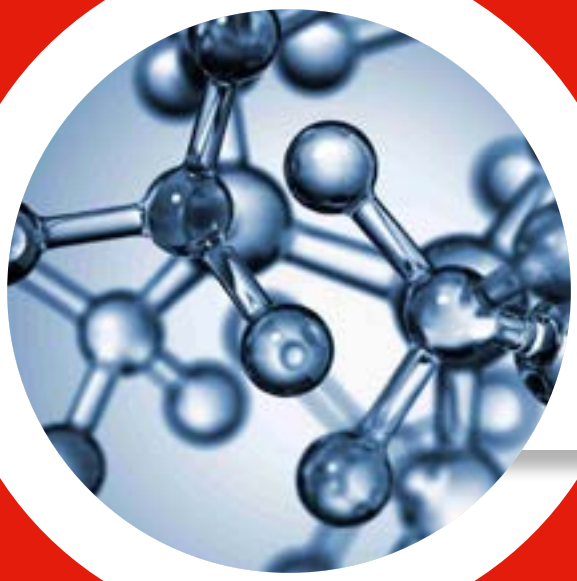

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SCIENTIFIC TRACKS & ABSTRACTS

Raman Singh, Mater Sci Nanotechnol 2022, Volume 06

Graphene Coatings - A disruptive approach for mitigation of corrosion

Raman Singh
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Corrosion and its mitigation costs dearly (any developed economy loses 3-4% of GDP due to corrosion, which translates to ~$250b to annual loss USA). In spite of traditional approaches of corrosion mitigation (e.g., use of corrosion resistance alloys such as stainless steels and coatings), loss of infrastructure due to corrosion continues to be a vexing problem. So, it is technologically as well as commercially attractive to explore disruptive approaches for durable corrosion resistance.

Graphene has triggered unprecedented research excitement for its exceptional characteristics. The most relevant properties of graphene as corrosion resistance barrier are its remarkable chemical inertness, impermeability and toughness, i.e., the requirements of an ideal surface barrier coating for corrosion resistance. However, the extent of corrosion resistance has been found to vary considerably in different studies. The author's group has demonstrated an ultra-thin graphene coating to improve corrosion resistance of copper by two orders of magnitude in an aggressive chloride solution (i.e., similar to sea-water).

In contrast, other reports suggest the graphene coating to actually enhance corrosion rate of copper, particularly during extended exposures. Authors group has investigated the reasons for such contrast in corrosion resistance due to graphene coating as reported by different researchers. On the basis of the findings, author's group has succeeded in demonstration of durable corrosion resistance as result of development of suitable graphene coating. The presentation will also assess the challenges in developing corrosion resistant graphene coating on most common engineering alloys, such as mild steel, and presents results demonstrating circumvention of these challenges).

Biography

Professor Raman Singh's expertise includes: Alloy Nano/Microstructure-Corrosion Relationship, Stress Corrosion Cracking (SCC), Corrosion/SCC of Biomaterials, Corrosion Mitigation by Novel Material (e.g., Graphene), Advanced and Environmentally Friendly Coatings, High Temperature Corrosion. He has supervised 50 PhD students. He has published over 250 peer-reviewed international journal publications, 15 books/book chapters and over 100 reviewed conference publications. His professional responsibilities include editor-in-chief of two journals, Fellow ASM International and Engineers Australia, over 40 keynote/plenary talks at international conferences (besides numerous invited talks), leadership (as chairperson) of a few international conferences.

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Bunsho Ohtani, Mater Sci Nanotechnol 2022, Volume 06

Design, preparation and characterization of functional nanomaterials based on energy-resolved distribution of electron traps

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How can we design functional solid materials, such as catalysts and photocatalysts? What is the decisive structural parameters controlling their activities, performance or properties? What is obtained as structural properties by popular conventional analytical methods, such as X-ray diffraction (XRD) or nitrogen-adsorption measurement, is limited to bulk crystalline structure and specific surface area, i.e., no structural characterization on amorphous phases, if present, and surface structure has been made so far. This is because there have been no macroscopic analytical methods to give surface structural information including possibly-present amorphous phases. Recently, we have developed reversed double-beam photoacoustic spectroscopy (RDB-PAS) which enables measure energy-resolved distribution of electron traps (ERDT) for semiconducting materials such as metal oxides [1,2]. Those detected electron traps (ETs) seem to be predominantly located on the surface for almost all the metal oxide particles, and therefore they reflect macroscopic surface structure, including amorphous phases, in ERDT patterns. Using an ERDT pattern with the data of CB bottom position (CBB), i.e., ERDT/CBB pattern, it has been shown that metal oxide powders, and the other semiconducting materials such as carbon nitride, can be identified without using the other analytical data such as XRD patterns or specific surface area, and similarity/differentness of a pair of metal-oxide samples is quantitatively evaluated as degree of coincidence of ERDT/CBB patterns. An approach of material design based on the ERDT/CBB analyses is introduced [3].

[1] Chem. Commun. 2016, 52, 12096-12099. [2] Electrochim. Acta 2018, 264, 83-90. [3] Catal. Today2019,321-322,2-8.

Biography

The research work on photo catalysis by Professor Ohtani started in 1981 when he was a Ph. D. course student in Kyoto University. Since then he has been studying photocatalysis and related topics for more than 30 years and published more than 300 original papers (h-index: 72) and two single-author books. After gaining his Ph. D. degree from Kyoto University in 1985, he became an assistant professor in the university. In 1996, he was promoted to an associate professor in Graduate School of Science, Hokkaido University and was then awarded a full professor position in Institute for Catalysis, Hokkaido University in 1998 and retired at the end of March 2022.

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Khairul Habib, Mater Sci Nanotechnol 2022, Volume 06

Proved thermophysical properties and energy efficiency of aqueous ionic liquid/mxene nanofluid in a hybrid PV/T solar system

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In this research, a binary solution of ionic liquid (IL) + water based ionanofluids are formulated successfully with two dimensional MXene (Ti3C2) Nano additives at three distinct concentrations of 0.05, 0.10 & 0.20 weight%. The layered structure of MXene and high absorbance of prepared nanofluids have been perceived by SEM and UVVis respectively. Rheometer and DSC are used to assess the viscosity and heat capacity respectively while transient hot wire technique is engaged for thermal conductivity measurement. After characterization of ionanofluids, a numerical study is executed in a PV/T solar system with optimum concentration of 0.20%. Maximum 47% improvement in thermal conductivity is observed for 0.20 wt% loading of MXene. Meanwhile, specific heat is noticed to rise consistently as temperature and concentration increase for each sample. More explicitly, as the temperature is increased from 25 to 60 °C specific heat augments from 2.4 to 2.53 J/g.K for 0.20 wt% of Ti3C2. Furthermore, the viscosity rises from 2.69 to 2.99 mPa.s with addition of Ti3C2 by 0.05 wt%, while for 0.10 and 0.20 wt%, viscosity further increases to 3.01 and 3.06 mPa.s respectively. Conversely, viscosity decreases substantially as the temperature increases from 20 to 60 °C. A comparative analysis in terms of heat transfer performance with three different nanofluids in PV/T system shows that, IL+ water/MXene ionanofluid exhibits highest thermal, electrical and overall heat transfer efficiency compared to water/alumina, palm oil/MXene and water alone. Maximum electrical efficiency and thermal efficiency are recorded as 13.95% and 81.15% respectively using IL + water/MXene, besides that, heat transfer coefficients are also noticed to increase by 12.6% and 2% when compared to water/alumina and palm oil/MXene respectively. In conclusion, it can be demonstrated that MXene dispersed ionanofluid might be great a prospect in the field of heat transfer applications since they can augment heat transfer rate considerably which improves system efficiency.

Biography

Khairul Habib obtained his B.Sc. (Hons.) and M.Eng. degrees from Bangladesh University of Engineering and Technology and National University of Singapore in 2002 and 2005, respectively. He received his Ph.D. in 2009 from the Kyushu University, Japan. He worked as a Research Scientist in Solar Energy Research Institute of Singapore prior to joining the Mechanical Engineering Department of Universiti Teknologi PETRONAS in 2011 as a Senior Lecturer. His main research interests are thermally powered sorption systems, nanofluid enhanced heat transfer, zero energy building, and energy efficiency assessment. He has published more than 80 articles in peer reviewed journals and international conference proceedings. He is a Chartered Engineer from IMechE, UK and a member of American Society of Mechanical Engineers (ASME).

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Osman Adiguzel, Mater Sci Nanotechnol 2022, Volume 06

Shape memory phenomena and nanoscale aspects of reversibility in shape memory alloys

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Shape memory alloys take place in a class of smart materials by exhibiting a peculiar property called shape memory effect. This property is characterized by the recoverability of two certain shapes of material at different temperatures. These materials are often called smart materials with the functionality and capacity of responding to changes in the environment. These materials are used as shape memory devices in many interdisciplinary fields such as medicine, bioengineering, metallurgy, building industry and many engineering fields. Shape memory effect is initiated by cooling and deformation, and performed thermally by heating, and this behavior is called thermoelasticity.This phenomenon is based on lattice reactions, called martensitic transformation, and this transformation is characterized by changes in the crystal structure of the material. This is plastic deformation; strain energy is stored after releasing and released on heating by recovering the original shape of material. These alloys are mainly used as deformation absorbent materials in control of civil structures subjected to seismic events, due to the absorbance of strain energy during any disaster or earthquake. These alloys exhibit another property, called superelasticity performed by stressing and releasing the material in parent phase region. Loading and unloading paths are different in stress strain diagram, and cycling loop refers to the energy dissipation. Thermal induced martensitic transformation occurs on cooling along with lattice twinning with cooperative movements of atoms by means of lattice invariant shear, which occurs in two opposite directions, 110 type directions on the 110 type planes of austenite matrix. Ordered parent phase structures turn into twinned martensite structures with thermal induced transformation, and the twinned structures turn into the detwinned structures by means of stress induced martensitic transformation by stressing the material in the martensitic condition.

Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures at high temperature parent phase field. Lattice invariant shear and twinning is not uniform in copper based ternary alloys and gives rise to the formation of complex layered structures, depending on the stacking sequences on the close-packed planes of the ordered parent phase lattice.

In the present contribution, x-ray diffraction and transmission electron microscopy (TEM) studies were carried out on two copper based CuAlMn and CuZnAl alloys. X-ray diffraction profiles and electron diffraction patterns reveal that both alloys exhibit super lattice reflections inherited from parent phase due to the displacive character of martensitic transformation. X-ray diffractograms taken in a long-time interval show that diffraction angles and intensities of diffraction peaks change with the aging duration at room temperature. Especially, some of the successive peak pairs providing a special relation between Miller indices come close each other. This result refers to the rearrangement of atoms in diffusive manner.

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied were focused on shape memory effect in shape memory alloys. He worked as research assistant, 1975-80, at Dicle University and shifted to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has been retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He supervised 5 PhD- theses and 3 M.Sc- theses and published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Also, he joined over 70 online conferences in the same way in pandemic period of 2020-2021.

Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

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Sergey Suchkov1, Mater Sci Nanotechnol 2022, Volume 06

Antibody-Proteases as translational tools of the newest generation to be applied for biodesign and bioengineering to get precision and personalized healthcare services re-armed

Sergey Suchkov

Moscow State University of Medicine & Dentistry (MGMSU), Russia

Catalytic Abs (catAbs) is multivalent immunoglobulins (Igs) with a capacity to hydrolyze the antigenic (Ag) substrate. In this sense, proteolytic Abs (Ab-proteases) represent Abs to provide proteolytic effects.

Abs against myelin basic protein/MBP with proteolytic activity exhibiting sequence-specific cleavage of MBP is of great value to monitor demyelination whilst in MS. The activity of Ab-proteases was first registered at the subclinical stages 1-2 years prior to the clinical illness. And the activity of the Ab-proteases revealed significant correlation with scales of demyelination and the disability of the patients as well. So, the activity of Ab-proteases and its dynamics tested would confirm a high subclinical and predictive (translational) value of the tools as applicable for personalized monitoring protocols.

Similar results have been gained by our team in autoimmune myocarditis and thyroid autoimmunity conditions to get a presence of thyroid and cardiac autoAgs-associated proteolytic activity occurred.

Of tremendous value are Ab-proteases directly affecting remodeling of tissues with multilevel architectonics (for instance, myelin, cardiac and thyroid tissues).By changing sequence specificity one may reach reduction of a density of the negative proteolytic effects within the myelin sheath and thus minimizing scales of demyelination. Ab-proteases can be programmed and re-programmed to suit the needs of the body metabolism or could be designed for the development of new catalysts with no natural counterparts. Further studies are needed to secure artificial or edited Ab-proteases as translational tools of the newest generation to diagnose, to monitor, to control and to treat and rehabilitate MS patients at clinical stages and to prevent the disorder at subclinical stages in persons-at-risks to secure the efficacy of regenerative manipulations.

Biography

Sergey Suchkov graduated from Astrakhan State Medical University and awarded with MD, then in 1985 maintained his PhD at the I.M. Sechenov Moscow Medical Academy and in 2001, maintained his Doctorship Degree at the Nat Inst of Immunology, Russia. From 1987 through 1989, he was a senior Researcher, Koltzov Inst of Developmental Biology. From 1989 through 1995, he was a Head of the Lab of Clinical Immunology, Helmholtz Eye Research Institute in Moscow. From 1995 through 2004, a Chair of the Dept for Clinical Immunology, Moscow Clinical Research Institute (MONIKI. Dr Suchkov has been trained at: NIH; Wills Eye Hospital, PA, USA; University of Florida in Gainesville; UCSF, S-F, CA, USA; Johns Hopkins University, Baltimore, MD, USA. He was an Exe Secretary-in-Chief of the Editorial Board, Biomedical Science, an international journal published jointly by the USSR Academy of Sciences and the Royal Society of Chemistry, UK. At present, Dr Sergey Suchkov is a Chair, Dept for Personalized Medicine, Precision Nutriciology and Biodesign, MGUPP. He is a member of the: New York Academy of Sciences, USA; American Chemical Society (ACS), USA; American Heart Association (AHA), USA; EPMA (European Association for Predictive, Preventive and Personalized Medicine), Brussels, EU; ARVO (American Association for Research in Vision and Ophthalmology); ISER (International Society for Eye Research); PMC (Personalized Medicine Coalition), Washington, USA.

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Alexander G. Ramm, Mater Sci Nanotechnol 2022, Volume 06

Wave scattering by many small particles and applications

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The theory of wave scattering by many small impedance particles of arbitrary shapes is developed. The basic assumptions are: a d λ, where a is the characteristic size of particles, d is the smallest distance between the neighboring particles, λ is the wavelength. This theory allows one to give a recipe for creating materials with a desired refraction coefficient. One can create material with negative refraction: the group velocity in this material is directed opposite to the phase velocity. One can create a material with a desired wave focusing property. Quantum-mechanical scattering by much potential with small supports is considered. The theory presented in this talk is developed in [1]-[9]. Practical realizations of this theory are discussed in [9]. In [9] the problem of creating material with a desired refraction coefficient is discussed in the case when the material is located inside a bounded closed connected surface on which the Dirichlet boundary condition is imposed.

Biography

A.G.Ramm was born in USSR and immigrated to USA in 1979. He is a US citizen, professor of mathematics at KSU, an author of more than 660 papers in mathematical and physical Journals, of 15 monographs, and an editor of 3 books. His scientific interests include differential and integral equations, operator theory, mathematical physics, especially scattering theory and inverse problems, numerical analysis, especially methods for solving ill-posed problems, various problems of applied mathematics and theoretical engineering. Professor A.G.Ramm was awarded many honors, including Fulbright Research Professorships in Israel and Ukraine, Mercator Professorship, NATO and DAAD professorships and grants, Khwarizmi international award, distinguished professorships in some countries and distinguished lectureships of London Mathematical Society and Hong Kong Mechanical society, and many other honors and awards. He gave invited plenary talks at many conferences throughout the world.

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