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PLENARY SPEAKERS

Id-700

SiGe, ZnTe and NANOPARTICLES in CdS/CdTe: PHOTOVOLTAIC CHARACTERISTICS SIMULATIONS and THIN FILM LASER DEPOSITION

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Abstract: Semiconductor materials consisting of a wide band gap such as CdS/CdTe show promising potential applications in several practical areas of electronics, specifically photovoltaics. In our previous studies at our Advanced Materials Synthesis and Characterization Laboratory (AMSCL) we have used pulsed laser deposition to deposit nanoparticles (Ag, and Au) to investigate the effects of these impurities on the photovoltaic properties of the CdS/CdTe based thin films. The main objective was to investigate how the inclusion of nanoparticles will affect light scattering in the at the interfaces and whether the different size and shape of nanoparticles will have a positive effect on the overall electrical performance of these thin film solar cells. In those earlier work, the effects of the embedded Ag nanoparticles on the photoelectric conversion efficiency were investigated on CdS/CdTe based thin film solar cells as synthesized by Pulsed Laser Deposition (PLD). Silver was shown to enhance the photovoltaic performance by almost doubling the photovoltaic conversion efficiency of the conventional CdS/CdTe films. Then a careful comparison of photovoltaic performance of Au versus Ag embedded thin films of CdS/CdTe on indium tin oxide coated glass substrates have been performed. Our results on the Ag case revealed electrical performance of these cells have correlates with the particles density and the particle size on the CdS/CdTe interface. Ag and Au nanoparticles have contrasting effects on the photovoltaic conversion efficiency in terms of their relative coverage at the interface. This will be discussed in the light of plasmonic resonances and effective light scattering for Ag and Au particles. However, recombination loss at the back contact of the cells may also occur due to the cell's high absorption property. Zinc telluride (ZnTe), having a wide band gap of 2.26 eV, would impede this loss, potentially resulting to a higher energy conversion. In this research, the effects of the addition of a thin-film ZnTe layer on minimization of the photovoltaic current loss was investigated. Using the theoretical software (WxAmps), the photovoltaic property calculations of ITO/CdS/CdTe/ZnTe, ITO/CdS/CdTe/ZnTe, ITO/CdS/SiGe/CdTe/ZnTe layers at various thickness and parameters, were performed. The results showed that the addition of ZnTe on the back surface of the film would result to a higher energy conversion efficiency. Various parameters including short-circuit current density, efficiency percentages, fill factor, and voltages, were optimized. From these optimized values the pulsed laser deposition parameters were determined to synthesize these higher efficiency CdS/CdTe based thin-film solar cells. This work is supported by NSF Award #:DMI-0420952 The New Jersey Space Grant Consortium (NASA) Spanish National Research Council-CSIC.

Keywords: Nanoparticles; Photovoltaic simulations; Thin film laser deposition.

PLENARY SPEAKERS

Id-701

TARGETING CANCER CHEMOTHERAPY RESISTANCE BY MEDICINE DRIVEN NANOMEDICALS

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Abstract: Therapy resistance is the major cause of cancer death. As patients respond heterogeneously, precision/personalized medicine needs to be considered, including the application of nanoparticles (NPs). Success of therapeutic NPs requires to first identify clinically relevant resistance mechanisms and to define key players, followed by a rational design of biocompatible NPs capable to target resistance. Consequently, we employed a tiered experimental pipeline from *in silico* to analytical and *in vitro* to overcome cisplatin resistance. First, we generated cisplatin-resistant cancer cells and used next-generation sequencing together with CRISPR/Cas9 knock-out technology to identify the ion channel LRRC8A as a critical component for cisplatin resistance. LRRC8A's cisplatin-specificity was verified by testing free as well as nanoformulated paclitaxel or doxorubicin. The clinical relevance of LRRC8A was demonstrated by its differential expression in a cohort of 500 head and neck cancer patients, correlating with patient survival under cisplatin therapy. To overcome LRRC8A-mediated cisplatin resistance, we constructed cisplatin-loaded, NPs with good colloidal stability, biocompatibility (low immunogenicity, low toxicity, prolonged *in vivo* circulation, no complement activation, no plasma protein aggregation), and low corona formation properties. 2D/3D-spheroid cell models were employed to demonstrate that in contrast to standard of care cisplatin, NP_{Cis} significantly ($p<0.001$) eradicated all cisplatin-resistant cells by circumventing the LRRC8A-transport pathway *via* the endocytic delivery route. We also report how engineered tumor acidity-responsive toxins can be used to improve safe and efficient nano-based cancer therapies. We here identified LRRC8A as critical for cisplatin resistance and suggest LRRC8A-guided patient stratification for ongoing or prospective clinical studies assessing therapy resistance to nanoscale (acidity-targeted) platinum drug nanoformulations *versus* current standard of care formulations.

Keywords: Chemotherapy resistance; Nanomedicals.

INVITED SPEAKERS

Id-755

GOLD-ASSISTED EXFOLIATION of EXTRAORDINARILY LARGE-SIZE MONOLAYER CRYSTALS of TWO-DIMENSIONAL MATERIALS

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Abstract: Here we report the exfoliation of extraordinarily large-size monolayers of a range of semiconductor two-dimensional (2D) materials, up to cm^2 in area, which is about a few hundreds of times larger than films produced by conventional exfoliation method. By taking advantage of the strong van der Waals force between gold surface and many 2D materials, extremely large-size monolayers of a variety of transition metal dichalcogenide (TMD) 2D films (MoS_2, WS_2, $MoSe_2$, WSe_2 etc) were exfoliated on smooth and clean Au surfaces. Near unity exfoliation yield was achieved with film sizes mainly limited by the size of parent crystals. As these films are prepared directly from mechanical exfoliation, they are of the highest quality, uniform and clean, free of chemical contamination and defects, which are the ideal platforms to facilitate a wide range of research and technological development. This work was supported by the Engineering and Physical Sciences Research Council (EPSRC) of the UK (ref. EP/N025938/1).

Keywords: 2D materials; Exfoliation; Monolayer; Transition metal dichalcogenide.

INVITED SPEAKERS

Id-760

ANHARMONIC LATTICE THERMAL CAPACITY and SIZE-DEPENDENT MELTING TEMPERATURE of SQUARE GRAPHENE NANO-FLAKES

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Abstract: A 'discretized' version of the 2-dimensional (2D) 'Generalized Skettrup Model' (GSM) implemented at simulations on temperature-dependent harmonic and anharmonic fractions of the lattice thermal capacity of square graphene nano-flakes as well as of their size-dependent melting temperatures. All mentioned above thermal characteristics of those square graphene nano-flakes are evaluated merely based on features of confined interacting in-plane acoustic phonons with the static plane-wave basis, while contributions from their in-plain 2D optical braches and 'outplane' ('flexural') modes are ignored completely because of their insignificant impact on the fraction of the anharmonic lattice thermal capacity in vicinity of melting point of those nano-flakes(s). Following 'ideologies', introduced elsewhere in refs. (see also references therein), effective interactions among the in-plane acoustic phonons are taken into consideration via temperature-dependent model parameter(s) of the 'discretized' 2D GSM. Obtained simulation results for the size-dependent melting temperature(s) of square graphene nano-flakes with the rib length ranging from ~ 5 nm to ~ 20 nm are discussed in comparison with their counterparts obtained via 'state-of-art' molecular dynamic simulations, nucleation theory, and atomistic approaches.

Keywords: Graphene nano-flakes lattice; Heat capacity; Melting temperature.

INVITED SPEAKERS

Id-780

NANOMATERIALS as CATALYSTS for NON-THERMAL PLASMA-ASSISTED CO_2 REDUCTION to VALUABLE COMPOUNDS

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Abstract: Plasma-activated CO_2 conversion into valuable compounds such as CO or CH_x deserves to be thought a novel environmentally friendly process since products are important chemical feedstock for synthetic fuels through the Fischer–Tropsch and methanol synthesis processes. It is possible to perform the reaction under NTP conditions (without a catalyst) and the overall process reaches the equilibrium, which can be manipulated e.g. by increasing the specific energy input (SEI) due to an increase in the average electron density. The CO_2 splitting in the excited states (e.g. under NTP or high temperature conditions) is dominated by electron-impact dissociation (forming CO and O atoms and ions), the ionization process (forming CO_2^+ ions) and electron dissociative attachment (forming CO and O^- ions). However, a fraction of the ions from these processes (e.g. CO and O) can recombine to CO_2 in the gas phase – equilibrium state. Therefore, the catalyst incorporation, especially nanocarbons, into the system seems to be highly reasonable for increase CO_2 conversion rate and disabling the recombination process. The carbonaceous nanomaterials, in general, affect the physical characteristics of the plasma discharge, which enhance the electric field and enable the formation of surface discharges and micro-discharges, thus (i) promoting gas-phase CO_2 dissociation, and (ii) working as perfect oxygen scavenger. However, effectiveness of these systems differs depending on the graphitization degree of the tested nanomaterials, i.e. amorphous nanomaterials showed higher activity than MWCNT or CNF. Additional impact of this work was to elucidate the mechanism of the process based on the results from *in-situ* FTIR experiments. It is shown that surface C=O as well as C-O-C functionalities are on decisive important during the process. Moreover, due to systems complexity – a “great zoo” of different charged and uncharged species new spherical carbon-nanomaterials are formed. Finally, as compared with the performance data presented in the current literature, NTP C-catalytic systems for selective CO_2 splitting still require further development and improvement.

Keywords: Non-thermal plasma; Nanomaterials; Excited state.

INVITED SPEAKERS

Id-787

EXPLOITING SUPRAMOLECULAR CHEMISTRY to DRIVE NANOMEDICINE

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Abstract: Due to their cancer relevance, a detailed biological understanding of the apoptosis inhibitor and mitosis regulator Survivin and the protease Taspase1 is of broad interest and key for innovative interference strategies. Both protein functions are regulated by their dynamic cellular localization, dimerization, and protein interactions. We thus aimed at the development of supramolecular interference strategies for intracellular protein transport signals; as proof-of-concept, we successfully targeted Survivin's nuclear export signal (NES, aa ^{89}VKKQFEELTL^{98}) and the import signal (NLS, aa ^{197}KRNKRK-x$_{14}$-KKRR^{220}) of Taspase1. We could demonstrate that an addition of peptides derived from Survivin's dimer interface (partially overlapping the NES) to the tweezer motif increases binding, regioselectivity, and signal specificity. We further demonstrated that multivalent ligands, e.g. from the coupling of tweezers to either ultrasmall nanoparticles let to ~5-fold more potent binders. Moreover, multivalent glutamate/aspartate binders with guanidiniocarbonylpyrrole (GCP) motifs allowed a selective targeting and investigation of the biological Survivin/Histone H3 interaction. Additional structural modifications allowed to access distinct Survivin regions: Duplication of the GCP-units combined with changes in their steric orientation resulted in ligands that either perturbed the Histone H3- or the NES/CRM1 interactions, even in cells. For Taspase1, PEGylated precision oligomers with incorporated GCP units were shown to inhibit the interaction of Taspase1's NLS with the import receptor Importin α, presumably by sterically shielding the flexible loop. Moreover, multi-armed GCP-ligands covered an extended surface area and affected Importin α binding, proteolytic activity, and cancer cell viability. These tools will be further used for dissecting the Taspase1/Importin α axis.

Keywords: Cancer therapy; Supramolecular chemistry; Nanoparticles.

INVITED SPEAKERS

Id-788

On NATURE of URBACH’S TAIL in OPTICAL ABSORPTION SPECTRUM of NANO-CRYSTALLINE ZINC OXIDE (nc-ZnO)

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Abstract: Results of some well-known experimental and theoretical studies on the nature and features of Urbach’s (exponential) bandtail in sub-gap optical absorption spectrum of different forms of crystalline zinc oxide (c-ZnO) are briefly summarized in the presentation. In particular (different kinds of) potential fluctuations, electron confinement, as well as key features of Berggren-Sernellius, Burstein-Moss and ‘side band’ models are discussed concisely in view of their possible relationship with particularities of spectrum of the optical absorption coefficient of polar solids. However, presented simulation results on features of the Urbach’s tail in <101>-oriented nano-crystalline ZnO (nc-ZnO) powder(s) are obtained using framework of so-called ‘Generalized Skettrup Model’ (GSM); see also references therein. Following the original Skettrup’s model, the GSM is based essentially on assumption on crucial involvement of (confined) Debye’s acoustic phonons into electron-phonon interactions, which are causing electronic and optical band tailing for c-ZnO. Furthermore, the GSM incorporates naturally contributions from many-particle states of those acoustic phonons, following closely the well-known Fock space formalism for separable many-particle spaces and states. Obtained simulation results are discussed in comparison with their experimental counterparts, reported elsewhere in ref.

Keywords: Urbach tail; Optical absorption; Zinc oxide; Nano-crystalline; Acoustic; Phonon; Fock space.

REGULAR SESSIONS

Id-748

CHARACTERISTICS of PLASTIC PARTICLES in the INDUSTRIAL ENVIRONMENT

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Abstract: Little is known about the effects of nano / microplastics on human health. Exposure may occur through ingestion, inhalation and skin contact, due to the presence of nano / microplastics in products, food and air. In all biological systems, exposure to nano / microplastics can cause particulate toxicity, with oxidative stress, inflammatory damage, and increased absorption or translocation. Knowledge of nano/microplastic toxicity is still limited and largely influenced by exposure concentration, particulate properties, adsorbed contaminants, tissues involved and individual susceptibility. Occupational exposure to PM unevenly damages the natural oxidative balance, resulting in a disproportionate amount of free radicals and the production of reactive oxygen species (ROS). It is estimated that the mass of inhalable, thoracic and respirable particles is a cause of death worldwide due to the increased risk of inhalation, ingestion, percutaneous absorption. The Textile and Garment (T&C) sector is an important component of the European manufacturing industry, with over 1.5 million employees but it is one of the main polluters of the environment, affecting both air, water and soil (EURATEX, 2020). This paper reviews the polyester nano / microplastics exposure routes of textile industry personnel and analyzes the characteristics of polyester particles collected in the vicinity of workplaces. Phases were selected from the technological flows of processing textile materials through classical technologies (weaving, knitting) and making garments (sewing). By using the Laser Aerosol Spectrometer set were determined: the total particle concentration (TSP) and the concentrations of the fractions of PM10, PM2.5 and PM1 in (µm3); total number (NC) of particles (1 / l). Specific methods for descriptive statistics were used to characterize the particle populations for which the recordings were made. Were calculated for each of the 4 variables considered defining for air quality in the vicinity of workplaces: mean, dispersion and standard deviation, median and quartiles, eccentricity (skewness) and vaulting (kurtosis) for asymmetry and highlighting the cases in which they should be performed. interventions. Box plot histograms and graphs for TSP, PM10, PM2.5 and PM1, TC variables and band graphs were plotted.The comparative analysis of the results led to the identification of the phases in which the concentrations and the number of particles in the air show the highest values but also of the weight of the nanoparticles in the polyester. The collection of particles was performed on quartz and polycarbonate filters with gold membrane with diameters of 25-47 mm and air flows of the pumps of 2l / min and 38l / min respectively. The amount of dust collected was determined by the difference in mass between the white filters and the filters after collection. Characterization of polyester dust collected by analysis: Scanning Electron Microscopy (SEM), Elemental analysis (EDX), Transmission Electron Microscopy (TEM), gas chromatography-mass spectroscopy (GS-MS), Raman spectroscopy allowed the identification of shape, size, chemical structure and structural footprint of polyester particles. In the next phase of the project, the toxic characteristics of the collected particles will be analysed *in vitro* and *in vivo*.

Keywords: Nanoparticles; Plastics; Polyester; Health; Textiles.

REGULAR SESSIONS

Id-772

COMPLEMENT ACTIVATION and INFLAMMATORY CYTOKINE RESPONSE by IRON OXIDE NANOPARTICLES

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Abstract: Nanoparticles have promised a range of diagnostic and therapeutic applications in biomedicine. They are attractive drug delivery vehicles for targeted organs or tissues. However, their interaction with immune system is very intriguing and challenging to develop their applications. This study reports that iron oxide nanoparticles are recognized by complement pathways and complement deposition enhanced their uptake by activated and differentiated THP-1 macrophages. Furthermore, secreted cytokines, chemokines and growth factors analyses showed complement-dependent down-regulation of pro-inflammatory cytokines, TNF-α, IL-1□, IL-6, IL-12, although their intracellular fate is independent of complement deposition. We propose that complement activation may cause several immune cells activation and infiltration due to release of cytokines, chemokines and growth factors, though without inducing pro-inflammatory immune response. Understanding of nanomaterials interaction with immune system is important for the design and engineering of nanomedicine for safer use. Translation of such strategies could be pivotal in designing complement safe and phagocyte resistant drug carriers. Furthermore, complement activation is not always detrimental as evident by inhibition of pro-inflammatory cytokines and chemokines. (This project was supported by National Plan for Science, Technology and Innovation, King Abdulaziz City for Science and Technology, Kingdom of Saudi Arabia, No. 15-NAN-3664-02).

Keywords: Nanoparticles; Iron oxide; Cytokines.

REGULAR SESSIONS

Id-773

ETHENE HYDROFORMYLATION USING Rh-Co BIMETALLIC CATALYST SUPPORTED by REDUCED GRAPHENE OXIDE

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Abstract: The influence of feed-gas ratio on the ethene hydroformylation over a Rh-Co bimetallic catalyst supported by reduced graphene oxide (RGO) has been investigated in a tubular fixed bed reactor. Argon was used as balance gas when the feed-gas ratio was changed, which can keep the partial pressure of the other two kinds of gas constant while the ratio of one component in feed-gas was changed. First, the effect of single component gas ratio to the performance of ethene hydroformylation was studied one by one (H_2, C_2H_4 and CO). Then an optimized ratio was found to obtain a high selectivity to C3 oxygenates. The results showed that: (1) 0.5%Rh-20%Co/RGO is a promising heterogeneous catalyst for ethene hydroformylation. (2) H_2 and CO have more significant influence than C_2H_4 on selectivity to oxygenates. (3) A lower H_2 ratio and a higher CO ratio in feed-gas can lead to a higher selectivity to oxygenates. (4) The highest selectivity to oxygenates, 61.70%, was obtained at the feed-gas ratio CO : C_2H_4 : H_2 = 4 : 2 : 1.

Keywords: Ethene hydroformylation; Reduced graphene oxide; Rhodium cobalt bimetallic catalyst; Effect of feed-gas ratio.

REGULAR SESSIONS

Id-775

STUDY of THERMOELECTRIC PERFORMANCES in THIN-FILMS vs BULK PELLETS

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Abstract: The rapid increase in the world's economy and population has elevated the energy demands. The current energy supply relies heavily on fossil fuels, which emit greenhouse gases, causing global warming. Globally, the world is seeking cleaner sources of energy to meet current needs without producing harmful outcomes. Moreover, a large part of the energy consumed in aircraft, industries, and power plants is dissipated in the form of heat. Thermoelectric (TE) materials grabbed much attention due to their ability to convert waste heat into electricity. These materials work on the principle of the Seebeck and Peltier effect. It allows us to convert waste thermal energy into useful electrical energy. Traditional coolant requires additional energy to eliminate the waste heat from aircraft, automotive, industries, electricity generation, etc. However, TE materials can serve as an alternative for the coolant without requiring additional energy and can convert this waste heat into useful electricity. They have several advantages over conventional coolants like no requirement of any moving part, immense reliability, silent operation, no maintenance, etc. Owing to its high electrical conductivity, polymer poly (3,4-ethylene dioxythiophene): polystyrene sulfonate (PEDOT: PSS) was extensively investigated for TE applications. Nevertheless, until now, only a few studies have focused on nano-dot embedded polymer nanocomposites for TE applications. The current study presents a novel approach for enhancing the TE properties of polymer PEDOT: PSS by employing **T**itanium dioxide **N**ano-dots **D**ecorated **G**raphene **O**xide (TNDGO). We have measured the thermoelectric transport parameters of the as-synthesized polymer nanocomposite, such as the Seebeck coefficient (S) and electrical conductivities (σ) at room temperature, and then their thermoelectric power factor (PF) was calculated by $PF = S^2.\sigma$. Besides, their performances in thin films were compared with that of bulk pellets and found that the thin film undergoes better TE performance than their bulk counterparts. A maximum power factor of 91 $\mu W.m^{-1}.K^{-2}$ was obtained from 2 wt. % TNDGO/ PEDOT: PSS thin film. The improved performance in the thin films was attributed to the formation of longer conducting pathways leading to higher crystallinity as confirmed by X-ray diffraction.

Keywords: Polymer nanocomposites; Functional nanomaterials; Thermoelectric materials; Energy conversion, Nano-dots.

POSTER SESSIONS

Id-728

LIQUID-PHASE AEROBIC OXIDATION of PENTADECANE in the PRESENCE of FULLERENE C_{60}, $(RCOO)_3Cr$ and $(RCOO)_2Ni$

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Abstract: The problems of modern catalysis lie in the selection and search for new catalytic systems that can speed up a chemical reaction. When choosing an active catalyst, researchers are inclined to their structure, the content of the metal of variable valence in it, as well as to all kinds of physical effects on the process. Ultrasonic cavitation (USC), which is one of these possibilities, promotes the acceleration of chemical reactions by realizing the multiple possibility of intermolecular collisions and increasing the specific surface area of the phase boundary. In this work, the effect of ultrasonic cavitation on the activity of catalysts of various structures in the reactions of liquid-phase aerobic oxidation of n-pentadecane was studied. The experiments involved $(RCOO)_3Cr$, $(RCOO)_2Ni$, synthesized from natural petroleum acid according to the procedure and C_{60} fullerene (Xzillion GmbH). The results of studies on the liquid-phase aerobic oxidation of alkane C_{15} in the presence of fullerene treated with ultrasound indicate:

- The catalytic activity of fullerene C_{60} in the activation of C-H bonds in hydrocarbons;
- On the superiority of C_{60} fullerene nanocatalyst over salts of metals of variable valence;
- In the accelerated formation of oxygen-containing products in the process of oxidation;
- The possibility of shortening the induction period due to the activity of fullerene C_{60};
- The ability of fullerene to convert paraffinic hydrocarbons into synthetic fatty acids, preventing them from being converted into oxy-synthetic fatty acids, but with ultrasonic treatment, this activity doubles.

The presented research results can be applied in production to enhance the technological regime of the process.

Keywords: Fullerene; Nanocatalyst; Oxidation; Pentadecane.

POSTER SESSIONS

Id-733

PEGylated GRAPHENE OXIDE and MONOCYTE METABOLISM

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Abstract: Graphene oxide (GO) is a lightweight two-dimensional material with unique properties. It is being actively studied for use in biomedical research. However, there are limited data on the interaction of GO with immune cells, particularly its effects on cellular metabolism are unknown. In our work, we investigated the effect of GO particles on the activity of mitochondrial respiration and the intensity of aerobic glycolysis in human monocytes. We used GO nanoparticles (Ossila, UK) functionalized with linear polyethylene glycol (PEG, pGO) in two sizes ("small" - S 100-200 nm and "large" - L 1-5 μm). It was found that in untreated cells and monocytes incubated with low concentration (5 μg/mL) of either small or large GO nanoparticles basal oxygen consumption rate was comparable. However, at high concentration (25 μg/mL) both small and large GO nanoparticles caused a significant increase in monocytes respiration rate. Interestingly, in monocytes treated with GO nanoparticles an increase in mitochondrial respiration was not accompanied by an increase in glycolytic activity. Moreover, treatment with large particles was shown to attenuate glycolysis at both low and high concentration. Hence, GO nanoparticles functionalized with linear PEG differently affect mitochondrial respiration and glycolysis in human monocytes. This work was carried out within the framework of the state assignment No. 121112500044-9 and was supported by the Russian Science Foundation (project No. 19-15-00244).

Keywords: Graphene Oxide; Monocytes; Metabolism.

POSTER SESSIONS

Id-764

SYNTHESIS and CHARACTERIZATION of 3D STRUCTURE NiCu FOAMS on Ti SURFACE MODIFIED with LOW LOADINGS of NOBLE METALS for DIRECT BOROHYDRIDE FUEL CELLS

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Abstract: A fuel cell is an electrochemical device that converts chemical energy directly into electricity. The fuel cells provide an important alternative to power produced from fossil fuels for low emissions. A significant challenge in their use is the need for better materials to make fuel cells cost-effective and more durable. This study developments in materials to fulfill the potential of fuel cells as a major power source. This study presents the synthesis of 3D metal NiCu nanostructured catalysts on titanium surface (NiCu/Ti) modified with low loadings of noble metals, their characterization, and application as the anode material in direct borohydride/hydrogen peroxide fuel cells ($NaBH_4$-H_2O_2). 3D structure NiCu foams were electroplated on the Ti surface from a bath containing 1 M HCl, 1.5 M H_2SO_4, 0.5 M $NiSO_4$, and 0.02 M $CuSO_4$ at the current density of 1.5 Acm^{-2} for different periods. The prepared CuNi foams have been modified with small quantities of Au or Pt particles by their immersion into a 1 mM $HAuCl_4$ or 1 mM H_2PtCl_6 solution, respectively, at 25 ºC for 1 minute. The morphology and composition of the catalysts have been examined using SEM, EDS, XRD, and ICP-OES. The electrocatalytic properties of the prepared NiCu/Ti, Au(NiCu)/Ti and Pt(NiCu)/Ti catalysts for sodium borohydride oxidation was investigated by cyclic voltammetry. Direct alkaline $NaBH_4$-H_2O_2 single fuel cell tests were carried out by employing the prepared NiCu/Ti, Au(NiCu)/Ti and Pt(NiCu)/Ti catalysts as the anode and a Pt sheet as the cathode. The anolyte was composed of an alkaline mixture of 1 M $NaBH_4$ + 4 M NaOH and the catholyte contained 5 M H_2O_2 + 1.5 M HCl. The performance of the fuel cell was evaluated by recording the cell polarization curves. It was also observed that immersion of Cu-Ni foam in a 1 mM $HAuCl_4$ or 1 mM H_2PtCl_6 solutions for 1 min increased the electrocatalytic activity of the prepared Au(NiCu)/Ti and Pt(Cu-Ni)/Ti catalysts for $NaBH_4$ oxidation compared to bare NiCu foam. The NiCu/Ti, Au(NiCu)/Ti and Pt(NiCu)/Ti catalysts deposited on the titanium surface seem to be promising anodic materials for direct $NaBH_4$-H_2O_2. This project has received funding from European Social Fund (project No 09.3.3-LMT-K-712-19-0138) under a grant agreement with the Research Council of Lithuania (LMTLT).

Keywords: Gold; Platinum; Noble metals; Nickel; Copper; Borohydride; Fuel cells.

POSTER SESSIONS

Id-768

SYNTHESIS, THERMAL STABILITY, and POROSITY of DIBASIC CALCIUM SILICATE HYDRATE with INTERCALATED COBALT IONS

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Abstract: Calcium silicate hydrates can be used in many industrial areas, such as medicine, the production of environmentally friendly cementitious materials, adsorbents, etc. According to the literature, the calcium silicate hydrates can be used for the removal of transition metal ions from wastewater and later for the production of innovative, environmentally friendly, and cheap catalysts. Such catalysts are chemically stable and have dispersed metal ions on the surface. However, the is no sufficient data about the synthesis and the properties of dibasic calcium silicate hydrates with intercalated metal ions. This work aimed to determine the formation, thermal stability, and porosity of dibasic calcium silicate hydrate with intercalated cobalt ions. For the synthesis the mixture of CaO, SiO_2 ($CaO/SiO_2 = 1.5$), and $Co(NO_3)_2{\cdot}3H_2O$ solution (c = 10 g Co^{2+}/dm^3) was used. The solution to solid ratio of the suspension was equal to 10:1. The synthesis was carried out under hydrothermal conditions at 175 °C temperature for 16 h. The thermal stability of calcium silicate hydrate with intercalated cobalt ions was determined by using *in-situ* XRD in a modular temperature chamber from RT to 1000 °C temperature. The shape of particles was evaluated with SEM and TEM, while the porosity of the sample was determined by using N_2 adsorption-desorption isotherms as well as BET and Kelvin equations. It was obtained that after hydrothermal treatment semicrystalline type calcium silicate hydrates (C-S-H(I)/(II)) with intercalated Co^{2+} and nitrate ions were formed. The analysis of the liquid medium showed that after synthesis, all cobalt cations and part of nitrate anions were intercalated into the structure of synthesis products. The results of in-situ XRD analysis showed that the synthesis product is stable till ~550 °C, while at the higher temperature the formation of cobalt oxide nanoparticles proceeds. According to the BET equation, the specific surface area of the synthetic and calcined product was equal to 132 m^2/g and 47 m^2/g, respectively. It is worth mentioning, that synthesis and calcined products can be used for VOCs oxidation to CO_2 and H_2O. This research is funded by the European Social Fund under the No 09.3.3-LMT-K-712 “Development of Competences of Scientists, other Researchers and Students through Practical Research Activities” measure.

Keywords: Calcium silicate hydrates; Cobalt ions; VOCs oxidation.

ALL SUBMISSIONS & TOPICS

Topics	Submissions
2D Materials Including Graphene	Id 755 - Gold-Assisted Exfoliation of Extraordinarily Large-Size Monolayer Crystals of Two-Dimensional Materials
	Id 760 - Anharmonic Lattice Thermal Capacity and Size-Dependent Melting Temperature of Square Graphene Nano-Flakes
Nanobiotechnology	Id 701 - Targeting Cancer Chemotherapy Resistance by Medicine Driven Nanomedicals
	Id 733 - PEGylated Graphene Oxide And Monocyte Metabolism
Nanomedicine	Id 772 - Complement Activation and Inflammatory Cytokine Response by Iron Oxide Nanoparticles
	Id 787 - Exploiting supramolecular chemistry to drive nanomedicine
Nanocatalysis	Id 728 - Liquid-Phase Aerobic Oxidation of Pentadecane in the Presence of Fullerene C_{60}, $(RCOO)_3Cr$ and $(RCOO)_2Ni$
	Id 768 - Synthesis, Thermal Stability, and Porosity of Dibasic Calcium Silicate Hydrate with Intercalated Cobalt Ions
	Id 773 - Ethene Hydroformylation using Rh-Co Bimetallic Catalyst Supported by Reduced Graphene Oxide
	Id 780 - Nanomaterials as Catalysts for Non-Thermal Plasma-Assisted CO_2 Reduction to Valuable Compounds
Nanocomposites	Id 775 - Study of Thermoelectric Performances in Thin-Films vs Bulk Pellets
Nanoparticles/ Nanofibers/ Nanowires/ Nanotubes/ Nanosheets	Id 700 - SiGe, ZnTe and Nanoparticles in CdS/CdTe: Photovoltaic Characteristics Simulations and Thin Film Laser Deposition
	Id 748 - Characteristics of Plastic Particles in the Industrial Environment
Chemical Bath Deposition	Id 764 - Synthesis and Characterization of 3D Structure NiCu Foams on Ti Surface Modified with Low Loadings of Noble Metals for Direct Borohydride Fuel Cells

Optical (i.e. Photo, X-ray, Laser, EUV,…) Lithograrpy	Id 788 - On Nature of Urbach’s Tail in Optical Absorption Spectrum of Nano-Crystalline Zinc Oxide (nc-ZnO)