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Prabhat Kumar Rai et al., J Mat. Sci. 2017, 5:6
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Corrosion and wear behavior of harmonic structured SUS304L austenitic stainless steel

Prabhat Kumar Rai[1], S Shekhar[1], M Nakatani[2], S K Vajpai[2], M Ota[2], K Ameyama[2] and K Mondal[1]
[1]Indian Institute of Technology, India
[2]Ritsumeikan University, Japan

Harmonic structured materials consist of a bimodal structure with a periodic or harmonic distribution of fine and coarse grains allowing optimum combination of high strength and ductility to be attained. Harmonic structured materials have potential in variety of applications, where high wear and corrosion resistance are required. Therefore, effect of harmonically distributed fine and coarse grains on the corrosion and wear behavior of a SUS304L austenitic stainless steel was studied and compared with a non-harmonic structured SUS304L and a conventional 304 stainless steel. The corrosion study was performed using linear, potentiodynamic and cyclic polarization techniques as well as salt fog exposure test for 30 days in 3.5% NaCl solution. Improved pitting corrosion resistance was found in case of the harmonic structured steel as compared to that of the non-harmonic and the conventional 304 stainless steel. Harmonically distributed fine grained structure, less porosity and higher fraction of passive α-FeOOH are attributed to the improvement in corrosion resistance of the harmonic structured steel. The wear study was performed using fretting wear tests at varying loads under ball-on-flat contact configuration. Coefficient of friction and wear volume were found to be minimum at intermediate normal load of 5 N, whereas maximum at 10 N in case of the harmonic stainless steel compared to other two steels. Harmonically distributed fine grained structure attributes to the higher wear rate of the harmonic structured steel because of hard and soft interaction of the ball with the harmonically distributed fine and coarse grains.

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Biography

Prabhat Kumar Rai is currently pursuing his PhD from Indian Institute of Technology Kanpur and has completed his M.Tech from Indian Institute of Technology, Banaras Hindu University, Varanasi, India. He has published three papers in reputed journals.

pkrai@iitk.ac.in

Notes:

Seungdu Kim et al., J Mat. Sci. 2017, 5:6
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A self-corrugated surface of graphene oxide to enhance sensitivity and responsibility for various graphene oxide applications

Seungdu Kim[1, 2], Youngbin Yoon[1], Won Kyu Park[2], Yeojoon Yoon[2], Su Yeon Choi[2], Woo Seok Yang[2] and Wan Sik Hwang[1]
[1]Korea Aerospace University, Republic of Korea
[2]Korea Electronics Technology Institute Seongnam, Republic of Korea

We are looking forward to the simple but strong method to enhance a sensitivity and responsibility of Graphene Oxide (GO) by forming a self-corrugated surface of GO. The self-corrugated surface was formed by the reaction of graphene oxide with Gallium chloride. The surface of GO is more corrugated with the concentration of gallium hydroxide during the dry of GO powder. The graphene oxide structure was distorted due to the three hydroxyl groups of gallium hydroxide. The properties of wrinkled GO were investigated by scanning electron microscope, energy dispersive spectroscopy, X-ray diffraction, Raman spectroscopy and atomic force microscope, respectively. This self-corrugated GO have superior advantages over normal GO for a higher sensitivity and responsibility for sensor applications.

Biography

Seungdu Kim is currently a student of Korea Aerospace University, Republic of Korea. He has published numerous research papers and articles in reputed journals and has various other achievements in the related studies.

seungdukim@gmail.com

Notes:

Heejun Kweon et al., J Mat. Sci. 2017, 5:6
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Polymer-derived nitrogen-doped carbon nanocage as an enhanced oxygen electrode in Li-O2 battery

Heejun Kweon, Katie H Lim and Hansung Kim
Yonsei University, Republic of Korea

Recently, Li-O_2 batteries have emerged as advantageous energy storage device, due to their extremely high theoretical energy density compared to commercial Li-ion batteries. The oxygen electrode has been identified as a key factor influencing the overall performance of Li-O_2 batteries. During discharging, Oxygen Reduction Reaction (ORR) occurs and insoluble discharge product Li_2O_2 is formed as a product on the electrode. The insoluble and insulating discharge product becomes decomposed during charge through the reverse reaction, Oxygen Evolution Reaction (OER). As charging and discharging processes are repeated, it is important to control the deposition and decomposition of Li_2O_2 efficiently for improvement in Li-O_2 battery performance in aspects of increased capacity and cycle stability. In this regard, many researches have been conducted for promoting ORR and OER in Li-O_2 battery which is highly related to Li_2O_2 formation and decomposition, respectively. Herein, we present the Polydopamine (PDA)-derived nitrogen-doped graphitic Carbon Nanocage (CNC) for a bi-functional oxygen electrode in Li-O_2 battery. Nitrogen was successfully and uniformly doped on graphitic CNC by utilizing adhesive property of PDA which also contains high concentration of amine group itself and subsequent heat treatment. The doped nitrogen content and heat treatment temperature were optimized in order to maximize the nitrogen doping effect. Various physical and electrochemical characteristics were investigated as an oxygen electrode in Li-O_2 battery. As a result, the PDA-derived nitrogen-doped CNC improved the performance of Li-O_2 batteries in terms of increased capacity, promoted rate capability and extended cycle life.

Biography

Heejun Kweon has received her Bachelor's degree in Environment & Energy Engineering at Gachon University. Presently, she is in combined course of Master and PhD at Department of Chemical and Bio-molecular Engineering in Yonsei University. Her research interest is synthesis and analysis of electro-catalytic materials for Li-air battery system.

victoryingod8@naver.com

Notes:

Chaemyeong Lee et al., J Mat. Sci. 2017, 5:6
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Oxidative catalytic activity from the cysteinyl bolaamphiphile assembly with hemin cofactor

Chaemyeong Lee and Sang-Yup Lee
Yonsei University, Republic of Korea

As a facile way to organize the amino acids in an ordered structure, self-assembly of amphiphilic molecules with amino acid motifs are very attractive. Here, we utilize the arrangement of amino acid segments of the amphiphilic molecules for the preparation of an enzyme-mimetic catalyst. Use of the amino acid as a hydrophilic segment of an amphiphilic molecule would lead the ordered arrangement of the amino acid on the surface of the assembled structure. To exploit this molecular arrangement, we synthesized cysteinyl bolaamphiphiled and dissolved them in water to induce self-assembly. The assembled structure was combined with hemin, a biological cofactor, to implement oxidative catalytic activity like the Horseradish Peroxidase (HRP). The prepared HRP-mimetic catalyst acts as a radical initiator together with hydrogen peroxide to promote the oxidation of the substrate. The performance of the catalyst was examined by the oxidation reaction of Acid Orange 7 (AO7), a well-known organic dye. The catalytic activity was analyzed from the color change of AO7. The self-assembled structure of cysteinyl bolaamphiphiles offered a protein-like platform on which various biological cofactors can bind to display biochemical activities.

Biography

Chaemyeong Lee has graduated from the Department of Biology of Chonnam National University. She has received her MS degree in Department of Chemical and Biomolecular Engineering at Yonsei University. She is currently a PhD candidate in the same university. Her main research interests include colloid, self-assembly nanomolecules and surface modification.

esther2cm@gmail.com

Notes:

Jong Wook Kim et al., J Mat. Sci. 2017, 5:6
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Mechanism of copper oxide nanostructured particles synthesized using silk fibroin template

Jong Wook Kim, Young Hwan Park and Chang Seok Ki
Seoul National University, Republic of Korea

In this study, various mesoporous Copper Oxide (CuO) nanostructured particles were synthesized by a simple wet chemical process using Silk Fibroin (SF) template. CuO nanoparticles were prepared with cupric acetate monohydrate, various amounts of 1 wt% SF aqueous solution, sodium dodecyl sulfate as a surfactant and distilled water as a solvent in alkali condition at 60 °C. The structural characterization of the nanoparticles was performed. The control of the amount of SF molecules in precursor solution could induce a change of morphological structure of the CuO/SF nanostructured particle. The formation of free $Cu(OH)_4^{2-}$ may be interrupted by the SF and a $Cu(OH)_4^{2-}$-SF complex is formed through coordination bonds between $Cu(OH)_4^{2-}$ ion and SF molecules. The development of a complex with SF can make $Cu(OH)_4^{2-}$ more stable without a drastic transformation into CuO. In the structural formation of CuO nanoparticles, crystal growth mainly occurred in the direction of the (010) lattice plain during condensation, in which $Cu(OH)_4^{2-}$ transformed into CuO. With an increase in the amount of SF, there were fewer free OH- ions due to interactions with SF molecules, which adsorbed preferentially on the (001) plane of CuO nanocrystals, resulting in assemblages not only on the (010) plane, but also on the (100) plane. Therefore, the SF plays multiple roles on monoclinic CuO nanostructure formation, such as stabilizing the $Cu(OH)4^{2-}$ ions without a drastic transformation to CuO nanocrystal and directing the oriented crystal growth of CuO nanocrystal.

Biography

Jong Wook Kim has received his PhD in Fiber and Polymer Science program from North Carolina State University, North Carolina, USA. He is a Professor of Seoul National University, Seoul, Republic of Korea in the Department of Bio-systems and Biomaterials Science and Engineering. He has published more than 100 papers in SCI journals and about 20 patents in the field of silk-based biomaterials.

whddnr2@snu.ac.kr

Notes:

So Eun Jeon et al., J Mat. Sci. 2017, 5:6
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Effect of Nd doping on the structural, magnetic and magnetocaloric properties of double perovskite $Sr_{2-x}Nd_xFeMoO_6$

So Eun Jeon, Imad Hussain, Tae Hwan Noh, Min Soo Kim and Bon Heun Koo
Changwon National University, Republic of Korea

The Fe-Mo based double perovskites have attracted much attention in the field of materials science due to their multiverse fascinating physical properties which make them suitable candidates for several technological applications. In the present work, the $Sr_{2-x}Nd_xFeMoO_6$ ($0.0 \leq x \leq 0.3$) samples have been investigated for their structural, magnetic and magnetocaloric properties. Polycrystalline $Sr_{2-x}Nd_xFeMoO_6$ ($0.0 \leq x \leq 0.3$) samples were prepared by using the conventional solid-state reaction method. To achieve the target double perovskite phase and to minimize the undesirable secondary phases, the samples were sintered in a reducing atmosphere, created by a gas mixture of 5% H_2/95% Ar. The structure, microstructure and phase purity of the samples were investigated by X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). XRD study confirmed the formation of tetragonal structure with Fm3m space group in all the synthesized samples. The Arrott plots and magnetization measurements showed a second order of ferromagnetic phase transition in all the fabricated samples. All the samples went through a paramagnetic to ferromagnetic phase transition at the Curie temperature (TC). A magnetocaloric effect was calculated in terms of isothermal magnetic entropy change. The value of the Relative Cooling Power (RCP) was observed to decrease with the increasing Nd content. A significant variation in the magnetocaloric properties of the samples was observed with the increasing Nd concentration. This investigation suggests that $Sr_{2-x}Nd_xFeMoO_6$ samples can be used as potential magnetic refrigerants for magnetocaloric applications.

Biography

So Eun Jeon is currently a student at Changwon National University, Republic of Korea. She has published numerous research papers and articles in reputed journals and has various other achievements in the related studies. She has extended her valuable service towards the scientific community with her extensive research work.

thdms2383@changwon.ac.kr

Notes:

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Collagen-hyaluronan in colloidal silver

Andrea Kargerova
Brno University of Technology, Czech Republic

Collagen and hyaluronan are natural biopolymers occurring in the human body as a materials for scaffold in tissue engineering, as a components of a bandage by wound healing processes, as an alternate fluid in human joints, as a space filling matter in plastic surgery and last but not least as a hydration matter in cosmetics. Hyaluronan exists in high concentrations during fetal skin development, is involved in cell migration and differentiation, and is the first macromolecule to appear in the ECM during tissue engineering repair. These two biomaterials dissolve in colloidal silver have been studied in this work for biomedical applications. Hayluronan HyActive (13kDa) from Contipro Biotech (Czech Republic) is produced biotechnologically and extracted from the cell walls of the bacteria *Streptococcus zooepidemicus*. Collagen from Inventia Polish Technologies Sp. z o.o., obtained from fish skins. Colloidal silver (20 ppm) obtained from Antibakterin (Czech Republic). The physical properties and finding of suitable concentration of biomaterials were measured by three methods. The suitable concentration and ratio of collagen-hyaluronan were measured by High resolution ultrasonic spectroscopy from Ultrasonic Scientific (Ireland) and Densitometer DSA 5000M from Anton Paar (Austria). The rheological properties were measured by Discovery Hybrid Rheometer from TA Instruments. By densitometric measurement was found that collagen-hyaluronan in colloidal silver was stable in temperature 20-50°C. Collagen-hyaluronan colloidal silver spray was tested for healing on human skin, for burn, frostbite, bedsore, varicose ulcer etc. Due to colloidal silver this spray could be applicate to raw wound. By densitometric measurement was found that collagen-hyaluronan in colloidal silver was stable in temperature 20-50°C. Collagen-hyaluronan colloidal silver spray was tested for healing on human skin, for burn, frostbite, bedsore, varicose ulcer etc. Due to colloidal silver this spray could be applicate to raw wound. The combination of collagen, hyaluronan and colloidal silver in ratio collagen:hyaluronan, 1:1 is the best ratio for good application in a spray form for healing of wound.

Acknowledgements: This research was supported by project No. LO1211 from the Czech Ministry of Education.

Biography

Andrea Kargerova presently assosiated with Materials Research Centre and Institute of Physical and Applied Chemistry, Faculty of Chemistry, Brno University of Technology. She has published numerous research papers and articles in reputed journals and has various other achievements in the related studies. She has extended his valuable service towards the scientific community with her extensive research work.

a.kargerova@seznam.cz

Notes:

Jisoo Ha, J Mat. Sci. 2017, 5:6
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Perpendicular orientation of lamella-forming block copolymer thin film by controlling interfacial interaction with substrate

Jisoo Ha
Yonsei University, Republic of Korea

Perpendicular orientation of Block Copolymer (BCP) micro-domains has been received attention for the next-generation lithography and nanotechnology. Many researchers have investigated various techniques to establish perpendicular nanostructures by controlling the interfacial interaction between BCP film and substrate. A surface modification method using random copolymer brush is extensively studied due to its simplicity and effectiveness. End-functionalized random copolymer brush chains attach to the substrate by condensation reaction, which forms covalent bond. In this study, we have controlled the interaction between substrate and the block copolymer by coating the Si wafer surface with random copolymer. On these modified substrates, polystyrene-b-poly(methyl methacrylate) (PS-b-PMMA) thin film was spin-coated with fine-tuned thickness and thermally-annealed to form its equilibrium structure. We observed the thickness window of vertical orientation and assessed the appropriate parametric extent of surface energy modification. The experimental result indicates the optimal extent of surface modification in order to obtain perpendicular orientation of BCP for nanopattern fabrication.

Biography

Jisoo Ha is currently a Master's degree student of Chemical Engineering at Yonsei University, Republic of Korea.

eternity5166@gmail.com

Notes:

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Orientation controlled gyroid structure thin films by substrate interactions in solvent vapor annealing

Yeongsik Kim[1], Sungmin Park[1], Wooseop Lee[1], Su-Mi Hur[2] and Du Yeol Ryu[1]
[1]Yonsei University, Republic of Korea
[2]Chonnam national University, Republic of Korea

A well-defined 3D bicontinuous network structure in nanoscopic regular array has attracted considerable attention because of its potential applications such as photonic crystals, meta-materials, energy devices and superconductor. In this study, the asymmetric polystyrene-block-poly (methyl methacrylate) (PS-b-PMMA) thin films on the two different substrate with high-molecular-weight were prepared to be exposed a neutral solvent vapor to generate a hexagonal (HEX) cylindrical morphology to long-range ordered Gyroid (GYR). The interfacial interaction by different substrate interaction induced the two distinct GYR, [211] and [111] planes, which were directed from cylinders, like the parallel and perpendicular orientation on the selective and neutral substrate, respectively. Moreover, we further performed coarse-grained simulations of a block copolymer model to provide the molecular mechanisms. Our results based on experiments and simulations suggest a simple route for the controlled and well-defined GYR structures.

Biography

Yeongsik Kim is currently a PhD candidate at Yonsei University, Republic of Korea. He has published numerous research papers and articles in reputed journals and has various other achievements in the related studies. He has extended his valuable service towards the scientific community with his extensive research work.

kim.yeongsik@yonsei.ac.kr

Notes:

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Influence of reaction gases on the structural and optical characteristics of Ce-oxide thin film coatings

Zainab N Jaf[1, 2], Hussein A Miran[1, 2], Zhong-Tao Jiang[1], Jean-Pierre Veder[3] and Mohammed Noor Altarawneh[1]
[1]Murdoch University, Australia
[2]University of Bagdad, Iraq
[3]Curtin University, Australia

Ce-oxide thin film coatings present unique optical properties. In this study, structural, chemical bonding and optical properties of the thin films in relation to the composition of reaction gas via sputtering process were investigated. All the thin films exhibited a polycrystalline character with cubic fluorite-structure for cerium dioxide along (111), (200) and (222) orientations. XPS analysis revealed that two oxidation states of CeO_2 and Ce_2O_3 are present in the films prepared at lower argon-oxygen flow ratios, whereas the films are totally oxidized into CeO_2 as the aforementioned ratio increases. Optical parameters (α, ε1, ε2, n and k) derived from UV-Vis reflectance data indicate that the thin films have indirect optical band gaps in the range of 2.25-3.1 eV. Density Functional Theory (DFT+U) implemented in the Cambridge Serial Total Energy Package (CASTEP) has been employed to model some optical properties of CeO_2 cluster at ground state. The simulated electronic Density of State (DOS) of the relaxed structure of CeO_2 demonstrates a band gap, agrees well with the measured optical band gap. The experimental and calculated absorption coefficient (α), have analogous trends and to some extent a similar range of values in the wave length. All in all, our theoretical findings consistently support the experimental results.

Biography

Zainab N Jaf has completed her Master's degree from College of Education for Pure Sciences/Ibn Al-Haitham, Department of Physics, University of Bagdad, Iraq. She is currently pursuing her PhD degree.

z.jaf@Murdoch.edu.au

Notes:

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Polymeric mixed micelles as an efficient strategy for meloxicam oral administration

Francisco Veiga, Amaral C and Figueiras A
University of Coimbra, Portugal

Purpose: The aim of this work was to demonstrate the advantages of using polymeric mixed micelles to encapsulate meloxicam, when compared to meloxicam alone and to characterize these micelles.

Methods: Morphology was studied by Transmission Electron Microscopy (TEM). 5 µl of freshly prepared micellar dispersions were placed on Formvar and allowed to dry for 5 min. To unveil the usefulness of such formulations concerning physical stability, formulations FM1-FM5 and meloxicam were dissolved in enteric and gastric medium. After 1 and 2 h we quantified meloxicam in gastric medium and after 3 and 4 h we quantified meloxicam in enteric medium. Quantification was performed using an UV spectrophotometer and absorbance taken at 363 nm. To determine encapsulation efficiency, FM1-FM5 was quantified immediately after preparation. Later on, micellar suspensions were centrifuged at 3000 g for 15 min using Amicon® Ultra 4 Centrifugal filter units, the supernatant was quantified and EE calculated based on the following equation: Finally, cytotoxicity of formulations was assessed in Caco-2 cells by Alamar Blue assay, performing a screening of crescent concentrations (0.625%, 1.25%, 2.5%, 5% and 10%) for each formulation.

Results: Micelles were found to present in very small sizes and approximately spherical shape with meloxicam forming a circular line near to the micelle's surface. All formulations significantly increased meloxicam physical stability in enteric medium (meloxicam: 3h-62.563%, 4h-35.890; FM1, FM2, FM3, FM4, FM5: 100%) In gastric medium, despite of FM2 and FM3 showed the best results (meloxicam: 1h-1.59%, 2h-1.54%; FM2: 1h-80.339%, 2h-66.281%; FM3: 1h-75.397%, 2h-61.260), all the other formulations showed a significant increase on stability. With the exception of FM1, all formulations demonstrate high EE % (FM1: 35.544±3.919, FM2: 93.162±1.071, FM3: 90.663±1.805, FM4: 89.840±1.991, FM5: 86.607±2.134). Finally, FM3 revealed no cytotoxicity in concentrations ranging from 0.625 to 5% and FM2 revealed no cytotoxicity in concentrations ranging from 0.625 to 2.5%.

Conclusions: FM2 and FM3 seem to be promising formulations to efficiently encapsulate drugs with low water solubility, as meloxicam.

Biography

Francisco Veiga has completed his PhD from University of Coimbra, Portugal. He is the Dean of Faculty of Pharmacy in the University of Coimbra. He has published more than 200 papers in reputed journals.

fveiga@uc.pt

Notes:

Joao Sousa et al., J Mat. Sci. 2017, 5:6
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Modeling of nanoparticle surface charge for targeting glioblastoma

Joao Sousa, Ana Miranda, Tania Cova, Maria Mendes, Carla Vitorino and Alberto Pais
University of Coimbra, Portugal

Glioblastoma Multiforme (GBM) is an aggressive brain tumor with poor prognosis, mainly because standard treatment is not always effective enough in reaching tumor cells. Blood-Brain Barrier (BBB) is pointed out as one of great challenges in this field. Considering the negative charge of BBB surface and its restricted permeability to small compounds, positively-charged nanoparticles have been developed to facilitate the transport of drugs through the BBB. This work aimed at studying the interaction of different cationic surfactants used in Lipid Nanoparticle (LN) formulations with BBB, using atomistic simulations. Surfactants incorporating natural structural motifs, specifically serine, were chosen instead of the conventional synthetic surfactants, due to the lower cytotoxicity and higher biodegradability, thus being environmental friendly. Molecular dynamics simulations were performed on 4 systems containing different serine-based surfactants, two of them are monomeric (16SerTFA and 12SerTFA) and the other two are dimeric ($(12ser)_2CON12$ and $(12ser)_2N5$), in a fully hydrated palmitoyloleoylphosphatidylcholine (POPC) lipid model, intended to mimic cell membranes of both the BBB and tumor. The systems were evaluated in terms of effects induced by the surfactants in this type of membranes and rationalize the interactions at molecular level. The results showed an integration of all surfactants into the POPC membrane. Longer chain length surfactants tended to induce the highest membrane stabilization, as evidenced by 16serTFA. Conversely, the dimeric $(12ser)_2CON12$ led to the greater disturbance in the membrane structure, probably due to bridging phenomena. This may anticipate a better BBB cross ability of LN containing $(12ser)_2CON12$. Overall, this computational study suggests the viability of cationic serine-based surfactants as appealing compounds in LN formulations for targeted GBM therapy.

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Biography

Joao Sousa is a Faculty of Pharmacy at University of Coimbra, Portugal. He has published numerous research papers and articles in reputed journals and has various other achievements in the related studies. He has extended his valuable service towards the scientific community with his extensive research work.

jjsousa@ff.uc.pt

Notes:

Chao-Liang Wu, J Mat. Sci. 2017, 5:6
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One-dimensional poly(L-lysine)-block-poly(L-threonine) assemblies as anticancer agents

Chao-Liang Wu
National Cheng Kung University, Taiwan

We synthesized cationic, one-dimensional fibril assemblies formed from coil-sheet poly(L-lysine)-block-poly(L-threonine) (PLL-b-PLT) block co-polypeptides as anticancer agents. The 1D fibril assemblies can efficiently interact with negatively charged cellular and mitochondrial membranes via electrostatic interactions, leading to cell necrosis through membrane lysis and apoptosis via the lytic effect of mitochondria. This effect is similar to that of one-dimensional drug carriers that exhibit enhanced cell penetration. Compared to free PLL chains, PLL-b-PLT fibril assemblies exhibited more selective cytotoxicity against cancer cells, lower hemolytic activity, higher membranolytic activity and a different apoptotic pathway, which may be due to differences in the peptide-membrane interactions. The fibril assemblies significantly inhibited tumor growth, improved survival and suppressed tumor metastasis to the lung in C57BL/6 mice bearing syngeneic LL2 lung tumors. An additive antitumor activity was also observed when the tumor bearing mice were treated with PLL-b-PLT in combination with the common chemotherapeutic drug cisplatin. Collectively, these results support the feasibility of using one-dimensional fibril assemblies as potential anticancer therapeutics.

Biography

Chao-Liang Wu is a Distinguished Professor of the Department of Biochemistry and Molecular Biology and Institute of Clinical Medicine, College of Medicine, National Cheng Kung University, Taiwan. He has received his PhD in Molecular Biology from University of Edinburgh. He has his expertise in the areas of translational medicine, animal models, gene therapy and nanotechnology. He has published more than 100 papers in peer-reviewed international journals.

wumolbio@mail.ncku.edu.tw

Notes:

Ai-Li Shiau, J Mat. Sci. 2017, 5:6
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Oligopeptide-based polymers targeting human antigen R (HuR) for the treatment of psoriasis

Ai-Li Shiau
National Cheng Kung University, Taiwan

Psoriasis is a common chronic inflammatory skin disease, characterized by abnormal differentiation and proliferation of keratinocytes, angiogenesis and infiltration of inflammatory cells that secrete Th1 and Th17 associated cytokines in the skin lesion, such as TNF-α, IL-17 and IL-20. Although mRNAs that encode cytokines are short-lived mRNAs in eukaryotes, the pre-mRNAs, which contain AU-Rich Elements (AREs) in their 3'-untranslated regions, are recognized and stabilized by Human Antigen R (HuR), an RNA-binding protein, for post-transcription. Previous studies have suggested that HuR is involved in the stabilization of mRNAs in the psoriatic skin. HuR binds to and regulates IL-20 mRNA and relocalizes to the cytoplasm of psoriatic keratinocytes. Furthermore, HuR can bind numerous transcripts involved in the pathogenesis of psoriasis. Therefore, HuR may be a potential therapeutic target for psoriasis. In the present study, we tested several novel oligopeptides that targeted the RNA binding site of HuR as therapeutic agents for psoriasis. A mouse model of imiquimod (IMQ)-induced psoriasis-like dermatitis was generated in BALB/c mice by daily topical application of IMQ cream on the ear from days 0 to 9. The mice were treated with oligopeptides from days 5 to 10. The pathological features of psoriasis were scored daily using the thickness gauge and clinical Psoriasis Area and Severity Index (PASI). We found that the oligopeptide JS-1 could significantly ameliorate psoriasis pathogenesis in a dose-dependent manner. The oligopeptide affected the HuR downstream signaling pathway. Collectively, this study may provide an alternative therapeutic strategy for psoriasis.

Biography

Ai-Li Shiau is a Distinguished Professor of the Department of Microbiology and Immunology and Institute of Clinical Medicine, College of Medicine, National Cheng Kung University, Taiwan. She currently serves as the Head of the Department of Microbiology and Immunology, NCKU. She has received her PhD in Molecular Biology from University of Edinburgh. She has expertise in viral vectors for gene therapy and vaccine applications and published more than 100 papers in peer-reviewed international journals.

alshiau@mail.ncku.edu.tw

Notes:

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Molecular dynamics study of graphene mobius bands: Equilibrium shapes and energies

Yoichi Takato and Eliot Fried
Okinawa Institute of Science and Technology, Japan

Graphene is a highly flexible 2D material that can easily bend and fold. This mechanical flexibility allows us to build various graphene-based structures such as Carbon Nanotubes and nano-origami shapes. The Mobius band, a non-orientable one-sided surface constructed by twisting a rectangular strip by 180 degrees and joining the ends, is a theoretically possible graphene-based structure but has not yet been observed in the laboratory. We use molecular dynamics to determine the equilibrium shapes and mechanical energies of Mobius bands made of monolayer graphene nanoribbons with armchair and zigzag edges. Our results show resemblance to continuum Mobius bands regardless of the discrete nature of the lattice structure and associated edge types. From the structural stability and energetics views, we discuss the feasibility of fabricating nanoscale graphene Mobius bands.

Biography

Yoichi Takato is presently associated with Okinawa Institute of Science and Technology, Japan. He has published numerous research papers and articles in reputed journals and has various other achievements in the related studies. He has extended his valuable service towards the scientific community with his extensive research work.

yoichi.takato@oist.jp

Notes:

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Complex characterization of ZK60 alloy processed by ECAP

Florina-Diana Dumitru, Mihaela-Andreea Moncea, Marius Viorel Olteanu, Monica Matei and Gyorgy Deak
National Institute for Research and Development in Environmental Protection, Romania

Samples of extruded ZK60 magnesium alloy were subjected to Equal Channel Angular Pressing (ECAP) following route A, with an equivalent strain per pass equal to 1.07. The processing temperature varied from 523 K to 423 K. Deformation-induced grain refinements is enhanced with the number of ECAP passes, therefore after 6 ECAP passes the fine grain size is reduced to 1.79 μm, from an average grain size of 5.75 μm in the starting material. This grain refinement improved the ductility of the processed material determined through tensile tests. The calorimetry analysis highlighted the transformations that occur in the material after the ECAP process. It was determined that the recrystallization temperature of the severely deformed plastic ZK60 depends on the deformation degree, decreasing with the number of passes, but also with the heating rate. From the storage energy determined for each sample, the energy of the defects (dislocations at the boundaries - Eb, dislocations within the grains/subgrains - Ed and the vacancies - Ev) was determined. It was observed that for the ECAPed samples, the Eb and Ed energies have relatively low values, while the Ev presents high values for all the studied passes. The vacancies being the major defects that occur in the ZK60 alloy is processed by ECAP.

Biography

Florina-Diana Dumitru has completed her PhD from the Politehnica University of Bucharest. She is a Researcher of the impact of built environment and Nano-materials Department at the National Institute for research and development in environmental protection, Romania. She has published more than 20 papers in specialized journals and participated in 7 conferences in the materials science field.

diana.dumitru@incdpm.ro

Notes:

Mihaela-Andreea Moncea et al., J Mat. Sci. 2017, 5:6
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Performant cement based materials reinforced with nano-SiO_2

Mihaela-Andreea Moncea, Florina-Diana Dumitru, Marius Viorel Olteanu, Madalina Boboc and Gyorgy Deak
National Institute for Research and Development in Environmental Protection, Romania

The paper presents the investigation of the effect of SiO_2 nanoparticles on the mechanical properties and microstructure of cement based materials. For this purpose nano-SiO_2 powders were obtained by sol-gel method using different molar ratios of TEOS/ethanol/water. The formation of nano-SiO_2 particles was confirmed by X-ray fluorescence analyses (XRF) and the nanometric sizes by scanning electron microscopy (SEM). The cement based materials admixture were obtained by using 0.45 and 0.5 water/binder ratio (w/b) and for each ratio the cement was substituted with 0.5 of 0.7% of nano-SiO2. The distribution of nano-SiO_2 particles within the cement matrix plays an essential role and governs the performance of these products. Therefore, the addition of 0.4% super-plasticizer for the w/b=0.45 was proposed to facilitate the distribution of nano-SiO_2 particles. The mechanical test results showed that after 7 days of hydration the cement based materials with 0.7% nano-SiO_2 content improved the compressive strengths compared with those of the etalon (E=45MPa Vs. AM1=55MPa). The microstructure of cement based admixtures highlighted the presence of $Ca(OH)_2$, ettringite and calcium silicate hydrates as well as nano-SiO_2 particles embedded into the cement matrix.

Biography

Mihaela-Andreea Moncea has completed her PhD from Politehnica University of Bucharest. She is a Senior Researcher at the National Institute for research and development in environmental protection, within the impact of built environment and Nano-materials Department. She has published more than 30 papers and is serving as Reviewer of specialized ISI journal in the materials science field.

andreea.moncea@incdpm.ro

Notes:

Andreea Georgiana Baraitaru et al., J Mat. Sci. 2017, 5:6
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Purification of waste waters contaminated with heavy metals using filters made of advanced silica based materials

Andreea Georgiana Baraitaru, Marius Viorel Olteanu, Marius Constantin Raischi and Gyorgy Deak
National Institute for Research and Development in Environmental Protection, Romania

Considering the continuous industrialization, the waste waters are loaded with heavy metals and because the removal methods are not entirely satisfactory, a new approach is needed. Taking into account the size of the water treatment plants, the production and maintenance cost and the efficiency of treatment, there are certain disadvantages that could disappear with the introduction of a thin mesoporous silica filter. This filter may have a depreciable production price because of its refreshment capability. Mesoporous silica is a form of SiO_2 with relatively recent use in the field of nanomaterials for environmental protection. Given the hexagonal mesoporous silica arrangement, characterized by a high specific surface, as well as very well defined shapes and dimensions of its pores, the interest in its absorbent and catalytic properties has increased. In this context, mesoporous silica was synthesized by the hydrothermal method. The chemical composition and microstructural properties of the obtained materials were determined by X-Ray Fluorescence (XRF), Electronic Scanning Microscopy (SEM) and X-Ray Diffraction (XRD) analysis. The efficiency of mesoporous silica filters, obtained by powders pressing, to retain heavy metals, was tested on water samples enriched with different amounts of Cu, Ni, Pb, Zn. Filters showed a high adsorption capacity, that goes up to 100% for Pb and Zn and about 70% for Cu and Ni.

Biography

Andreea Georgiana Baraitaru is currently pursuing Master's degree from the Politehnica University of Bucharest. He has participated in 2 conferences and in over 10 projects.

andreea.baraitaru@incdpm.ro

Notes:

Eun-Kyung Lim, J Mat. Sci. 2017, 5:6
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Rapid, simple detection of oseltamivir-resistant influenza-A virus (H275Y mutation) using gold nanoparticles-based colorimetric probe capable of specific recognition to the H275Y NA mutation

Eun-Kyung Lim
Korea Research Institute of Bioscience and Biotechnology, Republic of Korea

Recently, an oseltamivir-resistant pandemic H_1N_1 virus has emerged because of the increased use of oseltamivir. This oseltamivir-resistant virus has spread around the world and is being highly contagious. Therefore, for immediate virus control and prevention, accurate detection techniques that can rapidly identify oseltamivir-resistant virus are required. The currently used assays, which are dependent on genomic-based assays because of drug-resistant viruses caused by a genomic mutation in viral Neuraminidase (NA) (H275Y mutation), are time consuming and require trained personnel for sample preparation and analysis. We have developed a novel nanoprobe consisting of Gold Nanoparticles (GNPs) modified with an oseltamivir derivative (oseltamivir hexylthiol; OHT) as a targeting moiety (OHT-GNPs) enabling a simple colorimetric assay for oseltamivir-resistant virus (H275Y mutation) detection. This assay is based on the colorimetric change of GNPs in the presence of oseltamivir-resistant virus due to the specific interaction with OHT of nanoprobe (OHT-GNPs) and the mutated viral NA site. OHT exhibited 250-fold-higher binding affinity to the NA site of the mutant virus (H275Y mutation) than to the Wild-Type Virus (WT) according to NA activity and modeling analysis. Our results showed a color change of OHT-GNPs from deep red to purple because of OHT-GNPs aggregation by interacting with OHT structure of OHT-GNPs and NA on the surface of H275Y mutant virus. Especially, these colors were gradually changed to purple as the mutant virus concentration increased, which allowed determining the presence of the virus with the naked eye. Using OHT-GNPs, it was possible to sensitively detect oseltamivir-resistant virus (H275Y mutation) at low virus concentrations by changing its absorbance; the Limit of Detection (LOD) of this assay was 10 Plaque-Forming Units (PFU). Furthermore, OHT-GNPs-based dipstick assay could detect H275Y mutation as well as obtain their qualitative analysis. This assay may provide accurate information whether this virus is oseltamivir resistant that could support choosing appropriate treatments using Point-of-Care (POC) diagnostics.

Biography

Eun-Kyung Lim has completed her PhD degree in chemical engineering from Yonsei University, Republic of Korea. She has joined Bio-nano technology Research Center in KRIBB. Her research efforts are on development of smart theranostics nanosystems for cancer metabolism regulation and sensing nanoprobe for bacteria/virus.

eklim1112@kribb.re.kr

Notes:

Min Jin Lee et al., J Mat. Sci. 2017, 5:6
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Development of technology for improving the durability of the hydrogen electrode in Solid Oxide Electrolyzer Cells (SOECs)

Min Jin Lee, Jae Hwa Shin and Hae Jin Hwang
Inha University, Republic of Korea

A Solid Oxide Electrolyzer Cells (SOECs) is an electrochemical device for producing hydrogen by electrolysis water vapor at a high temperature. SOEC is that they can operate reversibly as solid oxide fuel cells, producing electricity with high efficiency by consuming stored hydrogen. It can also be used in next-generation power generation and storage systems that produce hydrogen using surplus power. SOEC have disadvantage to provide high temperature/high-pressure water vapor to the hydrogen electrode and since oxygen is released very quickly at the air electrode, deterioration of cells and stacks is larger than SOFC and it is a stumbling block to commercialization. In this study, the effect of operating conditions on hydrogen electrode performance and deterioration of SOEC was investigated. To improve the durability of the hydrogen electrode the material technology for inhibiting oxidation of Ni/YSZ was studied. The polarization resistance and J-V characteristics are evaluated in both SOFC/SOEC. The partial pressure of water vapor is changed to 10, 30 and 50%. The change of voltage is observed under the condition of applying current density of 0.1 mA/cm2 to the cell. And the durability of the cell is evaluated by measuring the voltage change according to the SOFC-SOEC switching operation. In addition, to suppress the oxidation of the hydrogen electrode (Ni/YSZ) in a steam atmosphere, a composite hydrogen electrode was fabricated by applying anti-corrosion technology and the possibility of oxidation suppression is examined.

Biography

Min Jin Lee is currently pursuing Doctorate degree in department of materials science and engineering, Inha University, Republic of Korea. His main research focuses on solid oxide fuel cell/solid oxide electrolyzer cell performance evaluation and fabrication of electrode materials.

kalmin0228@naver.com

Notes:

Yong Sun Park et al., J Mat. Sci. 2017, 5:6
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Fabrication and performance of Ni/MgO methane steam reforming catalysts by exsolution

Yong Sun Park, Ye Sol Lim and Hae Jin Hwang
Inha University, Republic of Korea

Interest in developing alternative energy sources is increasing due to depletion of oil resources and global warming. Therefore, fuel cells, which are new energy conversion and storage devices with low emission of pollutants, are emerging as an alternative. The process of producing hydrogen as a fuel of fuel cells requires a great deal of cost. Therefore, researches are being studying on reforming catalysts for converting natural gas rich in reserved into hydrogen energy and for use in fuel cells. In general, a transition metal (Ni, Co, Cu) or a noble metal (Ru, Pd, Pt) is used as a methane steam reforming catalyst. The noble metal catalyst has excellent catalytic activity and resistance to carbon deposition. But it is becoming a stumbling block to commercialization due to expensive cost. Ni-based catalysts are less expensive than noble metals and have a simple manufacturing process, but the problem of degradation due to carbon deposition and grain growth is pointed out as a disadvantage. In this study, Ni/MgO composite reforming catalyst activated Ni catalyst by exsolution was manufactured to improve durability. The size and amount of precipitated Ni particles were controlled by the reducing temperature and time. The catalytic activity and durability of the catalysts prepared as above were evaluated. The conversion rate of methane was measured and evaluated in the temperature range of 250-750°C and methane:water vapor = 1:2 atmospheres with catalyst in fixed bed reactor. The microstructure and distribution of the produced catalyst were confirmed by XRD and SEM.

Biography

Yong Sun Park is currently pursuing her MS degree in department of materials science and engineering from Inha University, Republic of Korea. Her research interest focuses on fabrication and performance evaluation of methane steam reforming catalysts by exsolution.

yongsun0625@gmail.com

Notes:

Daichi Shimonishi et al., J Mat. Sci. 2017, 5:6
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Evolution of microstructure of CSM345 steel from the surface to the interior of multifunction cavitation

Daichi Shimonishi, Daisuke Nakagawa, Masataka Ijiri, Kumiko Tanaka and Toshihiko Yoshimura
Tokyo University of Science, Japan

The hardness and microstructure at and just below the surface of Cr-Mo steel processed by a combination of Water Jet Cavitation (WJC) and ultrasonic cavitation, which we call Multifunction Cavitation (MFC), were investigated using scanning electron microscopy and micro Vickers hardness testing. Moreover, we also investigated the dependence of the microstructure and hardness on the MFC processing time and compared the results to those for WJC. MFC processing improved the corrosion resistance of the specimen surface and both WJC and MFC converted the tensile residual stress into compressive residual stress. Regarding the microstructure of the WJC-processed specimen, protrusion and disappearance of cementite from pearlite grains were observed at the specimen surface. Voids and cracks tended to occur at depths of 0.5-1 mm from the surface, but were not observed at depths of 2-3 mm. For the MFC-processed specimen, a precursor that results in the formation of spherical cementite inside pearlite grains was observed at the specimen surface and cementite spheroidization was observed at depths of 0.5-1 mm below the surface. Voids and cracks were not observed within the specimen.

Biography

Daichi Shimonishi has completed his Bachelor of Engineering at National Institute of Technology, Ube College. Currently, he is Senior in Tokyo University of Science, Yamaguchi.

f114401@ed.tusy.ac.jp

Notes:

Masataka Ijiri et al., J Mat. Sci. 2017, 5:6
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Surface modification of low-alloy steels by a multifunction cavitation

Masataka Ijiri, Daisuke Nakagawa, KumikoTanaka and Toshihiko Yoshimura
Tokyo University of Science, Japan

Alloy steels for machine structural are used for industrial equipment. However, the operating environment is often harsh, requiring the development and application of various surface treatments. The authors focus on the use of Water Jet Cavitation (WJC) with ultra-sonication. WJC technology enables the generation of high pressure during cavitation collapse near the surface when a water jet ejected from a nozzle impacts a metal surface. This pressure causes a slight deformation in the impacted surface region and introduces a compressive residual stress due to the elastic constraints of the underlying and surrounding metal. If ultrasonic irradiation is applied to WJC bubbles with diameters of several hundred microns, the bubbles are subjected to alternating high and low sound pressures which lead to a high-pressure and high-temperature reaction field. This technique is referred to as Multifunction Cavitation (MFC). In present study, the compressive residual stress and corrosion resistance of Cr-Mo and Ni-Cr-Mo steels were improved by MFC treatment. Moreover, the authors compared conventional WJC technology to MFC technology. MFC was found to lead to higher compression residual stresses and higher corrosion resistances compared to conventional WJC. The corrosion resistance was revealed by the formation of an oxide film through selective oxidation and the concomitant reduction of surface defects. The oxide coating is formed by a reaction between the dissolved oxygen in water with Cr on the metal surface during processing.

Biography

Masataka Ijiri has completed his Bachelor of Engineering and Masters in Mechanical and System Engineering. Specialist in Materials Engineering and has Engineering Doctor's degree at Okayama University.

ijiri@rs.tusy.ac.jp

Notes:

Keun Young Yoon et al., J Mat. Sci. 2017, 5:6
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Synthesis of high ion conductivity solid electrolyte NASICON: Glass complex

Keun Young Yoon, Yi Eun Jung and Hae Jin Hwang
Inha University, Republic of Korea

Many lithium ion batteries use metal oxide cathode materials and combustible organic liquid electrolyte. The liquid electrolytes have a high ion conductivity of 10^{-2} s/cm^2. However, fire and explosion caused by short circuit due to leakage of liquid electrolyte and breaking of membrane, etc. may occur and therefore, there is always a question about safety. Used solid electrolyte instead of liquid electrolyte prevents to fire and explosion effectually and possible to make a battery had high capacity. To commercialize solid electrolytes, they are demanded high ion conductivity similar liquid electrolyte and minimized reaction with cathode materials. Among the solid electrolytes, the NASICON type electrolytes have a stable phase in water and atmosphere and less reactivity with the anode and cathode materials. We studied to improve ion conductivity of $LiZr_2(PO_4)_3$(LZP) which have a Li-ion conductivity mechanism. LZP compound stabilizes in a triclinic structure at room temperature. On heating over 60 degrees, LZP compound stabilizes in a rhombohedral structure. The Li ion conductivities of a triclinic and rhombohedral phase are 5×10^{-8} s/cm at room temperature and 1×10^{-5} s/cm close to room temperature. For stabilization, a rhombohedral structure at room temperature, some studies substitute Y ion for Zr ion in LZP. The sintering temperature is high and the sintering time is long nevertheless they have low density. For improve theoretical density, we mixed Li-ion conductivity glass and Y ion doped LZP. Used SEM and XRD and HSM, we evaluated characteristics of NASICON-glass complex and ion conductivity was measured with impedance analyzer.

Biography

Keun Young Yoon is currently pursuing his MS degree in department of materials science and engineering from the Inha University, Republic of Korea. His main topics are studying on all solid batteries performance evaluation and basic properties.

ukn2088@gmail.com

Notes:

Rodrigo Rodolfo Gonzalez Jimenez, J Mat. Sci. 2017, 5:6
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Synthesis and characterization of solids with strong basic properties applied as catalysts in the synthesis of pseudoionone

Rodrigo Rodolfo Gonzalez Jimenez
Benemerita Universidad Autónoma de Puebla, Mexico

The fine chemistry is dedicated to the production of compounds of high added value, usually these compounds are obtained by organic reactions in liquid phase that is used as homogeneous catalysts acids and mineral bases, which generates problems of environmental, contamination and make difficult recovery of the final product. An important group of such compounds are α, β-unsaturated aldehydes and ketones such as the pseudoionone (6,10-dimethyl-3,5,7-undeca-trien-2-one), which is used as a raw material for synthesize ionones of cosmetic and pharmaceutical interest. An alternative way of carrying out these processes is by the use of solid catalysts which do not generate the aforementioned drawbacks. In the present work, results obtained are presented using metallic oxides mixed with strong basic properties ($MgO\text{-}Al_2O_3$, $CaO\text{-}Al_2O_3$, $SrOAl_2O_3$, $MgO\text{-}CaO\text{-}Al_2O_3$) are reported as possible catalysts in the synthesis reaction of Pseudoionone. These oxides were obtained from air calcination of hydrotalcite. The precursors were characterized by the techniques of nitrogen physisorption, EDS, DRX, SEM as well as by DTP of CO_2 and NH_3. The activity of the synthesized oxides was tested in the aldol condensation reaction between citral and acetone, under reflux conditions at 80 °C and over a period of 72 hours. The reaction mixture was analyzed at different times by GCMS technique. Under the selected reaction conditions, the highest yield of pseudoionone was 83%, resulting in retinol and retinal byproducts (10 and 2%, respectively).

Biography

Rodrigo Rodolfo Gonzalez Jimenez is a graduate from School of Chemical Engineering and completed his Masters in semiconductor devices from BUAP University, Mexico. He is presently a PhD student of Chemical Sciences (Area of Catalysis).

pigoyoyo@hotmail.com

Notes:

Seulki Hwang et al., J Mat. Sci. 2017, 5:6
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Material effects on arc characteristics and electrical contact damage

Seulki Hwang[1], Daesup Hwang[1], Gihyun Kwon[1], Chansun Shin[1] and Noh-Hoon Park[2]
[1]Myongji University, Republic of Korea
[2]LS Automotive, Republic of Korea

Electrical contacts used in automotive relays are degraded by electrical arcing occurring during turn on and off the switches. Prominent pips and craters may form on the surfaces of the electrical contacts. The formation of pips and craters is due to the material transfer between anode and cathode contact and closely related to the arc characteristics occurring between two contacts. This surface erosion along with the formation of oxide and carbide compounds on the surface can cause switch failures. In this study, we have investigated the effects of contact materials on the contact resistance and surface erosion. We found that not only contact materials but also contact arm (plate spring) materials have significant effects on the direction of material transfer between anode and cathode contact, hence the formation of pips and craters. Repetitive switching has been performed by applying a constant current of 9 A and 20 A at 12 VDC with DC electronic load. Voltage drops were measured during the tests and the contact surface morphology and composition of the contacts were analyzed after 30,000 switching by using digital optical microscopy and Energy-dispersive Spectroscopy (EDS) in Scanning Electron Microscopy (SEM), respectively. AgCu alloy and Ag metal oxide contacts showed the formation of craters on cathode and pips on anode contact when BeCu alloy contact arm is used. Interestingly, AgCu alloy contact attached on NiCu alloy contact arm showed the inverse material direction, i.e., prominent erosion occurred on anode contact and material deposition observed on cathode contact. This phenomenon will be discussed based on the measurement of the arc characteristics during contact closing and opening. The change of contact resistance and the formation of surface compounds will be compared among different contact materials.

Biography

Seulki Hwang is presently associated with Department of Materials Science and Engineering, Myongji University, Republic of Korea. She has published numerous research papers and articles in reputed journals and has various other achievements in the related studies. She has extended her valuable service towards the scientific community with her extensive research work.

c.shin@mju.ac.kr

Notes:

Chi-Chi Lin et al., J Mat. Sci. 2017, 5:6
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The biological resistance improvement of painted stainless steel by changing paint composition and adding nanometal

Chi-Chi Lin, Wen-Yun Chen, Yun-Tai Lee and Yu Chun Lin
National University of Kaohsiung, Taiwan

This study aims to compare the biological resistance of paint materials which contain different resin types (i.e., acrylic vs. polyvinyl acetate) and resin percentages (i.e. 20%, 30% and 40%) before and after nanometal treatment, as well as to explore the fungicidal effect of nanometals (i.e., Ag, Cu and Zn) to improve fungal resistance of paints. Six tested green paints are paints-A (20% acrylic resin), paint-B (30% acrylic resin), paint-C (20% polyvinyl acetate resin), paint-D (30% polyvinyl acetate resin), paint-E (40% acrylic resin) and paint-F (40% polyvinyl acetate resin), respectively. The *Aspergillus brasiliensis* or *Penicillium funiculosum* was inoculated on each sample and their growth was visually evaluated according to ASTM G21-09. In general, fungi could grow on paints no matter what kind of resin content they have. Paints with highest resin level showed obvious fungicidal ability even without treatment of nanometals. All test nanometals in this study helped improve the resistance of fungal growth on test paints except for the paints with 40% resin. The impact among various nanometal tested did not differ much in terms of final speed growth level. Fungal growth of *Penicillium* was a bit stronger than *Aspergillus* for each test under the same conditions. In the future, studies on more fungal species and combination of nanometals with other fungicidal agents (i.e., TiO_2) may be helpful finding the most efficient fungicidal additive with lower concentration, stronger fungicidal effect and less environmental impact.

Biography

Chi-Chi Lin has completed his PhD from The University of Texas at Austin. He is currently a Professor at National University of Kaohsiung in Taiwan. His research interests focus on emissions from various building materials and associated reactions between ozone and building materials, as well as the improvement of indoor air quality. He has published more than 20 papers in reputed journals.

chichilin@nuk.edu.tw

Notes:

Xiong Wang et al., J Mat. Sci. 2017, 5:6
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Preparation of the SAHA-Pluronic F127 nanoparticles and anticancer activity *in vitro*

Xiong Wang[1], Xiao Zhang[1], Manli Li[1], Ping Zong[1], Tingting Kong[1,2], Yanzhen Hu[1], Liyuan Liang[1] and Chao Li[1]
[1]Xi'an Jiaotong University, China
[2]Suzhou GuanJie Nano Antibacterial Coating Technology Co. Ltd., China

Purpose: Vorinostat (SAHA) is the most representative histone deacetylase inhibitor and a widely used anticancer drug, SAHA is applied in the treatment of hematological malignancies and most solid tumors. SAHA is challenging due to poor water solubility, low bioavailability and rapid elimination of drugs *in vivo*. In this study, we will prepare SAHA-Pluronic F127 Nanoparticles and investigated whether this could improve drug solubility, the effect of sustained release and inhibitory effect on cancer cells.

Methods: SAHA-Pluronic F127 nanoparticles were prepared by thin-film method. The drug loading, entrapment efficiency and *in vitro* drug release test were determined by High Performance Liquid Chromatography (HPLC). The proliferation on HeLa cell was examined by MTT. The mRNA expression of p53 and p21 were determined by real-time PCR.

Results: The particle size of the nanoparticles was 23.86±0.30 nm, the encapsulation efficiency was 94.36±0.76% and the drug loading was 1.31±0.062. The results showed that SAHA NPS can achieve about 17% sustained release effect and the inhibitory effect on cell growth of SAHA NPS was better than SAHA. Both the SAHA and SAHA NPS up-regulated p21 and down-regulated p53 in mRNA level after 24 h and 48 h treatment and SAHA nanoparticles had better effects compared to SAHA at 48 h.

Conclusion: This study confirmed encapsulation of SAHA into Pluronic F127 nanoparticles can improve drug aqueous solubility and sustained release in vitro and the inhibition of cell growth of SAHA NPS was more potent than SAHA.

Biography

Xiong Wang has completed his Bachelor's degree in Pharmacy from Wenzhou Medical University. Presently, he is pursuing his Master's degree from the Xi'an Jiaotong University, China.

w18862117607@yahoo.com

Notes:

Ji Hoon Jeong et al., J Mat. Sci. 2017, 5:6
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Effect of substrate temperature and flow rate of hydrogen gases on the characteristics of MZO and IGZO thin films

Ji Hoon Jeong, Yong-Ho Lee, Ji-soo Lee and Kyu-Mann Lee
Korea University of Technology and Education, Republic of Korea

Transparent Conductive Oxides (TCOs) thin films are used for electrodes in lighting devices like displays, solar cells, etc. TCOs have to show the low electrical resistances and the good light transmittances at the same time. ITO (Indium Tin Oxide, Sn-doped In_2O_3) of TCO materials has the above two properties and are most commercially used as TCOs. However, ITO has some problems. The cost of Indium of main ingredient of ITO is expensive and the supplies are unstable. Not only deposition temperature should be higher than at less 250°C but also heat treatment is needed after the deposition. These high temperature processes are main factors of the poor roughness of thin films and undesirable effects to the device stability. Because of these problems, we are interested in TCO materials to substitute ITO. Among TCO materials, ZnO based TCO materials are chemically stable and can be deposited at room temperature and has the low electrical resistance and the high light transmittance. In this study, we used two targets, MZO (Mo 2 wt%) and IGZO (In 1 mol%, Ga 1 mol%) by RF magnetron sputter. To observe the characteristics depending on atmospheric gas and substrate temperature, we flowed ambient gas (Ar+H2) from 0sccm to 4sccm and changed the substrate temperature from RT to 300°C. To observe microstructures of thin films, we used XRD and SEM and to indicate the electrical properties of thin films, we used Hall measurement system.

Biography

Ji Hoon Jeong is currently pursuing his Master's degree from Korea University of Technology and Education, Republic of Korea.

rain0o@koreatech.ac.kr

Notes:

Shatakshi Gupta et al., J Mat. Sci. 2017, 5:6
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Synthesis of Carbon Nanotubes using catalytic chemical vapor deposition

Shatakshi Gupta, Anshul Chawla, Hitesh Sewani, Pradeep Kumar Yadav and Taraknath Das
Indian Institute of Technology Roorkee, India

Chemical Vapor Deposition (CVD) synthesis of Carbon Nanotubes (CNTs) was carried out in a self-assembled apparatus consisting of a hot tube furnace. Magnesium oxide supported iron catalyst samples, containing varied proportions of iron loadings were prepared using impregnation method and spread uniformly over copper strips. Ceramic boats were placed in the furnace so as to expose the catalyst-loaded copper strips to industrial gases such as nitrogen, methane and hydrogen. Usage of horizontal tube furnace instead of conventional CVD reactor not only reduced the cost but also added to the simplicity of the apparatus. Additionally, ceramic boats are at least 50% cheaper than the commonly used quartz boats. FESEM tests on the resultant samples revealed that the CNTs ranged between 19.78 nm and 30.36 nm in diameter, which validates the nanotube structures. We demonstrate that increasing the iron loading in the catalyst samples enhanced the probability of CNT formation: 0% iron loading yielded no CNTs, while increasing the loading to 6.5% gave way to formation of Multi-Walled Carbon Nanotubes (MWCNTs). This study opens up an economical route for the mass production of MWCNTs.

Biography

Shatakshi Gupta is currently pursuing her Bachelor's degree from Indian Institute of Technology (IIT) Roorkee, India. She has developed Python program for implementing ray tracing algorithm for line-of-sight imaging of the rocket combustion chamber (BKH) cross section as a part of post-processing the results at DLR Lampoldshausen, Germany.

guptavshatakshi@gmail.com

Notes:

Insepov Zinetula Zeke et al., J Mat. Sci. 2017, 5:6
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NANOPUMP - Nanopumping Effect in nanochannels by surface acoustic wave

Insepov Zinetula Zeke, A M Ainabayev, D Zhumagulov and K B Tynyshtykbaev
Nazarbayev University Research and Innovation System, Kazakhstan

Innovative nanofiltration technology for water desalination and other fluids purification from salts, germs, bacteria and viruses are based on so called Nanopumping (NP) effect, when a fluid flow through nanomembranes and nanochannels is actuated using Surface Acoustic Waves (SAW) is presented. In this work, based on our own research results on application of SAW for fluid flow actuation and SAW amplification effect by using graphene film and fabrication of nanochannels in ultrathin films by radiation method, we developed a working model of the nanopump, that can demonstrate a water filtration process in a much simpler way than the existing desalination and purification methods using carbon nanomembranes in which the fluid motion is triggered by SAW. Moreover, such nanopumping devices will be of practical interest for the development of future energy sources, e.g., for direct methanol fuel cells, hydrogen energy and nanoengine for medical robots, as well as for use in a wide variety of chemical, food and agricultural applications.

Biography

Insepov Zinetula Zeke is a Doctor of Physical and Mathematical Sciences and was a founding Faculty Fellow of the Skolkovo Institute of Science and Technology (Skoltech)/Massachusetts Institute of Technology (MIT) initiative. He has previously held positions at Albert Ludwig University of Freiburg, Kyoto University, Japan and Argonne National Laboratory. He is a well-known expert in the field of nuclear and radiation material science and one of the authors of the development of a new radiation technology by the method of irradiating clusters of gas molecules.

zinsepov@purdue.edu

Notes:

Kyuwon Kim et al., J Mat. Sci. 2017, 5:6
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Virus-metal nano-composites prepared by electrodeposition

Kyuwon Kim and Shanmugam Manivannan
Incheon National University, Republic of Korea

A virus-incorporated bio-template on electrode surfaces and its use in electrochemical nucleation of metal nanocomposite as an electrocatalytic material for energy application is presented. The bio-template developed with M13 virus (M13)-incorporated in silica as a scaffold to nucleate Au–Pt alloy nanostructures by electrodeposition together with reduced Graphene Oxide (rGO). The engineered phage with Y3E peptides could specifically nucleate Au–Pt alloy nanostructures, which ensures adequate packing density, simultaneous stabilization of rGO, and significantly increased electrochemically active surface area. The electrocatalytic activity of the resulting sol-gel composite catalyst toward methanol oxidation in alkaline medium was investigated and found enhanced mass activity relative to wild-type M13 applied bio-template, mono-metallic Pt and other controlled Au–Pt nanostructures with different composition and support. M13 in the nanocomposite materials provides a close contact between Au–Pt alloy nanostructures and rGO. In addition, it facilitates the OH–rich environment to the catalyst. As a result, efficient electron transfer and synergistic catalytic effect of Au–Pt alloy nanostructures toward methanol oxidation were observed. Our nanocomposite synthesis on the novel bio-template and its application might be useful to develop novel clean and green energy generating and storage materials.

Biography

Kyuwon Kim is currently a Professor and a Director of ELSE Lab of INU. He has completed his PhD from KAIST, Korea in 2002. He joined INU in 2006. He has published more than 60 papers in electrochemistry journal. Dr. Manivannan has completed his PhD from Madurai Kamaraj University in India and is now postdoctor at ELSE Lab of Incheon National University (INU). He has published more than 15 journal papers in electrochemistry.

kyuwon_kim@inu.ac.kr

Notes:

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A study on the collision characteristic of the side crash simulation with three dimensional structure

Min-sik Lee, Ji-Hoon Hwang and Chung-gil Kang
Pusan National University, Republic of Korea

Recently in the automobile industries, the development of environment friendly materials for improving the safety and fuel efficiency of automobiles has come to the fore. As the demand for the technological development to achieve high performance and high efficiency increases, the research on applying advanced high-strength steel to parts manufactured by the hot press process has progressed. Further, research and development for fuel efficiency through additional weight reduction using Tailor Welded Blanks (TWBs) and Partial Quenching (PQ) has quickly spread in the automobile industry. Moreover, lighter materials than those currently used, materials having a high strength-weight-ratio and specific strength, are required such as hybrid steel/CFRP composites. Many car components have been replaced with various materials to improve collision toughness and safety during car crash. However, the standard of evaluation to replace auto part is still lacking. The standard needs to depend on mechanical properties of tensile and bending. The car crash test was conducted at IIHS to evaluate safety. But it's expensive and hard to evaluate collision toughness each car component. In this study, the side crash test was conducted by simulation and the collision characteristic of the center-pillar was evaluated. Fracture toughness was compared according to materials to propose a standard of collision test condition. As a result, the correlation between mechanical properties, weigh reduction and collision toughness was investigated.

Biography

Min-sik Lee has completed his PhD from Pusan National University. He has published more than 16 papers in SCI journals and has recieved best paper award from England, best researcher 2016 in BK21 plus.

minsik2@pusan.ac.kr

Notes:

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Target specific detachment of multiple RNA probes from graphene oxide using RNase H for a simple and direct molecular diagnostics

Joong Hyun Kim, Chan Ho Chung and Mina Park
Daegu-Gyeongbuk Medical Innovation Foundation (DGMIF), Republic of Korea

Strong fluorescence quenching and preferential adsorption of ss DNA or RNA on Graphene Oxide (GO) enabled to detect target gene in a simple and direct manner. However, GO interferes with probe binding to the target because of their strong binding affinity to GO resulting in decreased detecting sensitivity. Therefore, we introduce a strategy to detach multiple probes per single target DNA from GO using RNase H, a ribonuclease to act on only RNA paired with DNA. Since DNA becomes free to bind the RNA probe adsorbed on GO after digestion of the paired RNA by RNase H, multiple RNA probes could be detached from GO and are degraded by RNase H. As a result, fluorescence signal could be amplified allowing a sensitivity detection of target DNA. Until now, we could detach and digest maximum 76 RNA probes per single target DNA from GO. In current, we are addressing effect of GO on specificity of probe detachment and adsorption or deactivation of the enzymes as well. In the presentation, we will discuss more details of the results.

Biography

Joong Hyun Kim has completed his PhD in 2006 from University of California Riverside and postdoctoral studies from University of California Santa Barbara. Currently he is a Principal Researcher of Daegu-Gyeongbuk Medical Innovation Foundation (South Korea).

jhkim@dgmif.re.kr

Notes:

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Plasma polymer fluorocarbon thin films deposited by roll-to-roll sputtering

Sung Hyun Kim, Tae-Woon Kang, Mac Kim, Jae Heung Lee and Sang-Jin Lee
Korea Research Institute of Chemical Technology, Republic of Korea

Carbon nanotube/polytetrafluoroethylene composite polymer targets (abbreviated as composite target) are proposed for use in the fabrication of plasma polymer fluorocarbon (abbreviated as PPFC) thin films using the mid-range frequency sputtering process. Large-area PPFC thin films were fabricated on roll-type PET substrate (polyethylene terephthalate, width 700 mm, thickness 100 μm) by a pilot-scale roll-to-roll sputtering system. The PPFC thin films exhibit an amorphous phase with a smooth surface and show a high water contact angle, optical transmittance and bendability. Mechanical property of PPFC thin films were studied using nanoindentation method and analyzed using X-ray photoelectron spectroscopy and Fourier transform infrared spectroscopy. As the carbon nanotube concentration in the composite target increases, a carbon cross-linked structure was formed which enhanced the film hardness and the modulus of the PPFC thin films.

Biography

Sung Hyun Kim has completed his Master course of Nano Fusion Technology in 2015 from Pusan National University. He is a Ph.D. student at the Korea Research Institute of Chemical Technology and Pusan National University.

wdy1332@krict.re.kr

Notes:

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Effect of outgassing in polymer substrate for high performance conducting oxide thin films

Tae-Woon Kang, Sung Hyun Kim, Mac Kim, Jae Heung Lee and Sang-Jin Lee
Korea Research Institute of Chemical Technology, Republic of Korea

Recently, Roll-to-Roll (R2R) sputtering process have attracted much attention in deposition of Indium Tin Oxide (ITO) thin films on polymer substrates for flexible optoelectronics due to their high flexibility, low cost. We found that polymer substrate contained contaminative gases and moisture (H_2O) both on the surface and within hard coating layer, and the characteristics of ITO films are adversely affected by the contained gases. In this study, we report the importance of outgassing process in the deposition of ITO thin films on hard-coated Polyethylene Terephthalate (PET) by pilot-scale R2R sputtering. The optical and electrical properties of ITO films on PET films were improved by using an outgassing process. The outgassed ITO film shows a low sheet resistance to ~ 100 ohm/sq. and high optical transmittance to ~ 90 %.

Biography

Tae-Woon Kang has completed his Master course of Professional Graduate School of Flexible and Printable Electronics in 2016 from Chonbuk National University, South Korea. He currently works at Korea Research Institute of Chemical Technology.

twkang@krict.re.kr

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e-Poster

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E-BABE- Ultrafast and efficient transport of hot plasmonic electrons by graphene for Pt Free, highly efficient visible-light responsive photocatalyst

Dong-Kwon Lim
Korea University KU-KIST Gradaute School of Converging Science and Technology Seoul, Republic of Korea

We recently report that reduced graphene-coated gold nanoparticles (r-GO-AuNPs) are excellent visible-light-responsive photocatalysts for the photoconversion of CO_2 into formic acid (HCOOH). The wavelength-dependent quantum and chemical yields of HCOOH shows a significant contribution of plasmon-induced hot electrons for CO_2 photoconversion. Furthermore, the presence and reduced state of the graphene layers are critical parameters for the efficient CO_2 photoconversion because of the electron mobility of graphene. With an excellent selectivity toward HCOOH (>90%), the quantum yield of HCOOH using r-GO-AuNPs is 1.52%, superior to that of Pt-coated AuNPs (quantum yield: 1.14%). This indicates that r-GO is a viable alternative to platinum metal. The excellent colloidal stability and photocatalytic stability of r-GO-AuNPs enables CO_2 photoconversion under more desirable reaction conditions. These results highlight the role of reduced graphene layers as highly efficient electron acceptors and transporters to facilitate the use of hot electrons for plasmonic photocatalysts. The femtosecond transient spectroscopic analysis also shows 8.7 times higher transport efficiency of hot plasmonic electrons in r-GOAuNPs compared with AuNPs.

Biography

Dong-Kwon Lim is an assistant professor at KU-KIST Graduate School of Science and Technology in Korea University (Seoul, South Korea) (2015 ~ current). After he finished his BS and MS degree of Chemistry from Kyungpook National University (1996), he worked for more than 10 years in the pharmaceutical research institutes of the company in Korea. After he received his Ph. D. degree of Chemistry from Seoul National University in 2011, he started his postdoctoral research at MIT (David H Koch Institutes, Advisior: Prof. Robert Langer Lab) and Harvard Medical School (Children's Hospital Boston) (2011~2013). Dr. Lim has made pioneering contributions to the field of DNA-based nanostructure synthesis for single molecule surface-enhanced Raman scattering (SERS) and the developments of new bio detection & therapeutic strategies based on organic/inorganic hybrid nanomaterials.

dklim@korea.ac.kr

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Design and synthesis of Zr-containing multinary ceramics from hybrid polymers

Changwei Shao, Jun Wang and Xin Long
National University of Defense Technology, China

Polymer-derived method is superior in the fabrication of ultra-high-temperature ceramics with the designable composition and structure, low sintering temperature and easy densifying process. In this study, three kinds of hybrid precursors for ZrC/C, ZrC/SiC and ZrC/SiBNC multinary ceramics were synthesized via radical polymerization. ZrC/C ceramic precursor was synthesized using Cp2Zr ($CH_2CH=CH_2$) as monomer ZrC/SiC or ZrC/SiBNC precursor is obtained by further adding low molecular weight polycarbosilane (LPCS) or polyborosilazane (LPBSZ) for copolymerization. By controlling the preparation procedure, these hybrid polymers can dissolve in most organic solvent, which is essential to construct CMCs in complicated shapes and large sizes. After pyrolyzing at 1400°C, the synthesized precursors can convert into Zr-containing multinary ceramics, with ZrC nanoparticles finely dispersed in C, SiC or SiBNC matrix depending on the hybrid polymer. All of the three Zr-containing multinary ceramics can remain finely phase distribution at 1600°C, especially for ZrC/C and ZrC/SiC multinary ceramics, which can have a stabilized microstructure and little mass loss (less than 1.5 wt%) up to 2000°C in inert atmosphere. As for ZrC/SiBNC, the introduction of ZrC phase can restrict the decomposition of SiBNC matrix at 1800°C. Although the SiC and SiBNC components improve the oxidation resistance of ZrC, the oxidation weight increase of these multinary ceramics at about 500°C is still up to 5%.

chwshao@126.com

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Flexible electronics: Toward growth factors delivery and electrical stimulation of cells for treatment of neurodegenerative disorder

Dorna Esrafilzadeh[1], Rouhollah Jalili[1, 2], Binbin Zhang[2], Alex R Harris[2] and Qingsheng Zhang[2]
[1]RMIT University, Australia
[2]University of Wollongong, Australia

Aberrant neuronal growth underlies the prefrontal cortical (PFC) pathology of many neurodegenerative disorders. Current treatments are inadequate and commonly cause severe side effects. Importantly, conventional pharmacotherapy strategies have limited efficacy in treating PFC dis-regulation in neurodegenerative disorders. Electrical stimulation is a modern treatment method which can include electroconvulsive therapy, Deep-Brain Stimulation (DBS) and epidural stimulation, etc. Previous studied showed that the application of electrical stimulations promotes neuritis outgrowth resulted to inter neuronal networking. Wide range of metallic microelectrodes composed of gold, steel, platinum etc. have been previously utilized to perform electrical stimulation however, rigidity, incompatible mechanical properties, high initial impedance and low charge-transfer capacity limit their application. Graphene and its derivatives are an exciting class of materials, which are utilized in microelectrodes due to having excellent mechanical stability, electrical conductivity, biocompatibility, flexibility and ability to fabricate and scale up. This work develops three-dimensional (3D) flexible electrode composed of 3D printed Reduced Liquid Crystalline Graphene Oxide (rLCGO) on a polyurethane (PU) substrate. The flexible conducting electrode is used as Host Template for Human Neural Stem Cells (hNSCs) development during proliferation and differentiation. The application of electrical stimulation on hNSC using graphene/PU electrodes revealed promising results to improve neurites guidance through 3D printed lines and enhanced cell-cell communication and networking.

dorna.esrafilzadeh@rmit.edu.au

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Catalytic intervention of transition metals in Pd based nanocatalyst for direct ethanol fuel cell

Jayati Datta, Abhishek De and Achintya Mondal
Indian Institute of Engineering Science and Technology, India

The Proton Exchange Membrane (PEM) fuel cell has currently occupied a commanding position among the renewable technologies for clean and safety power generation. A special focus has been made on the state of the art technologies for cost reduction by developing CO- tolerant plurimetallic non-platinum catalyst formulation for designing and fabrication of ethanol based Fuel Cell. The synthesized catalyst materials include low level Pt and Pt free ternary combinations of Co and Ni with Pd, supported on vulcan XC-72 for use as anode component in a Direct Ethanol Fuel Cell (DEFC) operating with an Anion-Exchange Membrane (AEM) at room temperature. Information on physicochemical properties, structural characteristics, surface morphology and composition of the catalyst matrices was obtained employing respective techniques like XRD, EDAX, XPS and TEM etc. A series of electrochemical techniques including cyclic voltammetry, chronoamperometry, impedance spectroscopy and potentiostatic polarization were employed to investigate the catalytic efficiency of the materials toward Ethanol Oxidation Reaction (EOR) in alkaline medium. The enhanced electro-catalytic activity of the ternary electrode is ascribed to the catalytic intervention of the transition metal ad-atoms, Ni and Co and their surface oxides culminating to higher electrochemical surface area, preferred-OH adsorption on the surface and excellent CO tolerance of the Nano-catalysts. Considerable yield of the intermediate oxidation products CH_3CO_2- and CO_3^{2-} is obtained with the Pd, Co, Ni/C catalyst compared to Pt/C and Pd/C, as estimated by ion chromatography. Further, the electrical performance of the in-house fabricated DEFC with the non-Pt ternary matrix was outstandingly high, exhibiting power density output of 35 mW/cm^2. All these output parameters collectively substantiate to the catalytic superiority of the Pd, Co, Ni/C catalysts, at the same time, establish the affordability of using such Pt alternatives in low temperature DEFC.

jayati_datta@rediffmail.com

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Alginate/κ-Carrageenan and alginate/gelatin composite hydrogel beads for controlled drug release of curcumin

Jinu George
Sacred Heart College Thevara, India

Hydrogel beads based on natural polymers like alginate, κ-Carrageenan and gelatin represent an efficient scaffold for controlled hydrophobic drug delivery. We report herein the development and characterization different formulations of hydrogel systems based on the above mentioned polymers having adequate properties as drug delivery matrices. Different combinations of alginate/κ-Carrageenan and alginate/gelatin hydrogel beads were developed and drug release properties were compared using curcumin as a model drug. Alginate/κ-Carrageenan hydrogel beads with 50:50 weight ratio exhibited higher swelling and better drug release percentage than compared to other beads. Antibacterial activity of curcumin released from hydrogel beads against *B. cereus* was established by disc assay. Encapsulation efficiency and drug release behavior of different formulations of alginate/κ-Carrageenan and alginate/gelatin, indicates that the polymer blends synthesized possess considerable potential in pharmaceutical and medicinal applications.

jinujacobv@gmail.com

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Electro-optical synergy on plasmon-exciton co-driven surface catalytic reactions

Mengtao Sun
University of Science and Technology Beijing, China

The monolayer graphene-Ag nanoparticles hybrids system is fabricated as the electro-optical coordinated controlled substrate of Surface-Enhanced Raman Scattering (SERS) spectroscopy. Plasmon-exciton coupling interactions of this hybrid system are systemically investigated and applied in the field of surface catalytic reactions, manipulated by the electro-optical synergy. Our experimental results demonstrate that plasmon-exciton coupling interaction co-driven surface catalytic reactions can not only be controlled via plasmon-exciton coupling, but also by gate voltages and electric current (or bias voltage). The gate voltage can tune the Density of State (DOS) of hot electrons and electric current can make the hot electrons with higher kinetic energy. Both of them can significantly promote plasmon-exciton co-driven surface catalytic reaction. Our electro-optical device based on plasmon-exciton coupling can be potentially applied in the fields of sensor, catalysis, energy and environment.

mengtaosun@ustb.edu.cn

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Surface modification of TiO_2 nanotubes by grafting with APTS coupling agents

Duong Thi Hong Phan
Da Nang University of Technology, Vietnam

The aggregation of Titanium dioxide Nanotube-sized (TNTs) in various liquid media was necessary improved. The methodic study has been investigated the grafted modification with 3-Aminopropyl Triethoxysilane (APTS) on its surface. TNTs with approximately 10-20 nm diameters were achieved by hydrothermal treatment of TiO_2 p25 particles. The obtained products were revealed by the modern physicochemical systems such as X-ray diffraction (XRD), Transmission Electron Microscopy (TEM) and the BET specific area surface. The amounts of silane agent, reaction temperature and time have been adjusted to the influence of the grafting efficiency (from 2.5 to 6.5%) by Thermal Gravimetric Analysis (TGA). Dispersion stability test was indicated that APTS modification has been enhanced to reduce stability of nanotubes in organic solvents. Fourier Transform Infrared Spectroscopy (FTIR) has been confirmed a presence of organic functional groups and Ti-O-Si chemical bonds on the grafted-TiO_2 nanotubes were successfully linked.

dthphan@dut.udn.vn

Notes:

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Electrical investigations of PbTiO3 ceramics with Pb/Ti contents fabricated through solid state sintering reaction method

Nasira Sareecha
Islamia University of Bahawalpur, Pakistan

Polycrystalline $PbTiO_3$ ceramics were fabricated through solid state sintering reaction method at Pb/Ti molar ratio of x=1.00, 0.98 and 0.94. Keeping the technological position of $PbTiO_3$ ceramics for variety of applications; electrical investigations of crack free sintered $PbTiO_3$ ceramics were struggled under varying processing parameters in the wide spread spectrum of temperature from 40-700 °C at 1k Hz frequency. Stoichiometry and sintering regime strongly influenced the phase transition (TC) of $PbTiO_3$ ceramics; compositions-1.00 and 0.98 showed sharp phase transition predominantly at 490°C. Impedance spectroscopy revealed dielectric anomalies with a relaxor like behavior at higher temperatures. The temperature dependence of alternative current conductivity (σac) confirmed the presence of ferroelectric to para-electric phase transition. At room temperature, resistivity (ρ25) increased with increasing titanium contents. All specimens showed semiconductor behavior with Negative Temperature Coefficient of Resistivity (NTCR) characteristics; expanding drift mobility, μd through increasing temperature concerted the rise in conductivity. The bulk conductivity followed the Arrhenius law with E_a=2.3265-2.6269, 0.8302-0.7246 and 1.7665-0.3889 eV which can be attributed to the ionic conduction governed by V''_{Pb}, $V'O$ and $V''O$ vacancies. Dielectric studies at $PbTiO_3$ ceramics fabricated with optimal 0.98 compositions have potential application for high temperature applications.

nsareecha@hotmail.com

conferenceseries.com

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Characteristics of concrete with graphene and carbon fibers for marine environment

S Geetha and M Selvakumar
Rajalakshmi Engineering College, India

Addition of small discrete micro and macro fibers in controlling the growth of cracks in concrete is a wide practice in recent decades. Use of discrete fibers result in more uniform stress distribution in concrete and this delay the nucleation and the growth of micro/nano crack. Steel fibers, carbon fibers, glass and polymeric fibers are used to control the cracks at microscopic level, whereas nanofibers/particles such as nanosilica, nanoalumina, nanoiron oxide, nanotitanium oxide, nanoclay and grapheme oxide are used to control the cracks at nanoscopic level. Chopped carbon fibers are added in concrete to increase the flexural toughness of concrete. As marine concrete is prone to severe durability issues, this paper aims at characterizing high performance concrete with graphene and chopped carbon fibers which can be used for the construction of coastal structures. Design of experiments with central composite design has been adopted to design the trial mixes for this work. The experiments were carried with the designed values. The strength properties like compressive strength, flexural strength and tensile strength were studied. Apart from this, durability characteristics like concrete impermeability and rapid chloride penetration was also carried out. It was observed that the strength properties increased by 22% for 0.05% of graphene oxide and incorporation of chopped carbon fibers up to 0.05% improved the flexural toughness by 28%. The concrete was found to be resistant to chloride penetration and it was impermeable to water. Results show that this material can be potentially used as construction material for structures that are exposed to severe marine environment.

geetha.s@rajalakshmi.edu.in

Notes:

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Solution processed ZnPc hole-transporting layers for photovoltaic devices

Tamara Potlog
Moldova State University, Republic of Moldova

During four past decades, research on Organic Photovoltaic Devices (OPV) has progressed using a few standard materials which were not initially designed for this purpose but for other applications such as tainting, paint or xerography. The enhancement of the photo-generation of charges in a phthalocyanine in the presence of an electron-acceptor had been reported in 1980. Since Tang's first report in 1986 of a hetero-junction bilayer organic solar cell composed of Cu-phthalocyanine and a perylene derivative the field has expanded rapidly and recently includes a wide variety of small molecule solar cells containing phthalocyanines or porphyrins as dyes, conjugated polymers as the p-type donor phase and C_{60} or perylene derivatives as the acceptor phase. Most Metal Phthalocyanines (MPcs) are usually highly insoluble and need to be processed by vacuum deposition. Zinc phthalocyanine (ZnPc) is a particularly attractive sub-class of Pcs given the elemental abundance, very low toxicity levels and low band gap (~1.7 eV) well-matched to the incident solar spectrum. However, to date not report exists on the use of solution processed ZnPc as dyes in photovoltaic devices, therefore many research activities focused on synthesizing soluble phthalocyanines by adding functional groups to the molecule. Unfortunately, most of the substituted phthalocyanines are not as stable as the unsubstantiated compounds and their electronic properties are also different from those of the unsubstituted phthalocyanine. Here, we report the solubility of ZnPc in the mixture of formic acid and N-methyl-2-pyrrolidone and its use for solution processing of Schotttky and BHJ photovoltaic devices with photovoltaic open circuit voltage and short-circuit current density higher than if it is obtained by the vacuum evaporation method. Various characterization techniques were employed to estimate the structural and optical features of ZnPc hole-transporting layers, including XRD, FTIR and UV-VIS-NIR spectroscopy. In addition, the photovoltaic parameters of fabricated photovoltaic devices was estimated from current-voltage characteristics taken at 300 K using a Keithley 2400 source meter, under different illuminations.

tpotlog@gmail.com