent and non-insulin dependent diabetes mellitus and healthy donors was analyzed using a scanning probe microscope. The scanning of the cell surface membrane of blood lymphocytes were performed using silicon probes with a hardness of 0.06 N/m, and with the radius of curvature of 10 nm. The results of studies have shown that diabetes is a significant increase of Young's modulus of membrane of blood lymphocyte as compared with that in blood lymphocytes in healthy persons. Also significant differences are in the adhesion properties and surface topography of lymphocytes in different types of diabetes. In patients with insulin-dependent diabetes mellitus, the adhesion force and values of roughness of cells is higher than that in patients with non-insulin dependent diabetes mellitus. Biophysical indicators reflect changes in the molecular structural organization of membrane lymphocytes occurring in diabetes, however, it remains unknown how these changes determine the biological activity of lymphocytes. The present study demonstrates and opens possibilities for the study of structural relationships of proteins and lipids of native cell membranes of lymphocytes, understanding the role of lymphocytes in the development of immunological disorders, occurring in this disease.

Biography

Radik Khayrullin has completed his PhD from Bashkir State Medical University (Russia) and Post-doctoral studies from First Moscow State Medical University. He is a Professor, and Head of Human Anatomy Department of Ulyanovsk State University. He has published more than 80 papers in reputed journals and has been serving as an Editorial Board Member of repute.

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Effects of silver nanoparticle on oxidative stress biomarkers in liver mitochondria male rat: In vitro study

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Nanotechnology and nanoparticles are increasingly recognized for their potential applications in aerospace engineering, nanoelectronics, environmental remediation, medical healthcare and consumer products. As some nanoparticles can cross the cell membranes particularly mitochondria and mitochondria has a vital role in the regulation of cellular energy through aerobic pathway and electrolyte homeostasis, therefore the defects in mitochondrial function indued by nanoparticles can have severe effects on cellular function. The purpose of this study was to investigate the effect of AgNP on the oxidative stress biomarkers in rat liver mitochondia during different time intervals. In this study, the isolated mitochondria from the liver of male Wistar rats (180-250 g) were used. Isolated mitochondria were treated with different doses (5, 1, 50, 100, 250 mmol/ml) of 20 nm diameter AgNP respectively for 24, 48 and 72 hours. After treatment, oxidative stress biomarkers such as Total Antioxidant Capacity (TAC), Lipid Peroxidation (LPO), Total Thiol Groups (TTG) and Catalase Activity (CAT) were determined in isolated rat liver mitochondria. The results confirm oxidant/antioxidant effects of AgNP in various time. Results of this study showed that AgNP has paradox properties in liver mitochondial sample, while mitochondria is a source of reactive oxygen species (ROS).

Biography

Sara Malih has completed her MSc in Medical Biotechnology from Hamadan University of Medical Sciences. She has published more than three papers in reputed journals. She has two more research articles under review. She is Reviewer of *Tumor Biology*-Springer and has participated in more than three international congresses.

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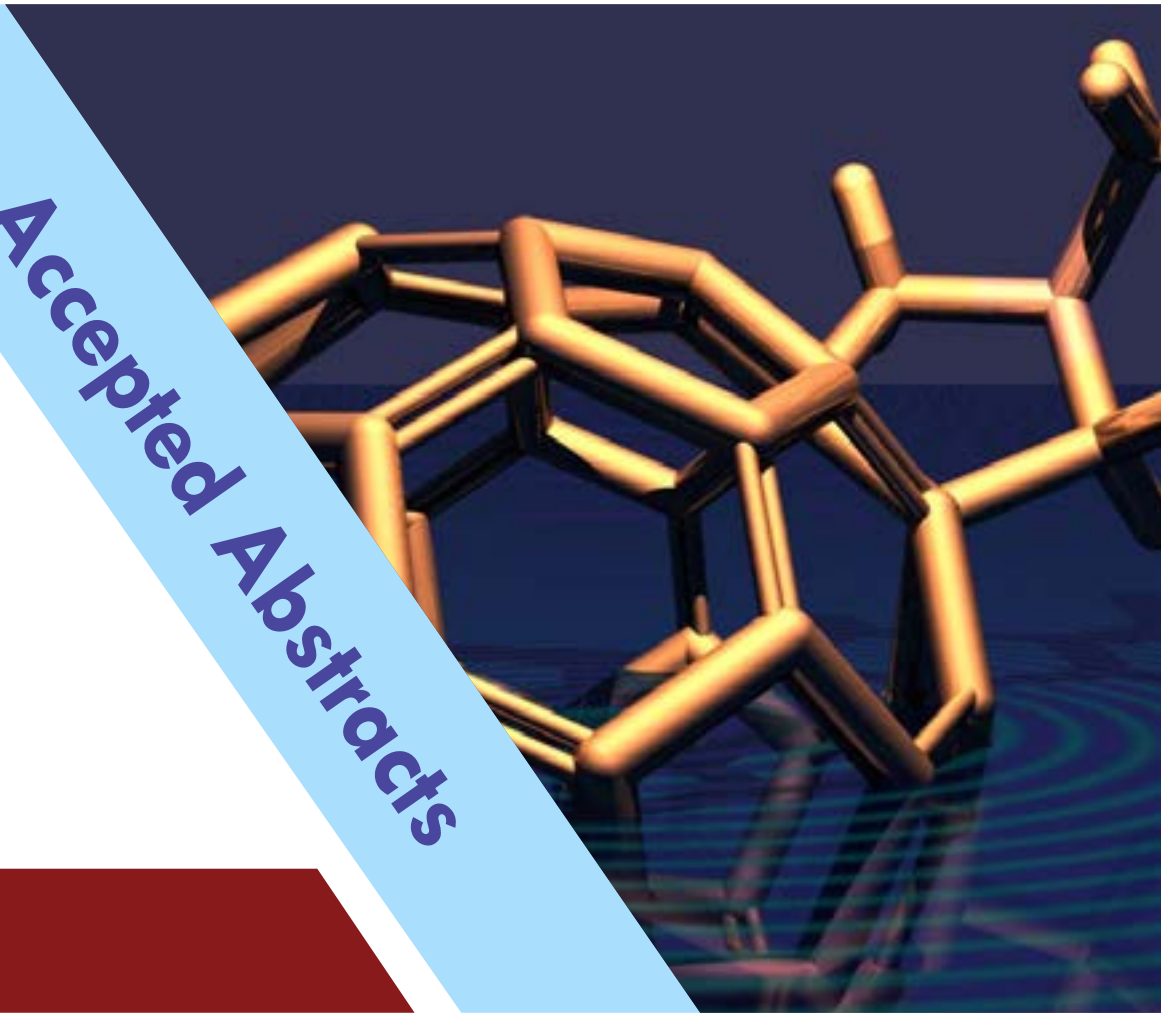




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Energy efficiency and building environment

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With the environmental protection posing as the number one global problem, man has no choice but reducing his energy consumption, one way to accomplish this is to resort to passive and low-energy systems to maintain thermal comfort in buildings. The conventional and modern designs of wind towers can successfully be used in the hot arid regions to maintain thermal comfort (with or without the use of ceiling fans) during all hours of the cooling season, or a fraction of it. Climatic design is one of the best approaches to reduce the energy cost in buildings. Proper design is the first step of defence against stress of climate. Buildings should be designed according to climate of the site for reducing the need of mechanical heating or cooling hence maximum natural energy can be used for creating pleasant environment inside the built envelope. Technology and industry progress of the last decade diffused electronic and informatics' devices in many human activities and now appear also in building construction. The utilisation and operating opportunities components, increase the reduction of heat losses by varying the thermal insulation, optimise the lighting distribution with louver screens and operate mechanical ventilation for coolness in indoor spaces. In addition to these parameters the intelligent envelope can act for security control and became an important part of the building demotic revolution. Application of simple passive cooling measure is effective in reducing the cooling load of buildings in hot and humid climates. 43% reductions can be achieved using a combination of well-established technologies such as glazing, shading, insulation, and natural ventilation. More advanced passive cooling techniques such as roof pond, dynamic insulation, and evaporative water jacket need to be considered more closely. The building sector is a major consumer of both energy and materials worldwide, and the consumption is increasing. Most industrialised countries are in addition becoming more and more dependent on external supplies of conventional energy carriers, i.e., fossil fuels. Energy for heating and cooling can be replaced by new renewable energy sources. New renewable energy sources, however, are usually not economically feasible compared with the traditional carriers. In order to achieve the major changes needed to alleviate the environmental impacts of the building sector, it is necessary to change and develop both the processes in the industry itself, and to build a favourable framework to overcome the present economic, regulatory and institutional barriers.

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Transformation of the physical properties of Carboxylated-Nanodiamonds in water solution exposed to gamma irradiation.

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Nanodiamonds (NDs) have unique optical, thermal and mechanic properties. They also have the advantage of high biocompatibility, which makes them appropriate to biomedical applications. Recently a protective effect against γ-irradiation of carboxylated nanodiamonds (cNDs) has been reported on erythrocytes. The structural, mechanical thermal and optical properties transformation of cNDs dispersed in water and exposed to γ-radiation were analyzed. Commercial detonation NDs and cNDs were analyzed by different techniques including transmission electron microscopy (TEM), scanning electron microscope (SEM), X-ray photoelectron spectroscopy (XPS), Raman spectroscopy and atomic force microscopy (AFM) after and before treatments with 20, 40, 60, 120 and 240 Gy of γ-irradiation. Here we report the water interaction with cNDs during radyolisis at different degree.

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Nanostructured semiconducting oxide thick films for monitoring food freshness

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Nowadays, people use the junk foods and readily available foods in packets available in the market, due to rush and rush in their routine works. Also, the modern life style prefers the food packets in birthday like parties. Some foods like tomato souse, ketchups, fruit crunches, fish, agricultural products, animal products, etc. are made the mandatory part of daily lives. Such foods may get degraded if not stored properly. It has been observed that, the cold storage units are not available in all the shops. This is the major problem in villages. Even though the degradation of such foods is less in amount, it affects the human health, on consumption, in terms of various diseases, viz. vomiting, diarrhoea, indigestions, stomach disorders, physiological and psychological disorders, etc. So, there is a strong need to detect the food freshness.The bismuth oxide powder synthesized at optimized conditions with the definite particle size was utilized in the form of thick films for monitoring food freshness. The effect of degradation time, the type of food, the surface nanostructure, operating temperature, long duration, long term exposure, etc. on the food freshness of the samples were studied and discussed.

Keywords: Junk foods, Tomato Souse, Ketchup, Fish, Food Freshness, etc

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Room temperature gas-sensing properties of multi-walled carbon-nanotubes functionalized with phthalocyanine

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Multi Wall Carbon Nanotubes (MWCNTs) have attracted extensive attention in sensing and storage of gases due to their unique one-dimensional carbon nanostructure and electrical properties. On the other hand, due to their high surface areas, central hollow cores and the outside walls, carbon nanotubes can be used as a superior material to adsorb and storage gases, such as oxygen, hydrogen, chlorine and nitrogen oxides. CNTs can respond to both reducing and oxidizing gases through a charge transferring reaction with the gas molecules that changes their conductivity [A]. Multiple research groups have focused on studying and improving the response of CNT-based sensors. Recently, in order to improve the sensing performance of these MWCNTs based sensors, many sensing materials such as conducting polymers, metals and metal oxides have been anchored on the surface of MWCNTs and play important roles in the improvement of the sensitivity and selectivity of the resultant gas sensors. Phthalocyanine (Pc), as an excellent sensing material, has been extensively studied based on its high sensitivities, excellent thermal and chemical stability. The electrical conductivity of phthalocyanine thin films can be changed by the presence of oxidizing or reducing gases.In this work, we have prepared a hybrid material of MWCNTs-COOH and F_{16}ZnPc. The formation of F_{16}ZnPc/MWCNTs-COOH hybrid was confirmed by UV-Visible, Raman and FT-IR spectroscopy. SEM, TEM and AFM studies revealed that F_{16}ZnPc molecules were successfully anchored on the surface of MWCNTs-COOH through π-π stacking interaction. Subsequently, a chemi-resistive sensor have been fabricated by drop casting F_{16}CuPc/MWCNTs-COOH hybrid onto alumina substrate. The gas sensing potential of the fabricated hybrid materials has been tested upon exposure to different hazardous gases like NO_2, NO, Cl_2 and NH_3 at different operating temperatures. It has been demonstrated that F_{16}ZnPc/MWCNTs-COOH hybrid is highly selective towards Cl_2 with minimum detection limit of 100 ppb. The response of sensor increases linearly with increase in Cl_2 concentration.The results obtained emphasize on the application of F_{16}ZnPc/MWCNTs-COOH hybrid material in Cl_2 sensing applications.

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Polyelectrolyte nanocomposite membranes using imidazole- functionalized nanosilica for fuel ctell applications

Elham Jafarnia
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The preparation and characterization of a new type of nano composite polyelectrolyte membran TM(PEM), based on DuPont® Nafion imidazole modified nanosilica (Im-Si), for Direct Methanol Fuel Cell (DMFC) applications is described. Related to the interactions between the protonated imidazole groups, grafted on the surface of nanosilica, and negatively charged sulfonic acid groups of Nafion, new electrostatic interactions can be formed in the interface of Nafion and Im- Si which result in both lower methanol permeability and also higher proton conductivity. Physical characteristics of these manufactured nanocomposite membranes were investigated by Scanning Electron Microscopy (SEM), Thermogravimetry Analysis (TGA), differential scanning calorimetry (DSC), Fourier Transform Infrared spectroscopy (FTIR), water uptake, methanol permeability and ion exchange capacity, as well as proton conductivity. The Nafion/Im-Si membranes showed higher proton conductivity, lower methanol permeability and, as a consequence, higher selectivity parameter in comparison to the neat Nafion or Nafion/silica membranes. The obtained results indicated that the Nafion/Im-Si membranes could be utilized as promising polyelectrolyte membranes for direct methanol fuel cell applications.

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Fabrication of different types of TiO_2 nanostructures and their gas sensing features

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In the last decades, metal oxides have been studied for some application areas such as solar cells, photocatalysts, and batteries. Nano-sized metal oxides are especially utulized more actively in the following fields; piezoelectric materials, optoelectronic devices, solar energy, and gas sensors. In case of fabricated metal oxide nanomaterials, the extraordinarily large surface-to-volume ratio leads to a dominant surface effect due to the increase of specific surface. Hence, high surface area results in the enhancement of the surface related properties such as catalytic activity or surface adsorption. Metal oxides such as zinc oxides, titanium oxides, and tin oxides are the most used nano-sized gas sensor. Among metal oxide-based gas sensors, TiO_2 has excellent sensing properties for various gases such as H_2, VOCs, NO_2, and CO. To improve their gas sensing properties such as sensitivity, response time and working temperature, metal oxides can be modified with different metals. In our study, TiO_2 nanotubes, nanowires and nanorods were fabricated by anodization and hydrothermal methods. Fabricated TiO_2 nanomaterials have 40-90 nm in diameters and 0.5-40 μm in length. We also achieved to modify TiO_2 nanomaterials with catalytic metal materials by some methods such as hydrothermal, cathodization and CVD. Gas sensing properties of pristine and metal-functionalized TiO_2 nanomaterials were investigated under dry air flow at the temperature range from 30 °C to 200 °C. The results revealed that the TiO_2 nanomaterials modified with metal materials exhibited excellent sensing performance to gases, especially H_2 even at room temperature, and also appropriate sensor behavior with clear response-recovery.

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Polymer mediated synthesis of self assembled zinc-tin-oxide/acid functionalized nanodiamonds nanoparticles as potential photocatalysts

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The multipurpose nanomaterial, Zinc Stannate ($ZnSnO_3$), is one of the highly regarded photocatalysts. The photocatalytic functionality of $ZnSnO_3$ is particularly dependent over its microstructure, morphology and bandgap. The conventional solid state methods are not suitable for its preparation owing to its metastability. Therefore, we come up with a strategically designed preparatory method to get control over the microstructure, morphology and optical bandgaps of ZnSnO3 nanomaterials. Single phase and self assembled ZnSnO3 nanoparticles having smaller bandgaps than the bulk are prepared and characterized. The metal ions were stabilized by in situ polymer formation, and the subsequent oxidation with NH4OH ensured ZnSnO3. The polymer was finally fired off at 400°C temperature which was established after TGA analysis of the metal oxide/polymer nanocomposites. The electron microscopic study shows that the ZnSnO3 nanoparticles self assemble around the polymers which agglomerated into spheres, may be due to the addition of aqueous solvent. The circularly self assembled structures further auto organized giving large assemblies of nanoparticles. The XRD analysis revealed that the self assembled nanoparticles are in a single phase i.e. perovskite ZnSnO3. The elemental compositions were established using EDX spectroscopy. The direct optical energy bandgaps were obtained for all the samples using DRS spectra. It has been observed that bandgaps of ZnSnO3 nanoparticles prepared at pH 3 are smaller than those obtained at pH 9. However, the overall bandgaps (2.66 – 3.25 eV) of ZnSnO3 nanoparticles were smaller than the bulk and earlier reported ZnSnO3 nanomaterials (3.35 – 3.89 eV) . The decrease in bandgaps was due to the addition of AFNDs as we have observed previously. Selective samples were used for photo-induced-degradation of Methylene blue dye, and it has been observed that more than 90% dye decomposed within two hours of exposure time.

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Comparison of different iron nanoparticles in their potential to combat contaminants in water.

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Nanoscale Zero-Valent Iron (nZVI) particles are known to be a great driver in combatting organic contaminants found in water. Following a Fenton-like reaction model, the iron nanoparticles are able to oxidize the contaminants into harmless by-products such as carbon dioxide and water. The conventional method to synthesize these nZVI particles presents an issue with toxic by-products such as sodium borohydride, therefore another proposed method for producing various metallic nanoparticles provides the use of plant extracts as the reducing agent to reduce Fe^{2+} or Fe^{3+} into the desire zero-valent iron, or Feo. *Larrea tridentata* (also known as creosote bush) is commonly found in our desert region, and will be used as the plant material extract utilized in the plant based production of nZVI particles. There is an optimal polyphenol content in the plant for the reaction with the iron salt solution to occur and produce the desired hydroxyl radicals. To test the potential use of nZVI produced from plant mediated procedures, commercial nZVI was tested against conventionally synthesized nZVI and plant extract synthesized nZVI in their ability to produce OH radicals; the main transient species for oxidizing pollutants. The characteristics of the three types of nZVI will be assessed, as well as the yields in hydroxyl radicals when reacted with hydrogen peroxide and UV radiation. The results showed that the nZVI form produced via the conventional method showed the greatest potential in production of hydroxyl radicals, and the plant synthesized nZVI was comparable in effectiveness when using a greater volume. Plant materials can be more involved in the production of these nanoparticles in hopes that the process can be improved thus leading to less harmful chemical waste.

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Photocatalytic degradation of Methylene Blue by Nitrogen doped MoS2 under visible light irradiation

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Due to the development of industrialization, water pollution has become a global concern. The pollution of water resources by dyes from textile has become a serious environmental problem. Therefore it is very essential to remove the dyes from an aqueous environment. Herein, the removal of a cationic dye with N-doped MoS2 is investigated. Nitrogen doped MoS2 was successfully synthesized using sol gel method. It's crystal structure was measured by X-Ray Diffractometry (XRD). A Scanning Electron Microscope (SEM) and high resolution transmission electron microscope were used to observe the morphology and structure of the sample. Photocatalytic performance was evaluated by discoloring of Methylene Blue under visible light irradiation. N-doped MoS2 showed excellent photocatalytc activities and durability on the elimination of organic pollutants under visible light irradiation. It has larger BET areas. Due to this fact the surface adsorption capacity of the reactants is improved. Also more active sites are exposed, guaranteeing higher activity in degrading the dye. This work provides potential applications in water pollution treatment, as well as other related fields.

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Tissue analysis using hodge decomposition

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It has been seen that a vector field decomposition method called the Helmholtz Hodge Decomposition (HHD) can analyze scalar fields present universally in nature. It aids to reveal the complex internal energy flows in interference and diffraction fields. A gradient field defined in a region R, can be separated into solenoidal and irrotational components. HHD applied onto Magnetic Resonance Elasticity data can also aid to retain the curl field, while revealing the tissue elasticity in such medical measurements. The segmented shear waves in affected brain tissues were explicitly segmented and studied using our least square method of Hodge decomposition. HHD can also reveal the condition of tissues after they have been targeted with nanomedicines.

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Nanocellulose for functional surface modification and coatings

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Cellulose is the most abundant, renewable, biodegradable and environmentally friendly organic compound found in nature. Cellulose is found in wood, plant fibers, marine animals, algae, fungi, and bacteria. Nanocellulose material is composed of fibrils with high aspect ratio (length to width ratio). These fibrils have lengths and widths in the micrometer and nanometer scales. Nanocellulose solutions or gels can be employed to fixate dye, antimicrobial, flame retardant, stain and soil resistant, hydrophilic, and/or other molecules to polyester, acrylic, polypropylene, nylon, cotton, and other types of fabrics. The first part of this research is to chemically modify nanocellulose gels with Polyethylenimine (PEI) and Poly(Oligoethylene Glycol Methacrylate) (POEGMA) to improve the adhesion between nanocellulose fibers and textile fabrics, and make stable, smooth, thin films for coating of textile materials. The second part of this research is to develop a new dyeing process using nanocellulose gels to reduce consumption of water and energy. The conventional dyeing process requires huge amounts of water and, produces large volumes of waste water. The dyeing technique using nanocellulose gels eliminates the need for enormous amounts of water and substantially decreases the amount of waste water.

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Three dimensional graphene sponge for use as a highly efficient and recyclable absorbent for oil water separation

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Three-dimensional graphene sponges obtained by enhanced Hummer's method and freeze-drying are a highly efficient tool for use during oil-water separation1. Due to the hydrophobic nature of the graphene and contact angles with water in excess of 170, three dimensional graphene sponge is an invaluable and feasible substitute to various natural absorbers and organic materials such as expandable perlite and wool fibre2. Due to the high porosity of the spongy graphene, it can absorb oils from 50 times up to a maximum of 120 times its own weight in various oils. For this study, a shape-mouldable and three dimensional spongy graphene with high specific surface area used as a protean and recyclable sorbent for not only oils but also toxic solvents such as chloroform. The nanoporous characteristic allows spectroscopy and microscopic studies such as the use of Raman spectroscopy and Environmental Scanning Electron Microscopy (ESEM). We study the influence of various parameters (porosity, hydrophobicity, surface area) on the absorption capability of the graphene sponge. Furthermore, we also report how to improve the regeneration efficiency(> 12 times) by heat treatment, adhering to the full release of absorbates (>99%) and still exhibiting the same micro and macro structure as before. In addition we will discuss how the introduction of halogen atoms to the graphene sponge enhances superhydrohobicity. The present work demonstrates that graphene sponges can be used in industry to separate oils and water. Topics regarding environmental protection will also be addressed.

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Facile synthesis of SiO_2@TiO_2@Ag_2O composite catalyst for degradation of RhB dye under UV and visible light

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Herein, the thin layered n-type TiO_2 semiconductor is coated on SiO_2 spherical particles followed by decorating p-type Ag_2O nanoparticles outside with the purpose of p-n heterojunction formation for effective electron and hole separation. The composite spherical particles abbreviated as SiO_2@TiO_2@Ag_2O was characterized by XRD, SEM, TEM, HRTEM, and DRS techniques. The catalytic performance was tested for degradation of RhB dye under UV and Visible light sources. The composite catalyst showed an excellent RhB dye degradation. The combined n-type TiO_2 with the rich in electron inward and the p-type Ag_2O with the rich in hole outward facilitates the degradation reaction of dye. Therefore, n-type TiO_2 inside and p-type Ag_2O outside on the surface of SiO_2 support can be used as a catalyst for effective degradation of organic dye.

Keywords: p-n heterojunction, catalyst, degradation, nanoparticles, RhB dye.

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A coarse-grained molecular dynamics study on the mechanical properties of multi-layer graphene

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Graphene is the thinnest, hardest and toughest material known. Multi-Layer Graphene (MLG) and other graphene assemblies are important aspects of graphene application for their outstanding properties. Coarse-grained molecular dynamics (CG-MD) methods are developed to investigate the behavior of MLG and graphene assemblies due to the limitations of experimental observations and full atom simulation. In this paper, the CG-MD method based on Tersoff potential is used to simulate MLG. Besides the obvious reduction in calculation amount, only the coordinates of the model are needed in the process of computation, which greatly reduces the time of modeling and makes it easier to build complicated models. The comparison between the results of full atom model and CG-MD model is made. It is proved that the CG-MD model can predict the behavior of MLG accurately. It has great significance to produce graphene fiber with high performance.

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Indium Nanoparticles – technology assessment for commercialization and innovation opportunities using patents as indicators

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Indium Nanoparticles – Technology Assessment for commercialization and innovation opportunities using patents as indicators: This research postulates a mechanism to identify new commercialization avenues for an inter-disciplinary technology portfolio through innovation mapping. The mechanism may be deployed for adding leverage to influence or market power of an existing technology as well. Patent informatics in form of technology spill-over analysis and technology competitiveness assessment is used herein. Both these factors are known innovation drivers and can be leveraged for mapping innovation and commercialization opportunities. Patents are a good indicator because inter-disciplinary technologies like nanotechnology progress through identifiable patterns of scientific, technological and economic developments and there is a time lag between different stages. Accordingly, patent documents can be used for studying technology influence and market power of portfolios and innovation network can be derived thereupon. Example of Indium Nanoparticles has been used to demonstrate aforementioned statement through a multi-dimensional analysis at a primary level and involving patent citations, family size, technical applications and bibliographic information provided in 1623 relevant patent documents. The analysis lead to mapping of technology spill-overs and competitiveness, which were later compared and remapped at secondary and tertiary levels to form detailed innovation map for the technology. Indium Nanoparticles have applications as a material for superconductivity, and as a semiconductor. The innovation map created through assessment presents evidence of possible applications and opportunities of innovation for indium nanoparticles in electrical, magnetic, optical, biomedical and bioscience sectors. These opportunities may be leveraged through various strategic decisions thereby opening a plethora of commercialization avenues like technology pooling, cross-licensing etc.

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Graphene and carbon nanotube thermoelectric transducers

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Using the local thermoelectric cooling on nanoscale enables exploiting of the low-temperature phenomena at ambient temperatures with no needs in bulky and expensive refrigerating equipment, thereby opening new horizonts for many approaches and methodologies. The key idea is to apply an energy-efficient cooling to individual transistors or quantum dots with a pin-point precision, concentrating on small limited areas, thereby dropping the necessity to refrigerate bulky devices. We conduct the experimental study and theoretical modelling of thermoelectric cooling observed in the Carbon Nanotube (CNT), whose opposite ends contain the charge carriers of opposite sign, either electrons or holes, created by doping with using of the local gate electrodes. Finite source-drain electric bias voltage *V* causes change of the local effective electron temperature Te at the middle of CNT, owing to the Peltier effect, whilst the magnitude is deduced from the change in the position and width of spectral singularities, which is manifested in the experimental curves of the source-drain electric conductance. We find that using the electrode doping, one achieves a sharp rise of both, the electric conductivity and Seebeck coefficient, while the thermal conductivity tumbles. Such the effect of thermal transistor improves the figure of merit of the thermoelectric transducing circuits. Depending on the sign of V, the thermoelectric effect causes either cooling or heating of the electron subsystem inside CNT, with the Te change ~70 K. The value of deduced figure of merit is ZT~10 and the cooling power density is ~ 80 kW/cm^2.

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Nano hybrid of Phosphorous doped single layer graphene with $Ni_{0.5}Zn_{0.5}Fe_2O_4$ nano particles: green synthesis , characterization and microwave dielectric spectroscopy

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Nano hybrid of Phosphorous doped single layer graphene sheets with nano crystalline $Ni_{0.5}Zn_{0.5}Fe_2O_4$ ferrites were produced through facile method using a green solvent. The $Ni_{0.5}Zn_{0.5}Fe_2O_4$ ferrite nano particles were synthesized through solvothermal synthesis method with average particle size of 20nm and spherical morphology as indicated by SEM and TEM. The as synthesizd nano hybrids prepared with different loading of phosphorous doped graphene were characterized through XRD, FTIR and TGA. The microwave dielectric spectroscopy was used to study the dielectric properties in 10MHZ-1.5GH_Z spectrum and microwave reflection loss suggested the potential candidacy of the nano hybrids as good microwave absorbers for commercial anechoic chambers.

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Fabrication of PANI nanowire as an electrochemical biosensor for DNA detection

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Polyaniline (PANI) is an organic polymer that possesses metallic conductivity and can be grown 1-dimensionally in the form of a nanowire. In this research the potentiostatic method was applied at the constant potential of 0.75 V to electrochemically deposit PANI nanowires on the stainless steel electrode. Morphological studies of the sample was carried out by Transmission Electron Microscopy (TEM) and it was observed that nanowires with 30–50 nm diameters were fabricated. Cyclic Voltammetry (CV), Scanning Electron Microscopy (SEM), and UV–vis absorption spectra were applied to characterize the PANI nanowires, and the results revealed that ultra-thin nanowires displayed high electrochemical activity. A single stranded Deoxyribonucleic acid (ssDNA) was fixed on PANI nanowires to investigate the efficiency of the system as a biosensor platform. Sensitivity of the PANI electrode was detected by measuring peak currents in Differential Pulse Voltammetry (DPV) after hybridization with different concentrations of the ssDNA. It was concluded that the system worked well even at low concentrations, and large peak current values at the order of mA were produced. Electrochemical Impedance Spectroscopy (EIS) of the sensor electrode was carried out with an Autolab-30 potentiostat/galvanostat to understand chemical transformations and processes associated with conducting polymer supported electrodes. The changes in impedance indicated that the system was extremely effective at low (10–16M) concentrations.

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Bis(2-hydroxy-1-naphthaldehydato)zinc(II) as a precursor for the synthesis of ZnO Nanoparticles and Aerosol-Assisted Chemical Vapour Deposition (AACVD) of ZnO thin films

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Zinc(II) complexes were prepared and used as precursors for the synthesis of zinc oxide nanoparticles via thermal decomposition method using hexadecylamine as a stabilizing agent. The prepared complexes were also used as single source precursors to deposit ZnO films on glass substrates at 350, 400, and 450 ^{0}C using the aerosol assisted chemical vapour deposition (AACVD) technique. The TEM images of the synthesized nanoparticles revealed different shapes of the particles when the decomposition temperature is increased. The diffraction patterns of all ZnO thin films prepared at different temperatures show the simple cubic structures with the lattice parameter of a = b = c = 4.278 A°.

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