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Abstracts

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A Andalouci et al., Nano Res Appl 2018, Volume 4
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Carbon nanotube growth on TiSiN supports by solid-state dewetting of ultra-thin cobalt films

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Simultaneous synthesis of cobalt nanoparticles and carbon nanotubes directly on conductive substrates are of special interest since it allows the fabrication of quasi one-dimensional hybrid systems with tunable properties and a wide range of applications in nano and microelectronics, spintronic and magnetic information storage. Since metals are high-surface energy materials, it is difficult to stabilize metal nanoparticles for nanotube growth directly on metal surfaces. In this work we present a simple and reliable fabrication approach to produce controlled Co magnetic nanoparticles by solid state dewetting of metal films deposited on a conductive substrates acting as barriers. Indeed, refractory conductive films such as titanium silicon nitride TiSiN were proposed as barriers to limit catalyst diffusion into the bulk of the substrate. In addition, the low surface energy of TiSiN favors catalyst de-wetting, thereby improving nanotube forest density and verticality. Titanium silicon nitride films were first deposited on silicon wafers by thermionic vacuum arc. Then, ultra-thin cobalt films with thickness up to 3 nm were deposited on the top of TiSiN; the dewetting process of the cobalt films was achieved by thermal heating followed by plasma treatment. After these steps, the initial continuous layer breaks up into isolated nanoparticles. Finally, carbon nanotube grow by methane decomposition on the cobalt nanoparticles by using plasma enhanced chemical vapor deposition (PECVD) reactor. In particular, the microscopic analysis showed that the density and the size of the generated nanoparticles depend on the thickness of the deposited cobalt films as well as the control of thermally activated processes mainly bulk diffusion. On the other hand, the magnetic properties measurements confirmed that the design of nanoparticles and their size distribution control their coercitive field. In this direction, high-ordered self-organized cobalt/nanotube hybrid systems could be proposed as functional nanostructured elements in magnetic information storage devices.

Recent Publications

1. **Rousseau O, et al., (2017) Elaboration and magnetic properties of cobalt-palladium magnetic nanowires encapsulated in carbon nanotubes. Journal of Surface Engineered Materials and Advanced Technology 7(1):1-12.**
2. **Chen G, et al., (2016) A sweet spot for highly efficient growth of vertically aligned single-walled carbon nanotube forests enabling their unique structures and properties. Nanoscale 8(1):162-71.**
3. **Marco Altomare N T N and Patrik Schmuki (2016) Templated dewetting designing entirely selforganized platforms for photocatalysis. Chemical Science 7:6865-6886.**

Biography

A Andalouci studied Petrochemical Engineering at the Faculty of the Chemistry and Hydrocarbons, Algeria, in 2015, and he also obtained his Master degree in Physics of Material from University of Paris 13, France , in 2017. He is currently a PhD student in the PPANAM axe at the LSPM laboratory of the University Paris 13. His research interests include the synthesis and functionalization of carbon nanotubes and nanomaterials for microelectronic and magnetic applications.

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Enhanced reduction of methylmercury by zero-valent iron particles

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The consumption and accumulation of high concentration of methylmercury ($MeHg^+$) through food pyramid leading to fatal public health problems could adversely affect central nervous system of fetus and its development of alteration. The gradual increase of $MeHg^+$ concentration in the natural and engineered environments attracts an attention and requests cost-effective and sustainable remedial technologies for the effective removal of $MeHg^+$, which is the most recent trend in environmental technology Markets. Zero-valent iron (ZVI) technology has been widely known for its effective treatment of diverse contaminants due to its high reactivity; moreover, ZVI has a metallic iron core that shows reducing (electron-donating) power and an iron oxide shell having an adsorptive capacity for metal ions on its surface. In this study, nanoscale zero-valent iron (nZVI) was synthesized via reduction of ferric ion with sodium borohydride; pumice-nZVI (P-nZVI) particles were produced by coating pumice granules with nZVI, and impregnation method was applied for the synthesis of indium-ZVI (In-ZVI) catalyst. The size and shape of the particles, distribution of nZVI and indium on P-nZVI and ZVI were analysed by a scanning electron microscope, respectively. This research has investigated the reactivity of nano-iron particles for the reduction of methylmercury in their suspension systems by conducting batch kinetic experiments. P-nZVI and nZVI particles showed much faster reaction kinetics for the reduction of $MeHg^+$ to Hg(0) than In-ZVI particles. The iron particles have been tested for adsorption properties. A series of control tests helped to determine the reaction mechanism. The experimental results suggest that zero-valent iron technology is a promising candidate for remediation of soil and groundwater contaminated with methylmercury in aqueous and subsurface environments.

Biography

Dr. Woojin Lee is working as a professor in civil and environmental engineering department of Nazarbayev University. He received a Ph.D. from Civil Engineering at Texas A&M University, College Station and postdoctoral fellowship training in Chemistry at Indiana University, Bloomington. He has been teaching and researching in the field of environmental science and engineering including environmental catalysts, carbon sequestration and conversion, fate of emerging chemical contaminants, and, integrated water treatment technologies at KAIST and POSTECH since 2005.

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Dorina E Coricovac et al., Nano Res Appl 2018, Volume 4
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Functionalization of betulinic acid by nanotechnology improved its *in vitro* antiproliferative activity

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In recent years, nanotechnology has become a key player in multiple biomedical fields, drug delivery being one of the domains where nanotechnological innovations are highly applied. Nanocarrier systems proved to be very useful in improving the physicochemical and pharmacological properties of different compounds, thus augmenting their effectiveness as therapeutic agents. Betulinic acid (BA) is a pentacyclic lupane-type triterpene of natural origin that exerts a plethora of biological effects, including antitumor, antiviral, anti-inflammatory, immunomodulatory, anti-angiogenic, hepatoprotective, etc. The main handicap of BA consists in very low water solubility what limits its use *in vivo*. To adjust this flaw and to improve its bioavailability, we prepared a nanoformulation of BA using silver and silver PEGylated (PEG) nanoparticles and verified its cytotoxic effects in vitro against a panel of tumor cell lines, as: human (A375) and murine melanoma (B164A5), lung (A549), breast (MCF-7 and MDA-MB-231) and hepatic carcinoma (HepG2) and on a healthy cell line – HaCaT – human immortalized keratinocytes. The obtained nanoformulation were characterized in terms of physicochemical properties by applying standard methods as transmission electron microscopy (TEM) and UV-VIS, that confirmed the development of stable solutions. The cytotoxicity was evaluated by the means of MTT (3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide) and Alamar blue techniques, and the impact on cell migration and proliferation was measured using scratch assay. The nanoformulations of BA managed to inhibit the proliferation of all tumor cells at a higher extent as compared with the solution of BA in DMSO (dimethyl sulfoxide) used as the standard, whereas in the case of a healthy cell line, the toxic effect was minimum. The migration of tumor cells was also impaired by the nanoformulations. These preliminary results indicate that the antiproliferative effect of BA was improved. Further studies are required to establish the mechanism of action of this nanoformulation and to prove its effectiveness *in vivo*.

Recent Publications

1. Coricovac D, Dehelean C, Moaca EA, Pinzaru I, Bratu T, Navolan D and Boruga O (2018) Cutaneous melanoma-a long road from experimental models to clinical outcome: a review. International Journal of Molecular Sciences 19(6):E1566.
2. Pinzaru I, Coricovac D, Dehelean C, Moacă EA, Mioc M, Baderca F, Sizemore I, Brittle S, Marti D, Calina C D, Tsatsakis A M and Şoica C (2018) Stable PEG-coated silver nanoparticles - A comprehensive toxicological profile. Food and Chemical Toxicology 111:546-556.
3. Coricovac D E, Moacă E A, Pinzaru I, Cîtu C, Soica C, Mihali C V, Păcurariu C, Tutelyan V A, Tsatsakis A and Dehelean C A (2017) Biocompatible colloidal suspensions based on magnetic iron oxide nanoparticles: synthesis, characterization and toxicological profile. Frontiers in Pharmacology 8:154.
4. Gheorgheosu (Coricovac) D, Duicu O, Dehelean C, Soica C and Muntean D (2014) Betulinic acid as a potent and complex antitumor phytochemical: a minireview. Anti-Cancer Agents in Medicinal Chemistry 14(7):936-45.
5. Gheorgheosu (Coricovac) D, Jung M, Ören B, Schmid T, Dehelean C, Muntean D, Brüne B (2013) Betulinic acid suppresses NGAL-induced epithelial-to-mesenchymal transition in melanoma. Journal of Biological Chemistry 394(6):773-81.

Biography

Dorina E Coricovac has completed her PhD from Victor Babes University of Medicine and Pharmacy Timisoara, Romania and Institute of Biochemistry I, Goethe University, Frankfurt, Germany. She completed her Postdoctoral studies at Victor Babes University of Medicine and Pharmacy Timisoara. At present, she is Associate Professor at the Department of Toxicology, Faculty of Pharmacy, Victor Babes University of Medicine and Pharmacy Timisoara. Her research activity consists of over 30 articles published in ISI indexed international journals. She won three national competitions for scientific grants and she is member in several national and international scientific projects.

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K U Huang et al., Nano Res Appl 2018, Volume 4
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Mechanical response of 3D printed composite materials

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Now-a-days in order to overcome the limitations of the physical abilities, humans have tried their best to find external ways and use the object or power to enhance their strength of physical endurance. Therefore, some auxiliary devices can be able to bear structures and power systems similar to exoskeletons have emerged that provide additional energy to enhance the power of the body. The common exoskeleton devices developed in the market are worn on the human body and it has the problem of the weight of the auxiliary device. Therefore, the design of the structure, especially porous structure is important since it is the efficient way for achieving the lightweight purpose. The porous structure is a three-dimensional structure formed by a large number of pores of the same shape. To compare with general continuous materials the porous structure has the advantages of low relative density, high specific strength, good permeability, etc. In this research, all of the samples were fabricated by fused deposition modeling (FDM) method. The materials used in this study are composite which combine nylon and carbon short fiber. The advantages of these composite materials are excellent tensile strength, corrosion resistance and fatigue resistance. However, the difference in scanning strategies during the manufacturing process would directly affect the mechanical properties of the structure. Hence, the relationship between the porosity structure design, scanning strategies and the mechanical properties will be explored and discussed in detail. Besides the differences between the loading directions of the porous structure are also the emphases in this research.

Biography

K U Huang was a MS student in the Department of Bioinformatics and Medical Engineering, Asia University, Taiwan. His research interests include mechanical response of 3D printed composite materials.

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Y P Wang et al., Nano Res Appl 2018, Volume 4
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Change the surface tension of the electrolyte to evaluate the effect of electro polishing on porous materials with different pore sizes

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In recent years, 3D printing technology has been applied widely and lots of medical devices such as implants were fabricated by 3D printing technologies. Materials that implanted in human body are usually made into a porous shape in order to improve bone ingrowth. The shape of porous biomedical materials are usually complex and with a hole size of only several hundred micrometers. It is difficult to polish the surface of the struts by using a conventional post-processing method and it is learned that electro polishing is the most effective method to conduct the post surface treatment. Generally, it's too difficult to make the electrolyte go through the small pores, which sizes are only a few hundred micrometers. Therefore, different concentrations of surfactants will be added to the electrolyte to reduce the surface tension, so that the electrolyte can penetrate into the porous structure and the struts in the porous materials could all be infiltrated in the electrolyte. In this study, titanium alloys (Ti64) which are widely used as biomedical materials were printed by using selective laser melting (SLM) technology. In the experiment, oleic acid was used as the surfactant. The hole size is designed from 300 m to 700 m and the concentration of electrolyte is 0% (no oleic acid added) to 100% (saturated) oleic acid. In this study, different ratios of oleic acid were added to the electrolyte and the relationship of the electrolyte with different concentration of oleic acid, pore size of the porous materials and the surface roughness of the struts inside the porous materials is explored and discussed in detail.

Biography

Y P Wang is pursuing her MS in Department of Bioinformatics and Medical Engineering at Asia University, Taiwan. Her research topic is focused on the post treatment R&D of 3D printed parts.

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Almira Ramanaviciene et al., Nano Res Appl 2018, Volume 4
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Sensing properties of electrochemically deposited polyaniline film doped with poly (3, 4-ethylenedioxythiophene)

Almira Ramanaviciene, Anton Popov, Benediktas Brasiunas, Lina Mikoliunaite and Arunas Ramanavicius

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Among different electrochromic materials conducting polymers and their derivatives are attractive due to their ease of processability, good stability, rapid response time and perfect optical properties. Conducting polymers are widely used in the fabrication of many devices such as transistors, sensors, biosensors and fuel cells. Furthermore, these polymers possess unique electrochromic and electrochemical properties and are perfect candidates for designing smart windows, optical and electrochromic sensors. In this work a film of electrochromic conducting polymers polyaniline and poly (3, 4-ethylenedioxythiophene) (PANI-PEDOT) was electrodeposited on a transparent indium tin oxide (ITO) modified glass from a water-based solution, characterized and applied for pH sensing. The optical properties and response time of the developed PANI-PEDOT film-based sensor was compared with PANI film. In addition, the PANI-PEDOT, PANI and PEDOT films thickness, surface activity, charge density and diffusion coefficient were calculated and compared. The doping of PANI by PEDOT improved conductivity of the synthesized film and shortened the response time of developed sensor. Absorbance at maximum of the three peaks (448, 602 and 895 nm) of PANI-PEDOT film depended linearly on the pH value of the solution in the range from 3.8 to 7.4. The developed sensor can be used for pH determination in physiologically important pH interval, especially when acidification of physiological fluids occurs during the course of the disease. In addition, synthesized PANI-PEDOT film can be used in the design of CO_2 gas sensors sensitive to the pH change of solution after the dissolution of gas.

Recent Publications

1. **Gicevicius M, Celiesiute R, Kucinski J, Ramanaviciene A, Bagdziunas G and Ramanavicius A (2018) Analytical evaluation of optical pH-sensitivity of polyaniline layer electrochemically deposited on ITO electrode. Journal of The Electrochemical Society 165(14):H903-H907.**
2. **Naveen M H, Gurudatt N G and Shim Y B (2017) Applications of conducting polymer composites to electrochemical sensors: a review. Applied Materials Today 9:419-433.**
3. **Deshmukh M A, Gicevicius M, Ramanaviciene A, Shirsat M D, Viter R and Ramanavicius A (2017) Hybrid electrochemical/ electrochromic Cu(II) ion sensor prototype based on PANI/ITO-electrode. Sensors and Actuators B Chemical 248:527-535.**
4. **Das T K and Prusty S (2012) Review on conducting polymers and their applications. Polymer Plastics Technology Engineering 51(14):1487-1500.**

Biography

Almira Ramanaviciene has completed her PhD in Biomedicine in the Institute of Immunology at Vilnius University, Lithuania in 2002. During 16 years of her research experience she gathered deep knowledge in biosensors development using electrochemical, optical and acoustic signal transducers. She has comprehensive experience in the synthesis of conducting polymers; metallic and polymeric nanoparticles and surface modification with different nanostructures and biomolecules. She is the co-author of more than 160 peer-reviewed research papers and reviews.

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Benediktas Brasiunas et al., Nano Res Appl 2018, Volume 4
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Preparation of gold nanostructures conducting polymer composites for electrochemical and optical sensors

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Vilnius University, Lithuania

Electrochemical arrays and sensors can be made from conducting polymers and applied in different fields such as environmental and biomedical sciences and industry front due to their attractive physical and chemical properties. Conducting polymers are not expensive and easy to synthesize while being distinguished by good stability and electrical conductivity. Nanotechnology and nano science have a significant impact on analytical chemistry, medicine, pharmacy and is still growing every year. Gold nanoparticles and nanostructures are one of the most widely used metal nano objects due to their desirable physical and optical properties. Combining conducting polymers with gold nano structures can significantly change the optical and electrochemical properties of polymeric films. Gold nanostructures are known as excellent chromophores due to excitation of surface plasmons, leading to higher conductivity and selectivity in addition to a change in optical properties of polymers. The aim of this work was to investigate electrochromic and optical properties of a polymer composite consisting of poly (3, 4-ethylenedioxythiophene) (PEDOT) and polyaniline (PANI) electrodeposited on indium tin oxide (ITO) coated glass pre-modified with gold nano structures (AuNS). Different methods were used for the electrochemical synthesis of AuNS onto ITO coated glass slide. Electrochromic properties, absorbance spectra, conductivity and stability of distinctly modified polymer layers were determined and compared. In addition, sensitivity of formed polymeric films to pH changes was evaluated.

Recent Publications

1. Deshmukh M A, Gicevicius M, Ramanaviciene A, Shirsat M D, Viter R and Ramanavicius A (2017) Hybrid electrochemical/ electrochromic Cu(II) ion sensor prototype based on PANI/ITO-electrode. Sensors and Actuators B Chemical 248:527-535.
2. German N, Popov A, Ramanaviciene A and Ramanavicius A (2017) Evaluation of enzymatic formation of polyaniline nanoparticles. Polymer 115:211-216.
3. Ramanaviciene A, Voronovic J, Popov A, Drevinskas R, Kausaite-Minkstimiene A and Ramanavicius A (2016) Investigation of biocatalytic enlargement of gold nanoparticles using dynamic light scattering and atomic force microscopy. Colloids and Surfaces A: Physicochemical and Engineering Aspects 510:183-189.
4. Mazeiko V, Kausaite-Minkstimiene A, Ramanaviciene A, Balevicius Z and Ramanavicius A (2013) Gold nanoparticle and conducting polymer-polyaniline-based nanocomposites for glucose biosensor design. Sensors and Actuators B: Chemical 189:187-193.
5. Ramanavicius A, Oztekin Y, Balevicius Z, Kausaite-Mikstimiene A, Krikstolaityte V, Baleviciute I, Ratautaite V and Ramanaviciene A (2012) Conducting and electrochemically generated polymers in sensor design (mini review). Procedia Engineering 47:825-828.

Biography

Benediktas Brasiunas is pursuing his Master's degree in Chemistry in the Institute of Chemistry, Faculty of Chemistry and Geosciences at Vilnius University, Lithuania. His subjects of interests and expertise are in nanotechnology, glucose and other reducing sugar sensors and biosensors, conductive polymers and their composites with nanostructures.

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Application of conducting polymer polypyrrole as electrochromic sensor of pH and CO_2

Vilma Ratautaite, Gintautas Bagdžiunas, Arunas Ramanavicius and **Almira Ramanaviciene**

Vilnius University, Lithuania

Conducting polymer polypyrrole (Ppy) has a long history of application in electrochemical sensor design. The polypyrrole has the following key features: low cost, easy preparation by chemical or electrochemical polymerization methods on various types of electrodes, it is a very suitable and convenient polymer as matrix for immobilization of biomolecules or for molecular imprinting [1,2,3]. In present investigation we studied the application of the Ppy as an electrochromic sensor. Polypyrrole was electrochemically polymerized on the indium tin oxide coated glass (ITO) electrode. In previous studies it was demonstrated, that electrode surface modification affects the polymer film adhesion to electrode. So adhesion of Ppy on the surface of ITO was alternated by ITO surface modification with two types of silanes. In previous studies were shown that initial electrochemical polymerization conditions principally determine the redox behavior of Ppy. These properties of the obtained Ppy layer are closely related to the electrochromic properties of the polymer. Therefore several electrochemical polymerization techniques were applied to obtain the Ppy on the ITO electrode. Hereby we compared cyclic voltammetry, potential pulse sequence and alternating current initiating electropolymerization method. Alternating current initiating electropolymerization method gives the ability to obtain thickest polypyrrole layer, but this layer was less stable on ITO electrode. All obtained Ppy layers were evaluated as possible candidates for the development of pH and CO2 sensor.

Recent Publications

1. **Ratautaite, V.; Plausinaitis, D.; Baleviciute, I.; Mikoliunaite, L.; Ramanaviciene, A.; Ramanavicius, A. (2015) Characterization of Caffeine-Imprinted Polypyrrole by a Quartz Crystal Microbalance and Electrochemical Impedance Spectroscopy. Sensor Actuat B-Chem, 212:63-71.**
2. **Ratautaite, V.; Topkaya, S. N.; Mikoliunaite, L.; Ozsoz, M.; Oztekin, Y.; Ramanaviciene, A.; Ramanavicius, A. (2013) Molecularly Imprinted Polypyrrole for DNA Determination Electroanalysis 25 (5):1169-1177.**
3. **Ratautaite, V.; Nesladek, M.; Ramanaviciene, A.; Baleviciute, I.; Ramanavicius, A. (2014) Evaluation of Histamine Imprinted Polypyrrole Deposited on Boron Doped Nanocrystalline Diamond. Electroanalysis 26:2458–2464.**
4. **Plausinaitis, D.; Ratautaite, V.; Mikoliunaite, L.; Sinkevicius, L.; Ramanaviciene, A.; Ramanavicius, A. (2015) Quartz Crystal Microbalance-Based Evaluation of the Electrochemical Formation of an Aggregated Polypyrrole Particle-Based Layer. Langmuir 31 (10):3186-3193.**
5. **Ratautaite, V.; Ramanaviciene, A.; Oztekin, Y.; Voronovic, J.; Balevicius, Z.; Mikoliunaite, L.; Ramanavicius, A. (2013) Electrochemical stability and repulsion of polypyrrole film. Colloid Surface A 418 (0): 16-21.**

Biography

Dr. Vilma Ratautaite received the PhD degree in Chemistry from Vytautas Magnus University, Kaunas, Lithuania in 2009. Currently she is researcher at the Institute of chemistry, Faculty of Chemistry and Geosciences, Vilnius University. She has research interests related in application of conducting polymers, such as polypyrrole, for electrochemical sensor design. She has investigated the polypyrrole in purpose use it as molecularly imprinted polymer, or electrochromic polymer. Other fields of scientific interests are a chromatography and electro-migration (capillary electrochromatography and capillary electrophoresis) methods.

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Electrochemical Capacitive Behaviour of Carbon based and /or NT-$CoFe_2O_4$ Nanocomposites

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Cobalt ferrite nanoparticles CoFe2O4 and their carbon based and /or NT nanocomposites : CoFe2O4-CoCO3 , CoFe2O4-CoCO3/NT have been successfully synthesized by a simple one step hydrothermal method, using NaOH, and urea surfactants. The X-ray diffraction confirms the presence of cobalt ferrite and cobalt ferrite-carbonate phases, the SEM and TEM analyzes reveals the nanosized particles. The electrochemical performances of these products were investigated by cyclic voltammetry, charge–discharge and electrochemical impedance spectroscopy in 6M KOH aqueous electrolyte, in a three-electrode system. A maximum specific capacitances (capacities) of 246 F.g-1 (27 mAh.g-1), 285 F.g-1 (31 mAh.g-1) and 277 F.g-1 (30 mAh.g-1) were obtained respectively for CoFe2O4 , CoFe2O4-CO3 and CoFe2O4-CoCO3/NT at a current density of 0,5 A/g. The Cobalt ferrite-carbonate shows an excellent capacitance retention of 97,8% after 1000 cycles at a current density of 5A/g.

Recent Publications

1. **O. Guellati, A. Harat, D. Momodu, J. Dangbegnon, T. Romero, D. Begin, C. Pham-Huu, N. Manyala, M. Guerioune (Electrochemical measurements of 1D/2D/3DNi-Co bi-phase mesoporous nanohybrids synthesized using free-template hydrothermal method) Electrochimica Acta 275 (2018) 155-171, doi: 10.1016/j.electacta.2018.04.112.**
2. **H. Kennaz, A. Harat, O. Guellati, D. Y. Momodu, F. Barzegar, J. K. Dangbegnon, N. Manyala and M. Guerioune (Synthesis and electrochemical investigation of spinel Cobalt ferrite magnetic nanoparticles for supercapacitor application) Journal of Solid State Electrochemistry 22 (3) (2018), 835-847, https://doi.org/10.1007/s10008-017-3813-y**
3. **T. M. Masikhwa, M. J Madito, D. Y Momodu, J. K. Dangbegnon, O. Guellati, A. Harat, M. Guerioune, F. Barzegar, N. Manyala (High performance asymmetric supercapacitor based on CoAl-LDH/GF and activated carbon from expanded graphite) RSC Advances 6 (52), (2016), 46723-46732.**
4. **Farshad Barzegar, Abdulhakeem Bello, Ouanassa Guellati, Damilola Y. Momodu, Aicha Harat, Julien K. Dangbegnon, Mohamed Guerioune, Ncholu Manyala, (Effect of addition of different carbon materials on hydrogel derived carbon material for high performance electrochemical capacitors) Electrochimica Acta 186 (2015), 277-284.**
5. **F Chouit, O Guellati, S Boukhezar, A Harat, M Guerioune, N Badi (Synthesis and characterization of HDPE/N-MWNT nanocomposite films) Nanoscale research letters 9 (1), (2014) 1.**

Biography

Dr. Aicha Harat is a teacher-researcher and head of a team research on LEREC laboratory (University of Annaba, Algeria). Her principal research topic is magnetic and high Tc superconducting materials. Now she deals with magnetic nanoparticles and their carbon based nanocomposites synthesized by various methods (co-precipitation, hydrothermal, combustion...) and their application in supercapacitors for energy storage. (orcid.org/0000-0002-1748-9290)

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Biodegradable polymer and nanotechnology in protein delivery

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In spite of rapidly growing peptide and protein drugs in the market, their limited therapeutic applications are due to the undesirable interaction between protein and solid surface. Several developments have occurred in the field of sustained delivery of proteins utilizing both biodegradable and non-biodegradable polymer. However, proteins are highly susceptible to adsorption on hydrophobic surfaces during manufacturing process which may lead to change in structure of the protein affecting safety and efficacy of the drug. Therefore, selecting the polymer surface suitable for specific protein delivery by investigating the adsorption behavior is crucial. Modified nanoprecipitation methods was developed for nanoparticle fabrication and equilibrium dialysis followed by fluorescence spectroscopy was employed for quantitative characterization of the adsorption of recombinant human growth hormone (r-hGH) onto Poly (lactic-co-glycolic) acid (PLGA) polymers with a different degree of hydrophobicity under varying conditions of pH. With the benefit of large surface area of nanoparticles to study surface interactions, internal fluorescence and circular dichroism spectroscopy were utilized in order to characterize the physicochemical interactions that govern the adsorption process onto polymer nanoparticles. In addition, desorption of adsorbed r-hGH upon dilution was also studied. The study resulted in selection of PLGA grade that can prove to be suitable for sustained delivery of r-hGH.

Biography

Vaishnavi Parikh has completed her PhD in Pharmaceutics from Philadelphia College of Pharmacy, University of the Sciences. She has more than eight years of experience in working as a Formulation Scientist in the pharmaceutical industry and currently manages Product Development Department at Genus Lifesciences Inc. She has published several papers in reputed journals; presented at several international conferences; has been serving as a reviewer on six reputed journals and also an Editor for the journal, ***Insight- Automatic Control.***

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Abstracts

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Making the hospital a safer place by the sonochemical coating of all its textiles and medical devices with antibacterial nanoparticles

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Sonochemistry is an excellent technique to coat nanomaterials on various substrates, imparting new properties to the substrates. After a short demonstration of coating NPs on ceramics and stainless steel, the author will present the coating of textiles such as polyester, cotton, and nylon. In all cases a homogeneous coating of NPs was achieved. Lately, the FDA shows less enthusiasm towards nanoAg, as a result, we have moved to NPs of ZnO, and CuO as antibacterial agents. They were coated on the above-mentioned fabrics and showed excellent antibacterial properties. The coated textiles were examined for the changes in the mechanical strength of the fabric. A special attention was dedicated to the question whether the NPs are leaching off the fabric when washed repeatedly. The coated ZnO NPs on cotton underwent 65 washing cycles at 92°C in water in a hospital washing machine, no NPs were found in the washing solution and the antibacterial behavior was maintained. Recently, an experiment was conducted at Pirogov Hospital in Sofia, Bulgaria in which one operation room was equipped with antibacterial textiles, namely, bed sheets, pajamas, pillow cover, and bed cover. Twenty patients in this operation room were probed for bacterial infections. Their infection level was compared with 17 control patient that were using regular textiles. The results demonstrate that a lower infection level is observed for those patient exposed to the antibacterial textiles. The following medical devices were coated with metal oxide nanoparticles and showed very good biocidal properties and inhibition of biofilm formation 1) urinal catheters 2) contact lens 3) cochlear electrodes, 4) metallic implants and 5) silicon implants. In his lecture the author will demonstrate examples of 1 and 2 respectively. Coating of catheters with the above mentioned NPs were performed and the coated catheters were inserted in rabbits. Results showed that the urine of the rabbits was not contaminated with bacteria.

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Automotive graphene based nanocomposites

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The automotive industry is widely viewed as being the industry in which the greatest volume of advanced composite materials will be used in the future to produce light vehicles. Now-a-days, several advanced materials are widely used in automotive industry. Because of its multifunctional properties and promising applications, many expectations in composite materials are related to graphene. However, no application of graphene based materials is currently marketed in the automotive sector. Therefore, research activities are under development to study the potentiality of these systems and all the value chain of automotive needs to be involved in this effort. One of most challenging aim is the economic impact of the innovative structures on the vehicle market, all the value's chain have to address their effort to get the final cost of the innovative products as low as possible. The present initiative provides a summary overview on graphene related materials (GRMs) for automotive applications and investigates efficient ways to integrate graphene as polymer reinforcements within composite materials for energy efficient and safe vehicles (EESVs). The idea is based on the concept oriented light weight design aiming for combination of light structures with novel multifunctional materials. For such a purpose, GRMs are addressed with respect to some challenging factors, for instance the large scale production of graphene or the non-existence of constitutive material models for high performance structural applications like crash worthiness. Therefore, accurate material models need to be developed to support simulation of structural design for these vehicles. A focus on the hierarchical modelling of GRMs with an emphasis on the multiscale constitutive behaviors of each material phase is elaborated in the framework of the graphene flagship to well understand such limitations for a full applicability of graphene. It is anticipated that this initiative will advance innovative lightweight graphene nanocomposites and their related modelling, designing, manufacturing, and joining capabilities suitable for automotive industry which requires unique levels of affordability, mechanical performance, green environmental impact and energy efficiency. This leads to complete understanding of the new graphene nanocomposites and their applicability in high-volume production scenarios.

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Tribology and velocimetry experimental coupling: an original setup to study confined and sheared phospholipid layers

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Our main motivation is to analyze the deformation mechanisms of polymers in confinement from experimental measurements that ensure an in situ observation of the phenomena from yielding (scratches) to viscoelastic properties. In this vein, the behavior of the sheared interfacial layer when a spherical tip is sliding on a polymer surface still raises many questions. The main objective of this study is to initially model this unknown interfacial layer by phospholipid multilayers in a boundary lubrication case. Tribological experiments on these ultrathin films were performed to identify the influence of parameters such as temperature, relative humidity, sliding speed of the tip and applied mean contact pressure. For instance, an analysis based on Eyring model concludes that with an increase of humidity rate the value of the activation energy Q decreases. In parallel the clear influence of moisture on the thickness of water film in the structure of phospholipid layers was demonstrated with neutron reflectivity experiment. In particular, for three layers the thickness of water film between the supported bilayer and third floating monolayer can be ranged from 0.3 nm to 1.2 nm by increasing the moisture content from 30% to 90% (Figure). From these results the underlying question is how to determine the velocity profile and locate the slip plane in such a friction experiment. We propose to associate velocimetry and tribology experiments (Tribo-FRAPP) to have more information on microscopic level and on localization of sliding plane in the friction experiment. For instance, preliminary studies on DSPC three layers have shown that at low speed all three layers are moving and the slip plane whereas at higher speed only the third layer moves. In this case, the slip plane is located within the water film.

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Control of plasmonic nanostructures for high performance applications

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Interaction of light with plasmonic nanoparticles whose wavelength is of the order of interacting light wavelength, have new physics and applications in electronics, optics and optoelectronics. When the light of wavelength corresponding to the surface plasmon resonance absorption propagates through a nonlinear medium metal nanoparticles strongly absorb visible light due to their surface plasmon resonance in which the conducting electrons undergo a collective excitation induced by electric field of visible light. This enhances the local electric field near and on the surface of metal nanoparticles. The enhancement of local electric field within the metal nanoparticles, leads to the formation of an electromagnetic wave. This wave induces a huge field on the particle surface strongly polarizing the atoms of the molecules adsorbed. As the electrons of the atoms vibrate around their center of mass, the induced dipole moment oscillates at the wave frequency. This will affect the density, velocity and plasmonic oscillations of the electronic clouds of each nanoparticle which will improve self-focusing property of the light propagating through a nonlinear media. Self-focusing can be tuned by controlling size and shape of nanostructures that can play a significant role in medical purposes, LEDs, lasers, sensor, solar cell, photovoltaic and other optical applications. The Ag@Au nanoparticles are used so that the plasmon resonance corresponding to excitation wavelength can be systematically tuned by varying the thickness of the Au-shell. This can help in increased stability and trapping capability of plasmonic nanoparticles that will boost the development of numerous applications in science and technology.

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Study on porosity defects of EB Med Ti64 components by tomographic analysis

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The Electron Beam Melting (EBM) is one of the most promising ALM technologies, which utilizes a high-energy electron beam, as a moving heat source, in order to melt and fuse (by rapid self-cooling) metal powder and produce parts in a layer-building fashion. Anyway many technical aspects concerning the quality of EBM produced components are still industrial open items and studies need to be carried out. The objective of this study is to evaluate the distribution and the features of porosity defects generated during the EBM process, at this aim a simple test case, consisting in rectangular parallelepiped (50x10x10 mm) samples manufactured in Ti6Al4V, was chosen (Figure 1). A suitable DOE was developed in order to investigate the effect of the following intra-build process parameters on porosity: Samples orientation (fig.2): samples were built according to n.4 different orientations: x, y, z (90°) and 45°. The x and y oriented samples were built horizontally and they were, respectively, parallel and perpendicular to the rake movement direction. The 90° oriented samples were built vertically Location of the sample in layer (fig.3): the group of samples shown in Figure 4a was built in n.5 different zones in the x-y plane which are named hereafter: Z1, Z2, Z3, Z4 and Z5. The Z5 zone was the central one while all the other zones were representative of the four corners of the x-y plane. Such configuration was chosen in order to guarantee a high build envelope symmetry. Height in the build chamber (fig.4): the group of samples shown in 2b was built at n. 3 different levels in the build chamber which are named hereafter: h1, h2 and h3. More in detail, the h1 level starts at z=40 mm, the h2 level starts at z=170 mm and the h3 level starts at z=300 mm.

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Simultaneous topographical and electrochemical mapping using scanning ion conductance microscopy – scanning electrochemical microscopy (SICM-SECM)

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Lately, scanning ion conductance microscopy (SICM) has emerged as a versatile non-contact imaging tool. To obtain spatially-resolved electrochemical information, scanning electrochemical microscopy (SECM), also known as the chemical microscope, has been developed. Hybrid SICM-SECM techniques have been developed, in which the SICM compartment provides the accurate probe-sample distance control, while the SECM compartment measures the faradaic current for electrochemical information collection. In this work, we demonstrate the use of an atomic force microscopy (Park NX10) in combination with an ammeter for concurrent topography imaging and electrochemical mapping. The SICM-SECM probe consisted of an Au crescent electrode (AuE) on the peripheral of a nanopipette. High resolution probe-substrate distance control was obtained by the ion current feedback from SICM, while simultaneous electrochemical signal collection was achieved via the AuE from SECM. As a proof-of-concept experiment, an Au/Pyrex pattern standard sample was imaged with the SICM-SECM technique. The Au bar and the Pyrex substrate were clearly resolved from the SICM topography image, with the bar height and pitch width closely matching the actual values. In terms of the electrochemical property mapping, higher Faradaic current was seen when the probe was scanned over Au bar as a result of redox cycling, while lower Faradaic current was observed when the probe was over Pyrex substrate due to hindered diffusion. The capability of the SICM-SECM technique described here holds promise of many applications in the field of electrochemistry, material science and nanoengineering.

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Promising graphene materials from biomass waste for CO_2 capture

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The increase in climate related natural adversities have reinforced the obvious need of diminishing green-house gaseous emissions, predominantly those of CO_2 and is leading government agencies around the world to develop a sequence of roadmaps, which aspire at moving forward to a low carbon economy. Carbon capture and storage (CCS) has been identified as one of the key technologies that could contribute in a greater degree to reach the CO_2 emission reduction targets. In the present study we have established a synthesis route for production of porous graphene material from the oil palm empty fruit bunches (EFB) for CO_2 capture. We have used a wide range of instrumental techniques including scanning electron microscopy, atomic force microscopy, transmission electron microscopy, X-ray photoelectron spectroscopy, X-ray diffraction and Raman spectroscopy together with the Brunauer–Emmett–Teller surface area analysis and density functional theory models to provide insights into morphological and structural characteristics of the porous graphene. The porous graphene show excellent performance as adsorbents for post combustion CO_2 capture (>2.0 mmol g−1) which is considerably higher than other competitive CO_2 adsorbents, including zeolite, activated carbon and some metal organic frameworks. Thus, these results suggest that the biomass waste used in current study could be effectively valorized as efficient CO_2 adsorbent under post combustion conditions.

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Surface reactivity of layered manganese oxides: an experimental and theoretical approach

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Electrochemical storage of energy through Li ion devices is the commonly used solution to address the intermittent character of renewable energy and the increasing demand of nomad technologies. $LiCoO_2$ is the most widely used positive electrode material of today's Li ion batteries. In the last decade, much research has been performed to explore alternative materials as mixed transition metal oxides $LiNi_xMn_xCo_{1-2x}O_2$ (NMC). The surface reactivity of these electrode materials towards the electrolyte is a key feature that has deep impact on the performance and lifetime of Li-ion cells and need to be understood and controlled. Within this framework, based on our previous experience on lithium layered oxides, we decided to study the surface reactivity of Li_2MnO_3 which can be viewed as a model compound for Mn(IV) layered oxides such as NMC or even Li rich materials. The strategy consists coupling adsorption of gaseous probe molecule (SO_2), X-ray photoelectron spectroscopy (XPS) and DFT calculation in order to identify the influence of the oxidation state of the transition metal on the adsorption reaction type (basic/acidic or redox). We focus our study on strengthening the experimental calculation coupling by studying the reactivity on a single crystal surface of Li_2MnO_3. Both approaches conclude to a redox adsorption mode with the formation of sulphate species. Chemical maps of the crystal surface after adsorption obtained by Auger spectroscopy provide information on the adsorption sites location. Stacking faults and spinel type default are usually encountered in the Li_2MnO_3 crystals. Thus, we completed this study with the investigation of the surface reactivity of Li_2MnO_3 polycrystals against the stacking faults rate. Moreover, the reactivity of $Li_{1+x}Mn_{2-x}O_4$ spinel materials will be checked to determine the influence of the spinel type default on the surface reactivity.

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Lab on a wire: application of silicon nanowires for nanoscience and biotechnology

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Synergy between physics, material sciences and biotechnology during last decade has led to a tremendous scientific progress in the fields of bio detection and nanomedicine. This tight interaction led to the emergence of a new class of bioinspired systems that enables to bring the area of biosensorics e.g., for cell or molecular diagnostics and analytics to the new level. The advances are expected in terms of possibility for early diagnostics of diseases due to the increased sensitivity of the detectors; real time and high through put analysis offered by combination of integrated electronics and microfluidic approach and establishing the new functional formats for the bioassays. Most promising candidates for the future diagnostics are the electronic nano biosensors that have attracted great attention in the last decades since they provide rich quantitative information for medical and biotechnological assays without pre-treatment and specific optical labelling of the detected species. One dimensional nano structures in particular semiconductor and metallic nano wires have attracted attention as highly efficient sensor elements due to their high surface-to-volume ratio, which simplifies the detection of biochemical species down to single molecules. The simultaneous detection of multiple targets within a single chip on a point of care device is a milestone drawing great attention within bio and nanotechnology areas for more than a decade. Here, we demonstrate a multiplexed, label free and real time detection platform for small molecules like hormones, DNA sequence or pathogenic proteins. The nanowires based devices offer noise reduced, versatile and reliable electrical characteristics with high on/off ratios upto 106. A sensitive and selective binding of the targets onto the SiNW-FETs can be realized by using aptamers/ antibodies, etc., as receptors in order to allow high sensitive screenings in physiological conditions.

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Emulsified Polymeric Gels for Oil and Gas Applications: Emulsion Formulation, Stability and Rheokinetics Investigation

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Water production is a serious issue associated with hydrocarbon exploration and production. The production of water was reported to be in the order of 249 million barrels per day (BPD) globally. The U.S alone produced an average volume of 57.4 million BPD. Approximately, $40 billion is spent annually on handling the unwanted produced water from oilfields. Commonly, inorganic and organically cross-linked gels are used. Nevertheless, a risk will be taken, that is blocking the hydrocarbon-producing zones alongside the water zones. Hence, Emulsified gels are proposed as a smart method for shutting off unwanted water produced from the oilfields without risking their productivity. In this study, emulsified polyacrylamide (PAM) polyethyleneimine (PEI) system was developed for high-temperature high-salinity applications. Emulsifier (e.g. surfactant) selection for such jobs is critical and undoubtedly expensive. In this work, we used the hydrophilic-lipophilic balance (HLB) for surfactant selection. Diverse surfactants were examined including ethoxylates, poly (ethylene glycols), fluorinated surfactants, and amides; and new insights on structure-surfactant stability relationship, beyond the HLB approach, are provided for surfactant selection. Additionally, nanomaterials (i.e. Organoclay) was proposed as a substitute for classical surfactants used in such an application. Furthermore, the thermal stability of the emulsified PAM/PEI gels was extensively investigated. The influence of different parameters, such as surfactant concentration water-oil ratio, salinity, mixing intensity and temperature, on the droplet size and the emulsion thermal stability was studied. A relationship between the emulsified system droplet size and its thermal stability was developed. Moreover, the impact of emulsification, salinity and temperature on gelation kinetics and gel strength are examined through high-pressure rheometry and differential scanning calorimetry (DSC). The rheokinetics of the gelling solution is modeled using Avrami based model. Emulsification was found to slow down cross-linking rate, and the activation energy for emulsified gels was found to be ~ 10 times higher than non-emulsified gels. We believe that this is the first of its kind study on emulsified polymeric systems, used for water control in oil and gas field conducted under typical reservoir conditions.

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Optimization of physical chemistry of the (PZT) interface for future high capacitance density devices

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The growing need for the integration of an increasing number of functions into the new generation of portable devices contributes to overcrowding of printed circuit boards. In this context, the miniaturization of discrete components is imperative to maintain a manageable size of the printed circuit boards. The capacitors, present in our cell phones today, occupy more than 50% area of all discrete components. There is thus a strong interest in going towards the densification and the integration of those components. The success of such integration relies on the use of both high dielectric permittivity materials and a suitable stacking architecture. Lead zirconate titanate (PZT) in decoupling multiple metal-insulator-metal (multi-MIM) stacks is a good candidate for the new generation of integrated capacitors. However, capacitor performance is heavily affected both by the PZT compositions and the quality of the interface with the electrodes. Therefore, it is important to engineer surface (PZT) and interface (Pt/Ru/PZT) physical chemistry which does not degrade the multi-MIM performance. This research has provided valuable information on the correlation of PZT surface properties and electrical responses from Pt/Ru/PZT (220 nm)/Pt presented in Figure 1. Operando HAXPES methodology showed in Figure 2, made it possible to investigate lead (Pb) excess precursors in PZT sol-gel solution and post metallization annealing (PMA) impact on the electrical functioning of Pt/Ru/PZT/Pt stacks. This work is a new step towards a complete understanding on the behaviour of the interface between electrodes and the PZT ferroelectric, in device-like multi-MIM or 3D-MIM heterostructures, in terms of electronic properties, capacitance density, loss tangent and breakdown field (reliability).

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Rubber composites with self-healing ability

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Self-healing materials have intensively been investigated over the past 15 years. Several approaches have been developed resulting in materials capable of dealing with damage events in a more or less independent way, thereby extending their service life and thus reducing waste. Large interest has been drawn to self-healing elastomeric materials, following either extrinsic or intrinsic approaches. However, limited attention has been paid to the self-healing of vulcanized rubbers. Healing is especially challenging in vulcanized rubbers, where the confinements imposed by the high density of cross-links restrict polymer chains to diffuse and form new bonds across former (pre-) fractured surfaces. We will discuss the development of rubber compounds with self-healing properties. While it is relatively easy to demonstrate the occurrence of self-healing (i.e., the restoration of mechanical properties) the underlying physico-chemical reactions which take place at molecular level during the healing process are less easy to be monitored. Thus, a systematic research on the molecular dynamics of these elastomers will help to elucidate the key healing reactions and how the relaxation behavior of the compounds can be affected by the degree of curing. In addition, the majority of studies covering the healing of polymer composites report on the healing of structural properties and on the use of reinforcing agents (e.g., nanofillers) for improving the mechanical performance. However, nanofillers can also be used for restoring other functionalities, i.e., non-mechanical properties such as thermal conduction, electrical conduction and magnetic shielding among others. Our aim is to restore more than one functionality after healing macroscopic damage in rubber nanocomposites. This study also focuses on the development of rubber composites that can combine together self-healing properties with the use of ground tire rubber (GTR) as alternative sustainable filler. The self-healing efficiency of GTR filled rubber composites will be compared to conventional carbon black filled compounds. These results will be seen as a starting model material for developing new sustainable applications economically and environmentally convenient with good mechanical properties as well as healing ability.

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Swarm robotics market

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Swarm robotics market is witnessing significant growth because of its increasing usage for solving big data problems, need for swarm robotics in the transportation business and rising adoption of swarm based drones in military. Moreover, the growing impact of connected cars, along with the rising adoption of swarm robotics in warehouses can generate huge opportunities for players in this market in the future. There are many swarm robotics algorithms currently being researched upon. Some of the algorithms include ant colony optimization, particle swarm optimization, bee-inspired algorithms, bacterial foraging optimization, firefly algorithms, and fish swarm optimization. The most widely accepted algorithms for real-world problems are ant colony optimization and particle swarm optimization. Swarm robotics algorithms can be used for controlling robots and unmanned vehicles, predicting social behaviours, enhancing telecommunications and computer networks, etc. For instance, airlines use ant-based routing in assigning aircraft arrivals to airport gates. Swarm robotics has various capabilities including optimization, routing, scheduling and clustering. These capabilities are used in a decision-making process and to solve complex problems such as nondeterministic polynomial time-hard (NP-hard) problems. The market for swarm robotics is becoming highly competitive with the presence of several start-ups. Industry players are also looking towards government support for funding and investments to achieve growth in the swarm robotics market. The intent of this conference is to cater to the various industry stakeholders, such as automotive companies, technology providers, universities and research organizations, drone manufacturers, robot manufacturers, swarm algorithm providers, investors and venture capitalists, and manufacturers implementing swarm robotics. Viewers can update themselves about the latest developments carried out in the swarm robotics ecosystem, and market dynamics, key trends, and use cases. They can also be informed about the new growth opportunities in the swarm robotics market.

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Nanomaterials for infrared light shielding smart window

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Synthesis of functional nanoparticles and their applications for smart window will be introduced. Various kinds of nanomaterials and their composites were successfully synthesized by solvothermal process. Thin films on glass substrate were fabricated by doctor blade method using nanoparticles as starting materials. The mixed valence state tungsten based homogeneous nanomaterials M_xWO_3 and $W_{18}O_{49}$ possessed excellent IR light shielding properties. In summer days, the mixed valence state tungsten based IR-shielding smart coating can block harmful UV light and most of the NIR lights with heat effect and keep cooler indoors, also transmit visible light. While, in winter days, the turnaround smart coating reduces heat loss from indoors, transmit visible light effectively. It is obvious that these materials have potential applications for the heat ray shielding and indoor energy saving effect. On the other hand, VO_2 monoclinic based nanoparticles possessed excellent and smart thermochromic property, possessed heat ray shielding effect in summer and heating effect of indoors in winter. The VO_2 based materials show higher energy saving effect than those of normal IR shielding materials. Also, multifunctionality of thin films was successfully realized by fabricating the composites with various functional components. Not only UV/IR shielding property, but also environment purification and self-cleaning functions can be expected, indicating their great potential as novel housing materials. The design of composites and thin films structure might result in property improvement of particle applications for smart windows.

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Electrochemical detection of sunset yellow using graphene modified electrodes

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The human health is highly affected by the usage of synthetic dyes in foods and drinks. The dyes are generally added to improve the appearance, color and taste of food but if the intake exceeds a certain amount, it may be pathogenic. Sunset Yellow (SY) belongs to the azo-dye family and contains an azo functional group (N=N) and aromatic rings, which may be harmful to human health. Since it is less expensive and more stable than natural dyes, SY is frequently used in food products (e.g., orange juice). According to the World Health Organization, the accepted daily intake value for sunset yellow is 0–4 mg.kg−1 and its concentration in non-alcoholic beverages should not exceed 50 mg.L−1. Its detection by electrochemical technique using graphene modified electrodes may be a viable alternative to the more laborious HPLC method. Graphene-based materials were prepared by exfoliation of graphite rod via pulses of current in solutions containing various electrolytes e.g., ammonium sulfate; a mixture of boric acid and sodium chloride; and a mixture of nitric and sulfuric acid. The samples were correspondingly denoted Gr-AS, Gr-BA and Gr-NS. After washing and lyophilization, the samples were morphologically and structurally characterized by transmission/scanning electron microscopy, X-ray powder diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and Raman spectroscopy. According to XRD spectra, the Gr-AS and Gr-BA samples (prepared in the first two electrolytes) contain few-layer and multi-layer graphene flakes. In contrast, the Gr-NS sample prepared in the third electrolyte contains not only few and multi-layer graphene flakes but also a large amount of graphene-oxide (39%). The performances of glassy carbon (GC) electrodes modified with the graphene based materials were tested toward sunset yellow (SY) detection and compared with those of bare GC. As expected, the graphene modified electrodes have higher sensitivities, wider linear ranges and lower detection limits.

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Designing low-power VLSI circuits: practical recipes

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The growing market of mobile, battery-powered electronic system demands the design of microelectronic circuits with low power dissipation. As the device size is drastically reducing, and density and complexity of the chips continue to enhance, the difficulty in providing adequate cooling might either add significant cost or limit the functionality of digital electronic systems which makes use of such integrated circuits. Power dissipation has become a critical design metric for an increasingly large number of VLSI (Very-large scale integration) circuits. The major challenges for design engineers are now to design new generation products that consume minimum power without compromising its performance or achieving minimum chip area as high speed and low power design as requirements for many applications. Modern chips consume ~100W of power of which about 20% is wasted in leakage through the transistor gates. The traditional means of coping with increased power per generation has been to scale down the operating voltage of the chip but voltages are reaching limits due to thermal fluctuation effects. Several techniques, tools and methodologies for designing low power circuits have been already been observed in the scientific literature. However, only a limited number of such techniques, methodologies and tools have found their way in current design flows. Design a digital circuit for minimum transient energy consumption by eliminating hazards and glitch filtering by increasing inertial delay of gates or by inserting delay buffers when necessary is the current trend in low power VLSI circuit design. Several tricks may also be adapted during design to reduce power dissipation which will be presented at the talk.

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Nano crystal silicon growth under electron irradiation

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In our experiment, it was observed that silicon nanocrystals rapidly grow with irradiation of electron beam on amorphous silicon film prepared by pulsed laser deposition (PLD) and silicon nano crystals almost occur in spherical shape on smaller nanocrystals with less irradiation time of electron beam. It is very interesting that magical electron affection promotes growth of nanocrystals due to nano scale characteristics of electronic de Broglie wave which produces resonance to transfer energy to atoms. In the process, it was investigated that condensed structures of silicon nanocrystals are changed with different impurity atoms in silicon film, of which localized states emissions was observed. Through electron beam irradiation for 15 min on amorphous Si film doped with oxygen impurity atoms by PLD process, enhanced photoluminescence emission peaks are observed in visible light and electroluminescence emission is manipulated into the optical communication window on the bigger Si-Yb-Er nanocrystals after irradiation of electron beam for 30min.

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