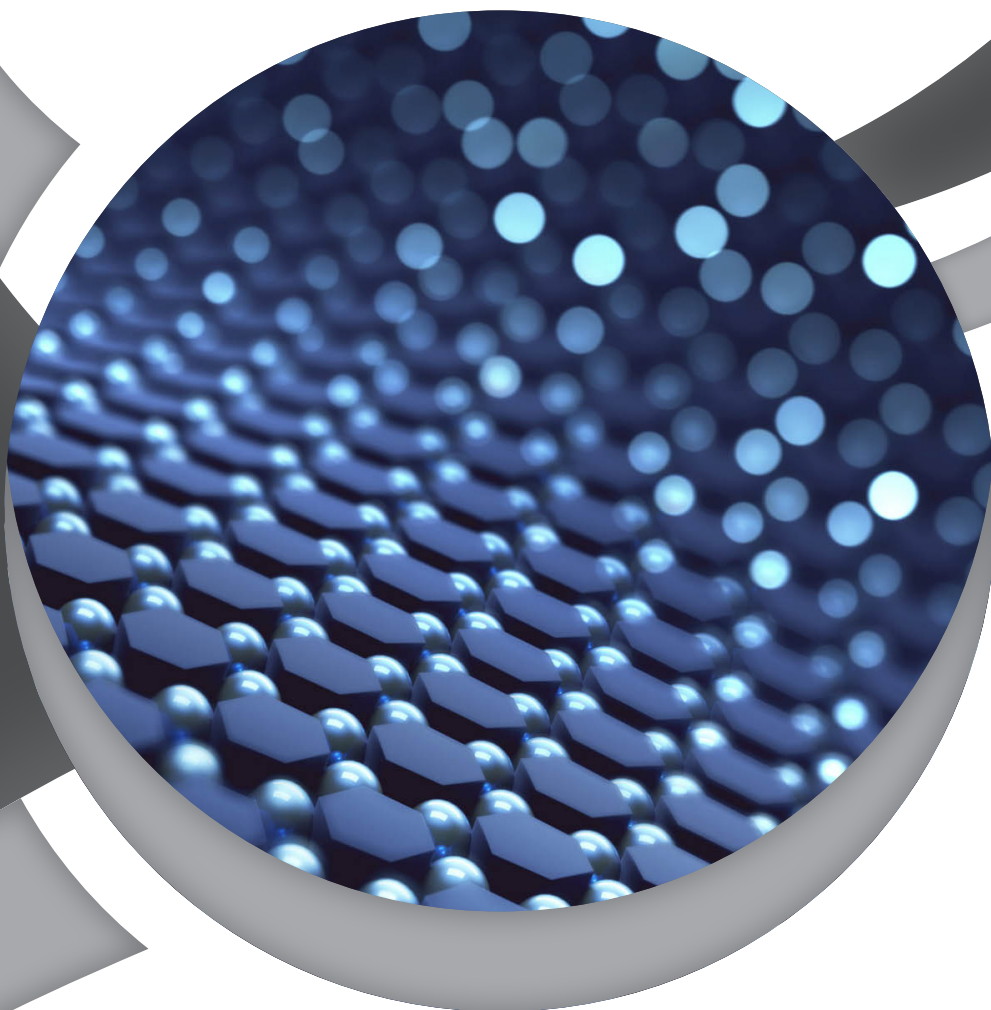




22nd International Conference on

Advanced Materials and Nanotechnology

September 19-21, 2018 Tokyo, Japan

Scientific Tracks & Abstracts

Day 1

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ADVANCED MATERIALS AND NANOTECHNOLOGY

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New application of mechanical coating process without solvent for Fischer-Tropsch synthesis

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Ultra-clean hydrocarbon fuels produced from syngas by Fischer-Tropsch (FT) synthesis has been applied in industry for decades. However, the FT catalysts are traditionally synthesized via wet-chemical methods, accompanied by solvent waste pollution and large energy consumption. The mechanical coating process, by contrast, applies high mechanical shearing/impacting forces to prepare heterogeneous catalysts without any solvent, releases no effluent and needs no drying or post-heating steps. It is more environmentally friendly and sustainable than wet methods. In this research, the dry coating process was applied to synthesize Co/Al₂O₃ FT catalysts and catalyst structure was optimized to improve catalytic activity and achieve high long-chain hydrocarbon yield. In the experiments, (2-15 wt%) Co/Al₂O₃ catalysts were prepared by mixing various contents of nanoscale Co₃O₄ and mesoporous spherical γ -Al₂O₃ in a high-shearing mixer Picomix (Hosokawa Micron B.V.) at 5000 rpm for 5 min. The obtained catalysts were characterized by a combination of methods (particle size, specific surface area, SEM and EMP imaging, XRD and H₂-TPR). Fluidization tests were performed to evaluate attrition resistance of the catalysts. FT activity was evaluated in a milli fixed-bed under 20 bars and 250 °C for 24 hours with syngas (H₂/CO=2 v/v). The results show that the prepared Co/Al₂O₃ catalysts possessed uniform Co₃O₄ coating on surface of Al₂O₃ particles and presented strong mechanical resistance ability. Among all the prepared catalysts, the 5 wt% Co/Al₂O₃ catalyst exhibited the highest reaction rate (18.4 mmolCO/s/molCo), with low CH₄ selectivity (13.3%) and high C₅+ selectivity (75.1%), therefore cost-effective for FT synthesis application.

Biography

Nouria Fatah has completed her Post-graduation and PhD degree in Chemical Engineering and Powder Technology. Presently she is a full Professor at Ecole Nationale Supérieure de Chimie de Lille and in the Unité de Catalyse et Chimie du Solide, Lille, France. She is also a Group Leader on Process and Powder Technology (powder technology and gas-solid fluidization, mechanosynthesis and coating of solids, characterization of powders (physical properties and flowability), fluidization of cohesive powders and numerical modelization). She is the Director of the Powder Technology and Processes Engineering at PLATFORM. She has published 98 articles, proceedings, patents and communications.

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Toughening of nanocomposites for applications in cryogenic fuel tank**Mohammad S Islam and Chun H Wang**

The University of New South Wales, Australia

Microcracks can occur in carbon fiber composite materials due to high thermal stresses induced by the large difference of the coefficient of thermal expansion between the polymer matrix and the carbon fibers. These micro-cracks can severely degrade the mechanical strength and gas permeability of composites, posing a significant challenge to the use of fiber composites in liquid fuel tanks of launch vehicles. The aim of the study was to develop a multi-scale toughening method to address the micro-cracking problem by incorporating hybrid nano-scale materials to enhance the fracture toughness and to reduce the coefficient of thermal expansion of the polymer matrix. Nanomaterials such as nanosilica, graphene and metal oxide were selected based on their thermal properties and toughening effect. Tensile and Single Edge Notch Bending (SENB) testing of the polymer and nanocomposites were carried out to study their tensile properties and bulk fracture toughness respectively, while Double Cantilever Beam (DCB) testing was carried out to determine the critical energy release rate (GIC values) of the fiber-polymer laminates. The results show that nanosilica improved the fracture toughness of the composites while metal oxide nanoparticles provided the best improvement in thermal conductivity, tensile strength, and fracture toughness.

Biography

Mohammad S Islam has obtained his PhD from the University of Waikato, New Zealand. Currently, he is a Research Fellow in the School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia. Previously, he held Research Fellow positions at the University of Sydney in Australia, the University of Minho in Portugal, CSIRO Materials Science and Engineering in Australia and Materials Scientist position in Pulton Composites, New Zealand. He has published more than 25 papers in journals and has been serving as an Editorial Board Member of Composite Materials of Science Publishing Group.

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High efficient fully printable organic-inorganic hybrid bulk heterojunction thin-film solar cells based on metal-alkoxides**Takehito Kato**

National Institute of Technology, Oyama College, Japan

Photovoltaic cells, which are expected to serve as a clean and renewable energy source, are among the most abundant technologies for energy on earth besides hydropower and wind power. On the other hand, organic-inorganic hybrid thin-film solar cells constructed using polythiophene derivatives and metal alkoxides constitute promising and novel organic-inorganic hybrid devices. We have reported some organic-inorganic bulk heterojunction solar cells with several p-type semiconducting polymers and Ti-alkoxides for the photoactive layer. These solar cells involve low fabrication cost and use safe materials but their conversion efficiency is not very high. One reason for this is that the phase-separated structure is not controlled adequately for utilization in exciton generation and diffusion, charge separation and charge transportation. Therefore, we present a three-component layer as the photoactive layer using the phase-separation assistant material. Organic-inorganic hybrid thin-film solar cell structure consists of indium-doped tin oxide transparent conductive film, photoactive layer (p-type semiconducting polymer/TiO_x/fullerene derivative as the phase separation assistant material) and organic electrode. The current density and voltage characteristics were measured using a direct-current voltage and a current source/monitor under illumination with AM 1.5G simulated solar light at 100 mW/cm². The phase-separated structures of the photoactive layers were investigated by scanning electron microscopy. The three-component bulk heterojunction solar cell with the p-type semiconducting polymer/TiO_x/fullerene derivative structure as a photoactive layer exhibited higher current density than the conventional two-component solar cell.

Biography

Takehito Kato is an Associate Professor of Mechanical Engineering in National Institute of Technology, Oyama College, Japan. He has received his PhD in 2007 at Kyushu Institute of Technology, Japan and had been a Researcher at Sumitomo Chemical Co. Ltd. during 2007-2012. His current research focuses on morphology control of organic-inorganic hybrid phase structure and energy conversion devices based on organic-inorganic hybrid materials. He has published articles in several international peer-reviewed journals and attended more than 100 national and international conferences. Furthermore, he has published over 60 patent applications.

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Quantitative characterization of the crystallinity of polycrystalline materials by applying electron back-scatter diffraction**Hideo Miura**

Tohoku University, Japan

Recently, physical properties of polycrystalline materials have been found to vary drastically depending on their micro texture. The crystallinity of grain boundaries was found to dominate both their mechanical and electrical properties and long-term reliability. This is because various defects such as vacancies, impurities, dislocations and local strain easily concentrate around grain boundaries and thus, degrade the quality of atomic configuration in grains and grain boundaries. In this talk, a grain boundary is defined as volumetric transition area between two grains, though it has been defined as a line interface between nearby grains. The quality of grain boundaries is independent of crystallographic orientation of nearby grains. Crystallinity of grain boundaries can be evaluated quantitatively by applying Electron Back-Scatter Diffraction (EBSD) method. The order of atom arrangement in the observed area is analyzed by the sharpness of Kikuchi lines obtained from the observed area. Various materials properties vary drastically depending on the order of atomic alignment, in particular, in grain boundaries. Both fluctuation and degradation of various properties of materials such as heat-resistant alloys and thin films are investigated from the viewpoint of the crystallinity of grains and grain boundaries. In addition, the diffusion of component elements is dominated by the local quality of grain boundaries. The degradation of materials mainly starts to occur around grain boundaries with low crystallinity because atomic diffusion is accelerated drastically along the poor-quality grain boundaries. Therefore, it is very important to evaluate the crystallinity of advanced materials or assuring their safe and reliable operation.

Biography

Hideo Miura has completed his PhD from Tohoku University, Japan. He had worked as a Chief Researcher and is the Director and Professor of Fracture and Reliability Research Institute. His main research topic is prediction and prevention of fracture of advanced functional materials and thin-film devices. He has published more than 200 technical papers in the field of mechanical reliability of various materials and thin-film devices and obtained more than 200 patents all over the world.

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Optimization of mechanical properties for a gear steel alloy for aero-engine applications**Zakaria Abdallah¹, M R Bache¹, K M Perkins¹, M Rawson² and J Hetherington²**¹Swansea University, UK²Rolls-Royce, UK

The characterization of steel alloys, candidates for employment as a gear material for future gas turbine aero-engine, will be described in the present study. Comparative studies were initially performed on seven potential steel alloy systems, considering a range of properties including mechanical behavior, the forgeability of the alloy, the depth and carbon content of the carburized layer alongside the Prior Austenite Grain (PAG) size. A major objective was to obtain a fully martensitic microstructure through quenching, deep freezing and tempering treatment of the chosen steel alloy. Specifically, the microstructures generated from various heat treatments alongside carburizing trials to improve the surface wear resistance will be characterized through metallographic and hardness assessments. The inspection methods employed to quantify the amount of carbon in the carburized layer included Wavelength Dispersive Spectroscopy (WDS) alongside electron probe micro analysis (EPMA). Flow stress was evaluated using Right Circular Cylinder (RCC) specimens tested under compression across a wide range of temperature and strain rate, with the associated thermo-mechanically driven phase transformations studied using Differential Scanning Calorimetry (DSC) and dilatometry, all supporting DEFORM® process modeling.

Biography

Zakaria Abdallah is the Principal and Lead Research Officer of Fatigue and Fracture in the Steel and Metals Institute at Swansea University, UK. He also worked at the Rolls-Royce University Technology Centre at Swansea University. He has worked as a Consultant for various industries, e.g. Airbus, TIMET, ETD, Rolls-Royce, in the UK within Swansea Materials Research and Testing (SMaRT) Ltd. he leads, or has led, several modules at Swansea University, e.g. advanced materials, fundamental of materials, maths for materials engineers, design against fatigue, etc. He has a very good track record of publications in internationally-recognized and peer-reviewed journals alongside international conferences and open access books. His research interests include steel and metals, composite materials, materials characterization, creep and fatigue, life predictions of materials, thermo-mechanical testing and heat treatment optimization.

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Large-scale synthesis of functional nanoparticles using a coaxial turbulent jet mixer**Jong-Min Lim**

Soonchunhyang University, Republic of Korea

Nanoparticles are widely studied for the diagnosis and therapy of various diseases. Microfluidic platforms are adopted for the synthesis of various nanoparticles due to controllability and reproducibility in their physicochemical properties. However, there are several intrinsic limitations in conventional Polydimethylsiloxane (PDMS) microfluidic systems for the synthesis of nanoparticles. In this work, we report a coaxial turbulent jet mixer capable of synthesizing various types of functional nanoparticles with high-throughput manner, while maintaining the controllability and reproducibility of PDMS microfluidic systems. In the coaxial turbulent jet mixer, the inner flow stream containing raw materials mixed with outer stream of non-solvent by turbulent flow for self-assembly of nanoparticles by rapid solvent exchange method called nanoprecipitation. Two dimensionless parameters, flow velocity ratio and Reynolds number (Re), were used to classify the mixing behavior into flow regimes. Operating in the turbulence jet regime, the mixing time could be precisely controlled by changing the Re. Nanoparticles obtained using the coaxial turbulent jet mixer at high Re (i.e., rapid mixing) were more homogeneous and smaller than those synthesized by bulk mixing, because the mixing time scale is more controllable and shorter than the characteristic aggregation time scale. Since the coaxial turbulent jet mixer is compatible with various organic solvents, it is versatile system where various types of nanoparticles. Various functional agents could be loaded in the nanoparticles during the nanoprecipitation. The coaxial turbulent jet mixer can be used to make functional nanoparticles with high-throughput and reproducible manner suitable for clinical studies and mass production.

Biography

Jong-Min Lim has completed his PhD degree in Chemical and Biomolecular Engineering from KAIST. After Post-doctoral studies from KAIST, Harvard Medical School and MIT, he has worked in Samsung Electronics as a Principal Engineer. Currently, he is an Assistant Professor in Department of Chemical Engineering, Soonchunhyang University. He has published more than 25 papers.

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Effect of Nb₂O₅/Ni catalysis on the kinetics behavior of MgH₂ solid-hydrogen storage system**Mohammad Banyan and M Sherif El-Eskandarany**

Kuwait Institute for Scientific Research, Kuwait

In the light of ever-increasing global energy consumption engaged with greenhouse gas emissions, our world faces difficult energy challenges regarding to the fuel sources, climate change and local air pollution. Hydrogen, which holds tremendous promise as a new clean energy option is considered as an efficient source of primary energy. Among the hydrogen economy challenges of production and transportation technologies, hydrogen storage presents the most crucial difficulty restricting utilization of hydrogen energy for real applications. However, Mg metal is the best known cheap solid-state hydrogen storage medium with high hydrogen capacity and operational cost effectiveness; it shows inherent poor hydrogenation/dehydrogenation kinetics and high thermal stability. In the present work, we have succeeded to prepare a new system of nanocrystalline MgH₂ powders doped with a mixture of 8 wt.% Nb₂O₅/2 wt.% Ni powders nanocatalytic agent that possesses superior hydrogenation/dehydrogenation kinetics (2.6/3 min) at relatively low temperature (250 °C) with long cycle-life-time (400 hours). The synthesized nanocomposite powders were consolidated into green-compacts using cold pressing technique. The compacts were utilized as solid-state hydrogen source needed for charging a battery of a cell-phone device, using integrated Ti-tank/commercial Proton Exchange Membrane (PEM) fuel cell system.

Biography

Mohammad Banyan is working as a Research Assistant at the Department of Nanotechnology and Advanced Materials at Kuwait Institute for Scientific Research (KISR). He has completed his Bachelor's degree in Mechanical Engineering from Cleveland State University.

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Enhancing transport properties of $\text{Bi}_2\text{Te}_3\text{-xSex}$ alloys via doping for thermoelectric power generation applications**Omer Meroz and Yaniv Gelbstein**

Ben-Gurion University of the Negev, Israel

While trying to find new alternative energy resources, new technological developments must be made to bring the society one step closer to a cleaner environment. The rising awareness of the global warming effect as well as the steady decline in the quantity of current resources and subsequently the climb in their price drive the search for improving current energy usage and finding new energy resources. Thermoelectric devices take thermal heat, either directly from solar energy or as a byproduct of fuel burn and transform it to electricity. The performance of thermoelectric devices is assessed by the dimensionless figure of merit ZT of the material, defined as $ZT = \alpha^2 \sigma T / \kappa$, where α , σ , κ and T are the Seebeck coefficient, the electrical and thermal conductivities and the absolute temperature, respectively. The thermal conductivity is a combination of thermal conductivity via electrons, κ_e and via phonons, κ_l . The main difficulty in improvement of the efficiency of a thermoelectric device is due to the complex relation between σ , α and κ . Improving the performance of thermoelectric materials is usually done either by improving the power factor, $\alpha^2 \sigma$ or by applying phonon scattering methods in order to lower the thermal conductivity. Bismuth-telluride-based alloys are of great importance not only as the best thermoelectric materials with the maximal ZT values close to unity near room temperature but also due to the potential for further performance improvement. In this study $\text{Bi}_2\text{Te}_{3-x}\text{Sex}$ compositions were electronically optimized by various CHI_3 doping levels, preferred alignment of the crystallographic orientation and lattice thermal conductivity minimization. The synthesis route included rocking furnace melting, energetic ball milling and hot pressing under optimal conditions for enhancement of the thermoelectric figure of merit, ZT commonly applied in low temperature power generation applications. The transport properties in perpendicular to the pressing direction were examined.

Biography

Omer Meroz is student at Ben-Gurion University of the Negev, Israel. Her research experience includes various programs, contributions and participation in different countries for diverse fields of study. She is a recipient of many awards and grants for his valuable contributions and discoveries in major area of research. Her research interests lie in Major areas of Study. She is committed to highest standards of excellence and it proves through her work and experience.

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Investigation on the nature of the verwey transition in Cu-doped Fe_3O_4 **Yousef Kareri**

University of New South Wales, Australia

Magnetite (Fe_3O_4), the oldest known magnet, is still a hotly debated material in scientific research, due to its complex magnetic, electronic and transport properties. One of the most interesting physical phenomena associated with Fe_3O_4 is the occurrence of a metal-insulator transition at ~ 120 K (TV), the so-called Verwey transition, which is associated to a charge ordering below TV, accompanied with a structural transition from the cubic phase to the monoclinic phase. However, due to the twinning of crystal domain, the detailed crystallographic structure is not fully solved yet and different charge ordered, and bond-dimerized ground states have been proposed. In order to overcome this problem, we have investigated Cu-doped Fe_3O_4 and have determined the stability range of the Verwey phase in the phase diagram of $\text{Fe}_{1-x}\text{Cu}_x\text{Fe}_2\text{O}_4$. Using neutron diffraction and high-resolution X-ray synchrotron diffraction we have investigate both the crystallographic and magnetic structure of Cu-doped Fe_3O_4 ($\text{Cu}_x\text{Fe}_{3-x}\text{O}_4$ with $x=0$ to $x=0.95$) to elucidate the effect of doping on the Verwey transition. Data obtained from both complementary diffraction techniques indicate that the Verwey transition temperature and the magnetic structure, in particular the magnetic moment remains unchanged up to highest doping levels of 75% Cu-substitution. The large stability range of the Verwey phase is a surprising result and did require a systematic investigation. The analysis of our high-resolution X-ray synchrotron diffraction data in combination with the neutron diffraction data did allow us to extract detailed information on the precise doping mechanism, for example, if the Cu-ions are placed on tetrahedral or octahedral sites in the spinel structure. The obtained diffraction data provide therefore valuable information on the charge order transition, i.e. the Verwey transition.

Biography

Yousef Kareri is student at University of New South Wales, Australia. His research experience includes various programs, contributions and participation in different countries for diverse fields of study. He is a recipient of many awards and grants for his valuable contributions and discoveries in major area of research. His research interests lie in Major areas of Study. He is committed to highest standards of excellence and it proves through his work and experience.

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Study on size variations of liposomes under osmotic pressure using asymmetrical flow Field-Flow Fractionation (AsFIFFF) - Multi Angle Light Scattering (MALS)**Minwook Kim, Woonjung Kim, Seungho Lee and Jongjin Jung**
Hannam University, Republic of Korea

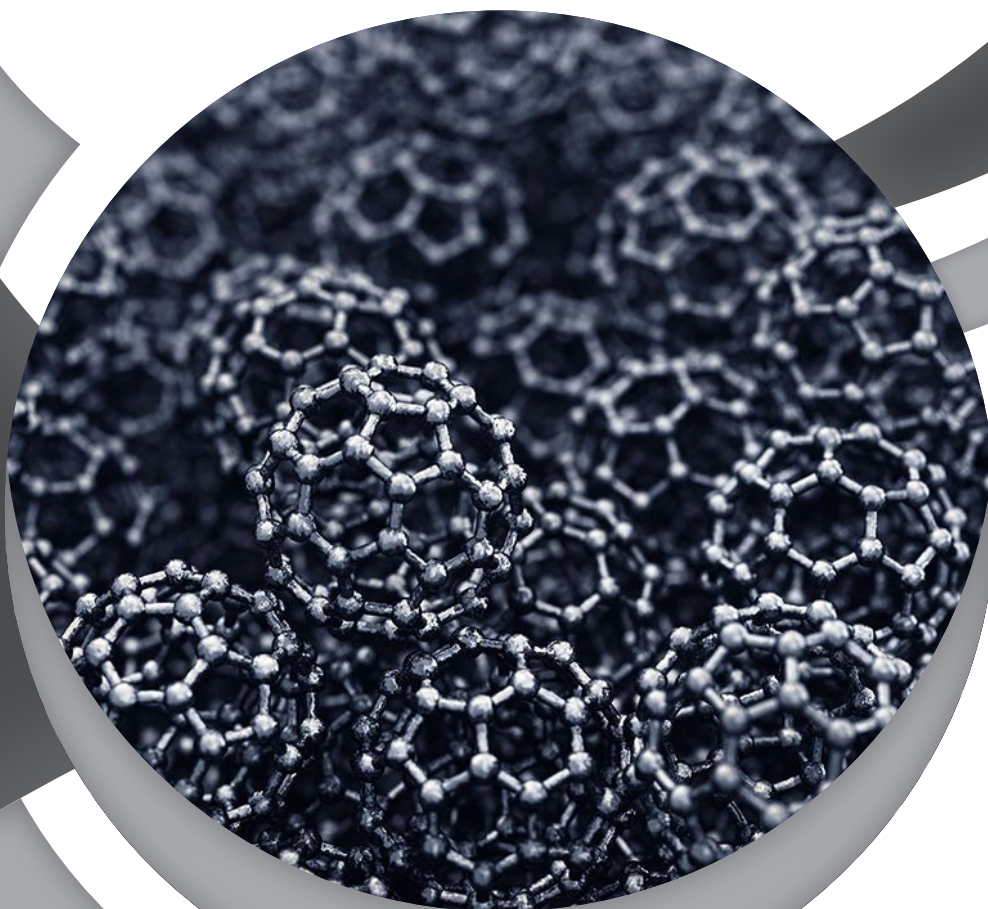
Liposome has been used for drug delivery, cosmetics, and foods due to easy control of the size, robust similarity to biological membrane, and low toxicity. Especially, the size and stability of liposomes under osmotic stress are of great importance because of leakage of contents and vesicle disruption in drug delivery. Measurement of the size and shape of liposome has been usually performed using Transmission Electron Microscope (TEM) and Atomic Force Microscopy (AFM), etc. However, its cost and complicated process has limited facile characterization of liposome. Thus, we have utilized asymmetrical flow Filed-Flow Fractionation (AsFIFFF) and Dynamic Light Scattering (DLS) for the facile prediction of size, its distribution and shape variations. In this study, we confirmed the size and shape variations of liposomes using AsFIFFF-MALS, DLS-Zeta and Cryo-SEM under osmotic pressure. The stability of liposome was enhanced as the lipid concentration is higher and the storage temperature is lower. The results of AsFIFFF showed that, the liposome turned into a rod-like shape in the hypertonic condition and a sphere-like one in the hypotonic solution. Based on these results, we assessed the correlation between the shape of liposome and efficiency of its cell membrane fusion in various osmosis conditions by encapsulating fluorescence dyes in liposomes. This study gave us the insight into both the stability of liposome and its release efficiency under osmotic pressure, in addition to optimal conditions for liposome preparation when it is used for a practical drug formulation.

Biography

Minwook Kim has earned his undergraduate course in Chemistry at Hannam University, Republic of Korea . Presently he is a graduate student of Chemistry at Hannam University.

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Functionalization of honeycomb-patterned porous polymer films using a reactive vapor in breath figure method**Do Sung Huh and Young Woo Kim**
Inje University, Republic of Korea

A new strategy is proposed to obtain pore functionalized honeycomb-patterned porous films by *in situ* polymerization during breath figure process. The polystyrene or hydrophobic polymers with a reactant materials such as benzoyl peroxide, SnCl_2 mixture in chloroform are casted under humid conditions generated by pumping air containing a reactive vapor such as aniline hydrochloride, Na_2S , etc., in water. The resulting films showed honeycomb-patterned porous morphology with functionalized pores. The formation of functionalized film is confirmed by color, conductivity, SEM and UV-visible studies, etc. The strategy can be extended to obtain various pore functionalized films by choosing one reactant in polymer solution and other in humid vapors with a facile method of one-step breath figure process.

Biography

Do Sung Huh has completed his PhD from Korea Advanced Institute of Science and Technology and Post-doctoral studies from West Virginia University of Chemistry Department. He is the Director of Inje University at Department of Chemistry and Nano Science and Engineering. He has published more than 50 papers in reputed journals and has been serving as an Editorial Board Member of reputed. His research area is functional polymer films.

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Anion-exchange membrane with highly cross-linking and high ion-aggregation for non-aqueous vanadium redox flow batteries**Hu-Geun Kwon and Seong-Ho Choi**
Hannam University, Republic of Korea

The Non-aqueous Vanadium Redox Flow Battery (NVRFB) has the advantage of being able to operate at a higher cell voltage, higher energy density, and wider temperature than the all-Vanadium Redox Flow Battery (VRFB). However, the development of NVRFB is still in its early stages of research and remains a challenge to be solved before it can be successfully applied to practical applications. One of the challenges is the ion exchange membrane, a key element in determining the energy efficiency of battery. Ion exchange membranes in NVRFB systems are mainly anion-exchange membranes to prevent permeability of metal cationic active species and serve to conduct BF_4^- or PF_6^- ions. However, due to the size of BF_4^- or PF_6^- ions, ionic conductivity is low because of ion size, which limits battery efficiency. Therefore, the novel anion-exchange membrane with large size ion channel must for NVRFB be developed in order to commercialize. In this study, anion-exchange membranes were synthesized by inducing ionic aggregation by introducing crosslinking and ion exchanger simultaneously. It is believed that the aggregation of the ion exchanger through crosslinking will have a high ionic conductivity by forming an ion channel and the use of butyl reagent as a crosslinking agent will prevent crossover of energy storage material due to their size. As evidence, NVRFBs single cell with this crosslinked membranes yielded high voltage efficiency and showed a tendency to increase coulombic efficiency as the degree of crosslinking increased.

Biography

Hu-Geun Kwon has completed his Bachelor's degree from Hannam University, Republic of Korea and currently pursuing his Master's degree from Hannam University. He has studied ion-exchange membrane for non-aqueous redox flow batteries. His current research interests are crosslinked polymer electrolyte membrane for non-aqueous/aqueous redox flow batteries and anion exchange membrane fuel cell including ion transport phenomena.

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Binary planet-satellite nanostructures using RAFT polymer**Wentao Peng**

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The hierarchical self-assembly of distinct nanoelements into precisely ordered nanostructures requires efficient and flexible fabrication strategies. We established the precise and simple methods to synthesize bimetallic (gold-planet-silver-satellite) and metal-nonmetallic (silica-planet-gold-satellite) nanostructures using RAFT polymer as particle linker. For bimetallic systems, we employed RAFT star polymer to connect planet AuNP (~13 nm) and AgNP (~8 nm). For silica-planet-gold-satellite nanostructure, RAFT polymer is grown from SiO₂NP (~35 nm) using surface-initiated RAFT polymerization technique. The prepared nanoassemblies have well-defined structures in which a planet is encompassed by several satellites, thus simultaneously incorporating the properties of both planet and satellite nanoparticles. The strength of this approach includes the tunability of interparticle distance by tailoring the molecular weight of polymer molar mass. The precise arrangement of distinct nanocomponents provides a template for 2D binary chemical patterning on nanoscale. We demonstrate the self-assembly monolayer of planet-satellite nanostructures on substrate with subsequently plasma treatment removing polymer for further chemical modification on nanoparticles. Our results highlight the general applicability of RAFT polymerization as a nanosynthesis platform for fabricating hierarchical nanostructure.

Biography

Wentao Peng is currently a PhD Fellow in Macromolecular Chemistry at the Georg-August-Universität Göttingen, Germany. His research focuses on the development of nanohybrid material based on novel nanocomponents and functional polymer for various applications.

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Novel polymer electrolyte membrane which proton conductive channel being constructed by core-shell type hybridized silica nanofillers**Keiji Shito¹, Yuki Takahashi¹, Satoshi Sekine¹, Tomohiro Nohara¹, Kazuki Koseki¹, Keisuke Tabata¹, Akito Masuhara¹, Philipp Vana², Wentao Peng² and Tohihiko Arita³**¹Yamagata University, Japan²University of Gottingen, Germany³Tohoku University, Japan

Polymer Electrolyte Fuel Cell (PEFC) is promising energy generating system because of their high energy conversion efficiency, low temperature operation and compact cell design. We designed a novel Polymer Electrolyte Membrane (PEM) for PEFC using inexpensive materials and fabricating precise nanostructures. We have focused on general inorganic filler filling method, which has advantage on improvement of heat resistance and gas barrier properties of the membrane. The structure of designed novel PEM composed of 2D oriented proton conductive polymer and spherical silica Nano Particles (NPs). Our PEM consists of silica NPs with proton conductive polymer layer prepared by Reversible Addition-Fragmentation chain Transfer Polymerization with Particles (RAFT PwP) on its surface. RAFT PwP can prepare precisely adsorbed hydrophilic polymer layer on particles surface, 2D ion conductive channel consists of weak acids can be effectively prepared. As a primary examination, proton conductive polymer was selected as inexpensive polymers with easy handling to examine our model.

Biography

Keiji Shito has completed his Master's degree from Yamagata University and PhD from Graduate School of Science and Engineering, Yamagata University. He is serving as a Research Fellowship for Young Scientists at the Japan Society for the Promotion of Science (JSPS).

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