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VIRTUAL CONFERENCE ON

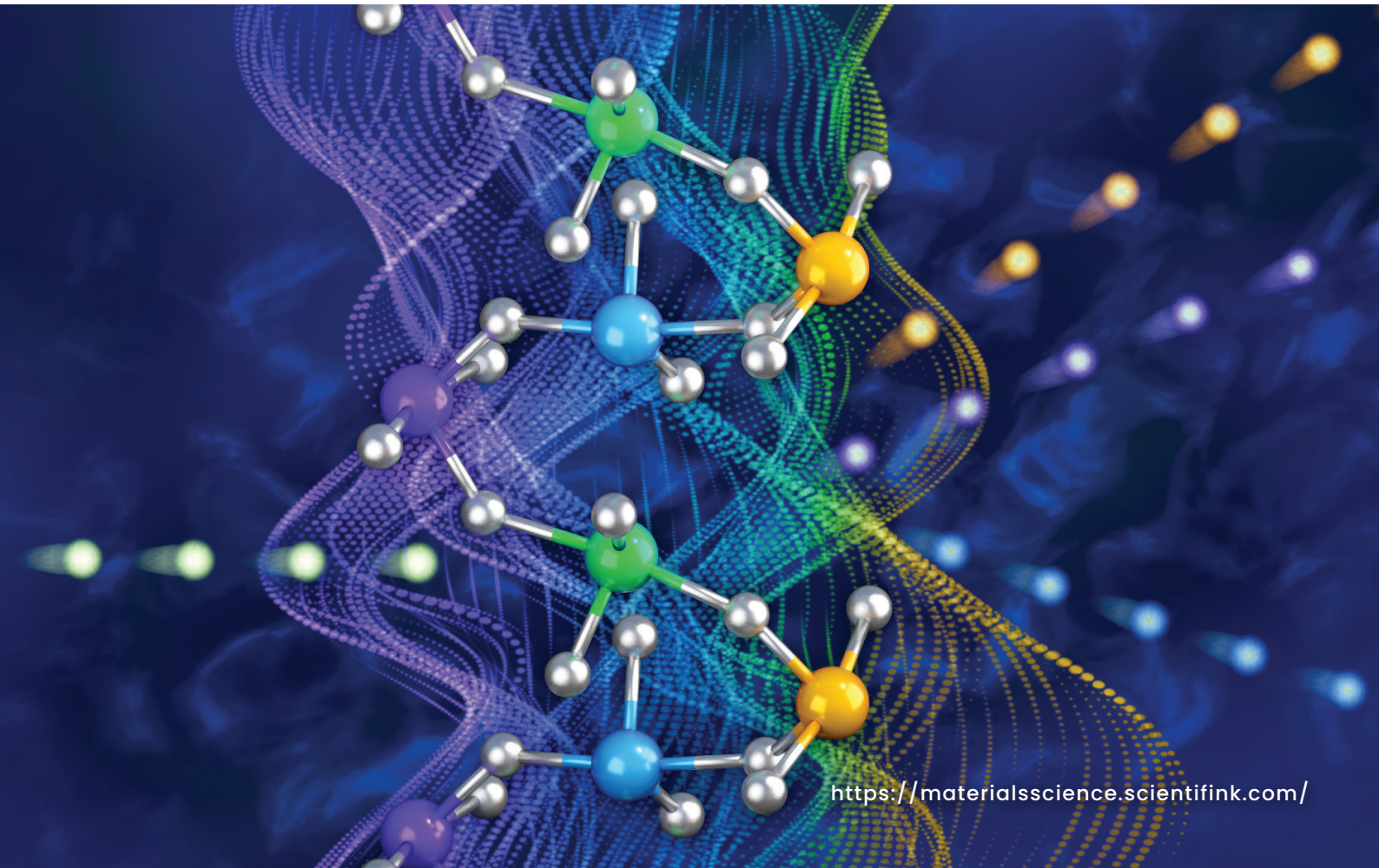
MATERIALS SCIENCE & ENGINEERING

Theme:

"Outlining the forefront research in the field of materials science and nanotechnology.

29-30 MAY 2023

Materials World 2023



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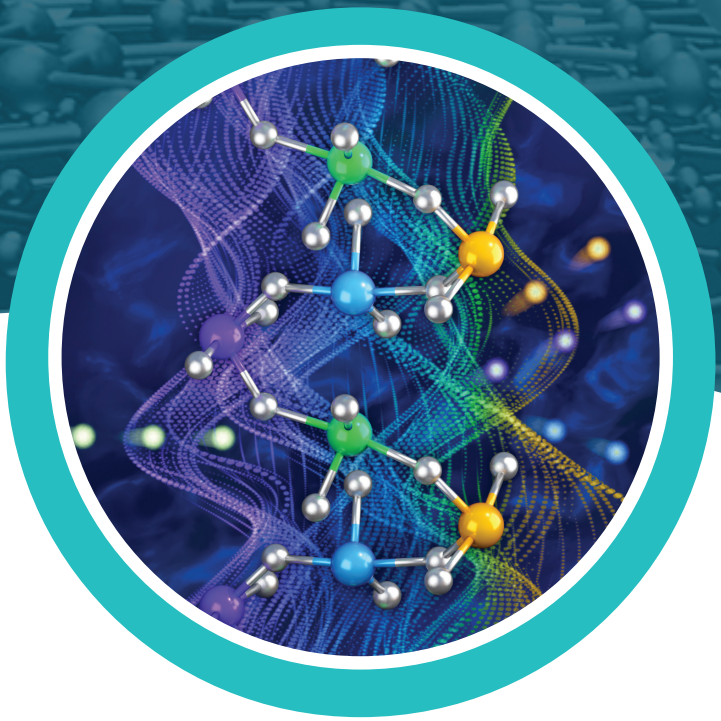

Virtual Conference on

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Keynote Forum

DAY-1

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Remarkable and Durable Corrosion Resistance of Metals and Alloys due to Ultra-thin Graphene Coatings

Raman Singh

Department of Mechanical & Aerospace Engineering, Department of Chemical & Biological Engineering, Monash University (Melbourne), Vic 3800, Australia

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.

What will audience learn from your presentation?

- Understanding of graphene, a material with unique characteristics, including as remarkable corrosion-resistant coating.
- Challenges in developing graphene coatings on nickel and copper, for their effective and durable corrosion resistance, and
- Non-trivial challenge of developing graphene coatings on mild steel.

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), He has supervised 52 PhD students. He has published over 260 peer-reviewed international journal publications, 15 books/book chapters and over 100 reviewed conference publications. His professional responsibilities include Guest Professorships at ETH Zurich (2020, 2023, 2024), US Naval Research Lab, Indian Isntitute of Science, and University of Connecticut, editor-in-chief of an Elsevier and an MDPI journal, Fellow ASM International and Fellow Engineers Australia, over 50 keynote/plenary talks at international conferences, leadership (as chairperson) of a few international conferences.

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Design, Preparation and Characterization of Photofunctional Nanomaterials Based on Energy-resolved Distribution of Electron Traps

Bunsho Ohtani

Professor Emeritus, Hokkaido University and Nonprofitable Organization, touche NPO, 1-6-414, North 4, West 14, Sapporo 060-0004, Japan

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., an 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 can be quantitatively evaluated as degree of coincidence of ERDT/CBB patterns. In this talk, an approach of material design based on the ERDT/CBB-pattern analyses is introduced [3].

1. Chem. Commun., 2016, 52, 12096–12099. [2] Electrochim. Acta, 2018, 264, 83–90. [3] Catal. Today, 2019, 321–322, 2–8.

What will audience learn from your presentation?

- Understanding the meaning and necessity of "identification" of materials on design, fabrication and characterization.
- Knowing the novel method of "reversed double-beam photoacoustic spectroscopy (RDB-PAS) for solid-material identification and characterization.
- Finding a unique way for the design of functional materials with structural properties.

Biography

The research work on photocatalysis by Professor Bunsho 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 40 years and published more than 300 original papers (h-index: 70) 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 the Catalysis Research Center (presently Institute for Catalysis), Hokkaido University in 1998 and retired at the end of March 2022. He was awarded several times form the societies related to chemistry, photochemistry, electrochemistry and catalysis chemistry.

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Chameleon Nanocarriers for Delivery of RNA Nanomedicines

Ernst Wagner[1,2]

[1]Pharmaceutical Biotechnology, Department of Pharmacy, Ludwig-Maximilians-Universität (LMU), Munich, Germany
[2]Center for NanoScience (CeNS), LMU, Munich, Germany

By early 2023, 24 gene therapy drugs and 21 RNA therapies reached the medical market. Targeted intracellular delivery remains the key requirement. For refinements of RNA nanocarriers we focus on a bioinspired, sequence-defined process including (i) use of artificial amino acids, (ii) precise assembly into sequences ('xenopeptides') by solid phase-assisted synthesis, and (iii) screening for delivery and selection of top candidates. A recent chemical evolution process combined aminoethylene amino acids as polar protonatable units with novel lipo amino fatty acids (LAFs) as hydrophobic protonatable motifs. These novel double pH-responsive nucleic acid carriers utilize intracellular delivery mechanisms of both cationic lipids and cationic polymers. The endosomal pH-dependent tunable polarity of LAF was successfully implemented by a central tertiary amine, which disrupts the hydrophobic character once protonated, resulting in drastic pH-dependent change in the logarithmic (octanol/water) distribution logD from around +1 (pH 7.4) to -1 (pH 5.5). This "molecular chameleon character" turned out to be highly advantageous for pDNA, siRNA, mRNA or CRISPER/Cas9 sgRNA delivery. Noteworthy, the efficiency of best performers was up to several 100-fold higher compared to previous carriers. Transfection activity of mRNA lipoplexes was maintained even in the presence of 90% serum and even at extremely low dosage of 3 picogram mRNA (~2 nanoparticles/cell), in the range of the viral potency. mRNA lipoplexes showed great in vivo performance in mice with high expression levels in spleen, tumor, lung, and liver upon intravenous administration of 1 µg luciferase mRNA. With this class of delivery carriers, also CRISPR Cas9 /sgRNA or siRNA can be delivered to therapeutically modulate cell functions.

What will audience learn from your presentation?

The audience will hear about:

- Synthetic formulations of therapeutic nucleic acids into nanoparticles
- Dynamic chemical properties ('chameleons') required for potent cellular entry
- precise solid-phase assisted assembly of novel carriers as xenopeptides.

Biography

Ernst Wagner is professor of Pharmaceutical Biotechnology and Center for Nanoscience at LMU Munich since 2001. From 1992-2001 he was Director Cancer Vaccines, Boehringer Ingelheim (first polymer-based gene therapy trial in 1994), 1987-1995 group leader at IMP Vienna and Vienna University Biocenter, 1985-1987 postdoc at ETH Zurich, in 1985 PhD in chemistry (TU Vienna). He is Academician of European Academy of Sciences, member of CRS College of Fellows, Board member of German Society for Gene Therapy. He has authored 497 publications, with 49 903 citations, h-index 112 (GS).

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Advancements of calcium-based host phosphor materials for phototherapy applications

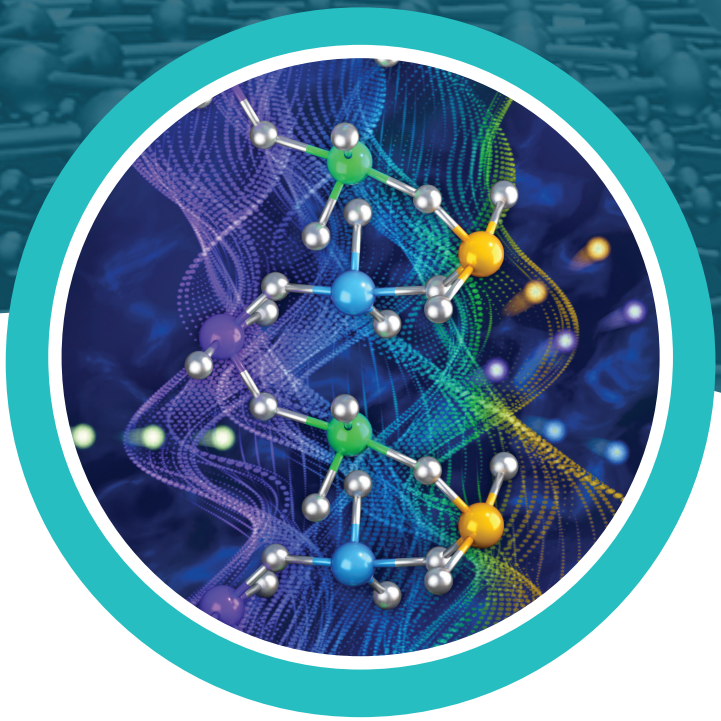
Leelakrishna Reddy

Department of Physics, University of Johannesburg, Johannesburg, South Africa

Apart from the use of sun therapy for the cure of many skin diseases and disorders of bygone days, nowadays artificial light sources of a narrow band (NB) ultraviolet-B (UVB) have effectively revolutionized the treatment the treatment of such skin diseases. This was achieved through the unique single line spectral peak emission of trivalent gadolinium (Gd^{3+}) ions in the narrow UV region of (310-313) nm in specific inorganic host materials, which is attributed to $^6P_{7/2} \rightarrow {}^8S_{7/2}$ transition of Gd^{3+} ion. Gd3+ activated host materials in fluorescent lamps are considered prime sources of NB UVB emissions. Calcium-based host materials are proving to be popular environments for embedding of dopants for such emissions. As such calcium-based phosphor materials are at the forefront of research for phototherapy applications because of their strong absorption in the UV region with Gd^{3+} as a activator. Applications of phosphor hosts materials of this nature are generally chemically and thermally stable, have a low synthesis temperature and produce enhanced NB UVB emission specifically suited for phototherapy lamps. This paper is a review of calcium -based phosphor host materials in Gd^{3+} activated dopants or through energy transfers from sensitized dopant ions for enhanced NB UVB emissions that is pertinent for treatments of many skin diseases such as psoriasis, vitiligo, eczema, and many other skin conditions.

Biography

Prof Leelakrishna Reddy has obtained his PhD from the University of Johannesburg in condensed matter physics, where he is currently a lecturer. He has supervised several MSc and PhD students. He has given several Invited and Keynote lectures in many conferences around the world. He has published more than 70 peer reviewed articles. Presently his focus is on phosphor materials for applications in optical devices, LEDs and in the Phototherapy.



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Scientific Sessions

DAY-1

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Plane strain state of composite material reinforced by crystalline fibers in dynamic elastic-plastic formulation

Vladislav Bogdanov

Progressive Research Solutions, Sydney, NSW, Australia

The design of composite and reinforced or armed materials is a requirement of the modern level of production and life. Many methods of calculation and design of such materials are successfully used. In this article, for the design of composite and reinforced materials, a technique for solving dynamic contact problems in more accurate an elastic-plastic mathematical formulation [1] is used. To consider the physical nonlinearity of the deformation process, the method of successive approximations is used, which makes it possible to reduce the nonlinear problem to a solution of the sequences of linear problems. In contrast to the traditional plane strain, when one normal stress is equal to a certain constant value, for a more accurate description of the deformation of the sample, taking into account the possible increase in longitudinal elongation, we present this normal stress as a function that depends on the parameters that describe the bending of a prismatic body that is in a plain strain state. The problem of a plane strain state of a beam made from the composite one-layer material reinforced by sequence of crystalline in the middle of the layer is being solved. The reinforced or armed beam consists of two materials: the main material of glass reinforced by basalt crystalline. Glass is a non-crystalline, often transparent amorphous solid, that has widespread practical and technological use in the modern industry. Glass has high strength and is not affected by the processes of aging of the material, corrosion, and creep. In addition, this material is cheap and widely available. Glass can be strengthened, for example, in a melt quenching process. The reinforced composite beam is rigidly linked to an absolutely solid base and on which an absolutely solid impactor acts from above in the centre of the composite beam. This problem is the continuous of problems of non-stationary interaction of hard body (like a bullet) with a layer of glass reinforced from the top by thin layer of steel [2 – 6].

1. Bogdanov V. Problems of impact and non-stationary interaction in elastic-plastic formulations, Cambridge Scholars Publishing, 2023, 282 p.
2. Bogdanov V. Plane Strain and Stress States of Two-Layer Composite Reinforced Body in Dynamic Elastic-Plastic Formulation, Journal of Materials and Polymer Science, 2023, P. 1–7
3. Bogdanov V. Problem of plane strain state of two-layer body in dynamic elastic-plastic formulation (Part I) http://uwtech.knuba.edu.ua/article/view/275549/270577
4. Bogdanov V. Problem of plane strain state of two-layer body in dynamic elastic-plastic formulation (Part II) http://uwtech.knuba.edu.ua/article/view/275552/270578
5. Bogdanov V. Problem of plane strain state of two-layer body in dynamic elastic-plastic formulation (Part III) http://tit.knuba.edu.ua/article/view/275916/270845

6. Bogdanov V. Problem of plane stress state of two-layer body in dynamic elastic-plastic formulation http://tit.knuba.edu.ua/article/view/275917/270846

What will audience learn from your presentation?

- Audience will be able to use new methodology of solving plane contact problems in dynamic elastic-plastic mathematical formulation.
- Audience will be able to simulate the impact of hard body on elastic base.
- It is possible to solve problems of impact and non-stationary interaction of absolutely hard bodies and fine elastic shells. Using new methodology, it is possible to determine the life-resource and crack resistance of constructions such as an airplane, rockets, ships, trains, bearings, magistral gas- and oil-pipelines, all big scale metal constructions, constructions which have cylindric and spheric panels. The methodology described here will be useful for the precise solution of the problems of shock, thrust, and impact, and for the reliable simulation of dynamic contact processes. The approach provided to solving contact problems in the dynamic elastic-plastic formulation offers the audience the ability to design new composite reinforced and armed materials. As such, the presentation will be of interest to scientists, students, and engineers.

Biography

Dr Vladislav Bogdanov studied in the Mathematical Department of Odessa I.I. Mechnikov National University, Ukraine, and the S.P. Timoshenko Institute of Mechanics of the National Academy of Sciences of Ukraine. V. Bogdanov's doctoral work was about the impact of fine elastic shells on an elastic half-space in elastic mathematical formulation. He has worked as Senior Research Associate at the E.O. Paton Electric Welding Institute of the National Academy of Sciences of Ukraine since 2005 and as an Associate Professor at the National Transport University, Ukraine, since 2010. In 2013 he migrated to Australia where he have opened his own company Progressive Research Solutions.

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Density Functional Theory Molecular Modeling (DFT/MM) Opens Up Materials Science (1): Validating the Critical Role of I3- in N3 Dye-Sensitized Solar Cells (DSSCs) and PbI6- in perovskite solar cells (PSCs)

Shozo Yanagida[1*], Susumu Yanagisawa[2] and Masatoshi Yanagida[3]

[1]Osaka University, Japan

[2]University of the Ryukyus, Japan

[3]National Institute for Materials Science (NIMS), Japan

In general, efficient dye-sensitized solar cell (DSSC) has an anode/ TiO2 / N3/ KI/I2 / acetonitrile (AN) / spiro-OMeTAD/cathode structure. Its film thickness is as thick as about 10□m, giving an excellent fill factor in the IV curve. An excellent NIMS-fabricated perovskite solar cell (PSC) which has a structure of anode/ PCBM/PbI64-(CH3NH3+)4/[(NiO)2]2/cathode gives high open-circuit voltage which exceeds 1 V. We verify on the basis of Density Functional Theory Molecular Modeling (DFT/MM) that as for high fill factor of DSSC, the KI/I2/AN electrolyte is in equilibrium with [(K+I3-)2/AN] electrolyte. Because van der waals force between I- and I2, and I3- itself in [(K+I3-)2/AN] electrolyte gives the electrolyte high electronic conductance. As for PSC, PbI64- ions also have a strong van der Waals force and the strong interaction with PCBM, PbI64- and [(NiO)2]2, blocking reverse electron transfer between them, resulting in high open-circuit voltage.

Biography

Shozo Yanagida (Emeritus Professor of Osaka University since 2004) is a pioneer of molecular-structured solar cells, especially DSSC, and since 2011, he has been staying at the forefront with regards to quantum chemsigtry molecular modeling of van der Waals force-aggregates. Now, he has come well known as a molecular modeling chemist. He may appreciate it if you check internet using key words "Shozo Yanagida, molecular modeling". In Osaka Universit, Instutte of Sceinec and Industrial Reserch (ISIR), he opened Energy Solution Material Laboratory of M3 Laboratory Inc. Incidentally, "M3" stands density-functional theory based molecular modeling of materials. (https://www.m3lab.en/).

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Metal chalcogenide thin films

Ho Soonmin

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The nanostructured thin films have been intensively studied by many researchers due to unique properties. In this work, various types of films (metal sulphide, metal selenide and metal telluride) have been prepared using chemical bath deposition (CBD) method. The main advantages of CBD method were simple set-up, inexpensive technique, could deposited on various types of substrates at low bath temperature. Researchers have pointed out that the costs of operating of physical deposition method were very expensive (included maintenance costs, electricity, gases get involved and coating source material). The band gap and optical properties could be measured through UV-visible spectrophotometer technique. The obtained films could be used in solar cell applications if the band gap value was appropriate (1.1 eV to 1.8 eV) and showed excellent absorption coefficient value (105 to 106 cm-1) in the visible light region. The photovoltaic parameters (fill factor, power conversion efficiency, short circuit current density) were investigated. The power conversion efficiency was reported in synthesized films such as CdTe (17.8%), copper indium gallium selenide (25.5%), InSe (0.52%), MnCdSe (0.37%), CdSe (0.67%), MnCuInSe2 (6.38%), CuInS2 (10.2%), CuInSe2 (4.57%), CuInTe2 (4.13%), Sb2Se3 (5.6%), PbMoS (2.16%), PbS (2.20%), ZnS (8.83%), CdS (8%), CuS (0.39%), Cu2ZnSnS4 (6.03%). Researchers have concluded that thin film based solar cells showed less efficient if compared to silicon based solar cells. According to the world solar cell market, the market shares of thin film based solar cell have been increased annually, while silicon based solar cell reduced rapidly.

What will audience learn from your presentation?

- We can produce thin films using chemical bath deposition technique.
- The properties of the thin films will be studied using different tools.
- This material could be used in solar cell applications.

Biography

He is a professor at INTI International University in Malaysia. He received Ph.D. in Materials Chemistry at University Putra Malaysia in 2010. He had worked for more than 12 years as lecturer, researcher, examination panel member, examination moderator and conference committee for university. At INTI International University, he has taught a variety of chemistry courses such as physical chemistry, organic chemistry, general chemistry, chemistry & society for undergraduate courses. Currently, he is member of Institute of Materials Malaysia, Malaysian Institute of Chemistry, Malaysian Analytical Sciences Society, Malaysian Solid-State Science & Technology Society, Researchers Society of Chemical Sciences, Scientific and Technical Research Association, Asian Chemical Society, Asian Council of Science Editors and World Researchers Associations. As active researcher in university, his research areas include renewable energy, solar energy, chalcogenide metals, activated carbon, wastewater treatment, green chemistry, semiconductors, nano materials, and thin film materials. He has authored or co-authored more than 187 articles in Scopus/ISI/international referred journals, successfully produced more than 48 book chapters and 4 books. He has been appointed as a journal reviewer (reviewed more than 650 papers), editorial board member (more than 90 journals), and thesis external examiner (evaluated more than 125 theses).

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Protein Adsoprtion on Modified Smart Biomaterials ePTFE

Norsyahidah Mohd Hidzir[1,2*] and **Nur Ain Mohd Radzali**[1,2]

[1]*Department of Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia (UKM), Bangi, Selangor, Malaysia*

[2]*Nuclear Technology Research Centre, Faculty of Science and Technology, Universiti Kebangsaan Malaysia (UKM), Bangi, Selangor, Malaysia*

Protein adsorption plays a major role in determining the biocompatibility of biomaterials. The first stage of implant integration is the adhesion of protein followed by cell attachment. The nature of protein forming on biomaterial surfaces can affect the performance of implantable device. Thus, this study was conducted to elucidate the effect of surface functionalization and wettability on protein adsorption onto the modified expanded polytetrafluoroethylene (ePTFE). In this work, a smart biomaterials ePTFE was functionalized by grafting with thermo-pH sensitive copolymer via gamma radiation method. The thermosensitive N-isopropyl acrylamide (N) and pH-sensitive acrylic acid (A) monomers were used to graft copolymer onto ePTFE, whereas protein bovine serum albumin (BSA) was used for the adsorption study. Protein adsorption was evaluated by Fourier-transform infrared spectroscopy (FTIR) and ultraviolet-visible spectroscopy (UV-Vis). The fabricated smart biomaterials ePTFE-g-AN (graft yield=36%, wettability = ≤90°) revealed that the intensity of amide peak was observed higher after BSA adsorption for modified ePTFE. UV-Vis analysis also proved that the protein adsorption capacity of BSA (λ=290 nm) of ePTFE-g-AN is higher that unmodified ePTFE. These findings map out a unique relationship between surface chemistry and protein adoption through surface modifications.

What will audience learn from your presentation?

- Explain how the audience will be able to use what they learn?
- Audience will learn about the capabilities of dual properties polymer to adsorp protein and the functionality of polymer can be tailor through radiation induced grafting technique.
- How will this help the audience in their job? Is this research that other faculty could use to expand their research or teaching? Does this provide a practical solution to a problem that could simplify or make a designer's job more efficient? Will it improve the accuracy of a design, or provide new information to assist in a design problem? List all other benefits.

Dual properties of polymer act as a smart material whereby able to absorp protein at certain conditions and change their response in the environmental conditions.

Biography

Norsyahidah Binti Mohd Hidzir is a Senior Lecturer at the Universiti Kebangsaan Malaysia (UKM). She obtained her bachelor's degree in Nuclear Science at UKM, and her PhD from the University of Queensland, Australia in the field of Radiation Chemistry. After finishing her PhD, she was later appointed as lecturer in UKM. She teaches Nuclear Science Programme for undergraduate level, Radiation and Nuclear Safety, and Safety, Security and Safeguard for Master level. Apart from teaching, she is also active in research. Her current research interests include radiation chemistry of polymer, effect of radiation on materials, radiosensitiser, biomaterials and material science.

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Conjugated Polymer as Electron Transport Layer for Organic Solar Cells

Fang-Chi Hsu[1*], Yu-An Lin[1] and Chi-Ping Li[2]

[1]Department of Materials Science and Engineering, National United University, Miaoli, 360, Taiwan

[2]Department of Chemical Engineering, National United University, Miaoli, 360, Taiwan

An inverted type organic solar cell (OSC) is composed of layers of ITO/electron transport layer (ETL)/ organic photoactive layer/MoO3/Ag. Generally, solution processable inorganic ZnO with good electron mobility is the common ETL. For developing next generation opto-electronic products, flexible and stretchable can an important feature. Therefore, it is ideally to take the advantages of inherent mechanical properties of organic materials. Generally, it is difficult to stack two consecutive organic layers of similar solvent preference on top of each other. In this study, we propose a facile, straight forward approach to fabricate OSCs using solution processable polymers as electron transport layer (ETL) for the inverted devices. By introducing a solvent barrier between the polymer ETL and the photoactive layer, the OSCs can be successfully fabricated with good performance. In addition, devices made from those polymer ETL have shown better operational stability than those with conventional ZnO. The impact for the solvent barrier will be discussed in detail.

What will audience learn from your presentation?

- The audience can learn the way to fabricate flexible OSCs.
- Provide a practical and simple solution to deposit organic multilayer structure to prevent redissolution problem.

Biography

Dr. Fang-Chi Hsu received her B.S. and M.S. degrees from the Physics Department, National Taiwan University in 1997 and 1999, respectively. She studied the optical properties of multilayer InAs/GaAs quantum dots structures for her master thesis. She earned her Ph.D. degree in Physics Department from The Ohio State University, USA in 2005. During pursuing her doctoral degree, she joined Prof. Epstein's group and started to work on a multidisciplinary project. Currently, She is a full professor at National United University. Her research interests mainly focus on developing organic electrical/opto-electrical devices and their novel applications in wearable technology and information technology.

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Tungsten Trioxide Nanocrystal Films for Electrochromic Windows

Chi-Ping Li*and **Bing Ze Li**

Department of Chemical Engineering, National United University, Maioli, Taiwan

Template-assisted sol gel chemistry provides a versatile approach to introduce order and porosity into nanostructured materials. However conventional evaporation induced self-assembly techniques are not easily scaled to produce films with sufficient thickness over large areas at the throughput required by electrochromic windows. The principles of sol gel chemistry may be deployed using ultrasonic spray deposition (USD) for scalable synthesis of nanocrystalline WO3 films with unrivalled electrochromic performance are demonstrated. Systematic manipulation of sol chemistry enabled the production of mesoporous films with high specific surface area (>100 m2/g), mean pore sizes of ~5 nm, and narrow pore size distributions. Film thickness is found to be proportional to the sol concentration and number of spray passes, and various combinations are shown to produce films capable of modulating >98% of incident solar radiation in the visible spectrum (450–900 nm). Elimination of haze enables full transmission in the bleached state, while the broadband coloration is attributed to the exceptionally high charge density (>120 mC/cm2). The materials have good switching speeds which improve with specific surface area, and the long term durability is promising.

What will audience learn from your presentation?

- The audience will be able to use what they learn to improve the performance of the materials.
- This research will help the audience to design a material that exhibits higher charge density of optoelectrochemical device.
- This research can provide a practical solution to enhance the specific surface area of a material.

Biography

Dr. Chi-Ping Li received his PhD of Materials Science from Colorado School of Mines (USA) in 2014 and followed by postdoctoral research in National Renewable Energy Laboratory (NREL, USA) in 2015. He joined Department of Chemical Engineering in National United University in Taiwan as an assistant professor in 2018. His research interests are mainly focused on synthesis of nanostructured films, nanocomposite films and nanoparticles. Those materials are used in electrochromic windows, lithium batteries, organic photovoltaics and LED encapsulants. His goal is to overcome the challenges and produce great but low cost materials in the fields of green and renewable energy.

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Photoalignment and photopatterning nanosize azodye layers : new trends for liquid crystal technology

Vladimir G. Chigrinov

Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Nanjing Jingcui Optical Technology Co., LTD, Nanjing, China

Photoalignment and photopatterning has been proposed and studied for a long time [1]. Light is responsible for the delivery of energy as well as phase and polarization information to materials systems. It was shown that photoalignment liquid crystals by azodye nanolayers could provide high quality alignment of molecules in a liquid crystal (LC) cell. Over the past years, a lot of improvements and variations of the photoalignment and photopatterning technology has been made for photonics applications. In particular, the application of this technology to active optical elements in optical signal processing and communications is currently a hot topic in photonics research [2]. Sensors of external electric field, pressure and water and air velocity based on liquid crystal photonics devices can be very helpful for the indicators of the climate change.

We will demonstrate a physical model of photoalignment and photopatterning based on rotational diffusion in solid azodye nanolayers. We will also highlight the new applications of photoalignment and photopatterning in display and photonics such as: (i) fast high resolution LC display devices, such as field sequential color ferroelectric LCD;

(ii) LC sensors; (iii) LC lenses; (iv) LC E-paper devices, including electrically and optically rewritable LC E-paper; (v) photo induced semiconductor quantum rods alignment for new LC display applications; (vi)100% polarizers based on photoalignment; (vii) LC smart windows based on photopatterned diffraction structures;

(vii) LC antenna elements with a voltage controllable frequency.

Acknowledgements :

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Biography

Professor Vladimir G. Chigrinov is Professor of Hong Kong University of Science and Technology since 1999. He is an Expert in Flat Panel Technology in Russia, recognized by the World Technology Evaluation Centre, 1994, and SID Fellow since 2008. He is an author of 6 books, 31 reviews and book chapters, about 317 journal papers, more than 668 Conference presentations, and 121 patents and patent applications including 36 US patents in the field of liquid crystals since 1974. He got Excellent Research Award of HKUST School of Engineering in 2012. He obtained Gold Medal and The Best Award in the Invention & Innovation Awards 2014 held at the Malaysia Technology Expo (MTE) 2014, which was hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014. He is a Member of EU Academy of Sciences (EUAS) since July 2017. He got A Slottow Owaki Prize of SID in 2018 http://www.ee.ust.hk/ece.php/enews/detail/660. He is 2019 Distinguished Fellow of IETI (International Engineering and Technology Institute).

http://www.ieti.net/news/detail.aspx?id=184 http://www.ieti.net/memberships/Fellows.aspx

Since 2018 he works as Professor in the School of Physics and Optoelectronics Engineering in Foshan University, Foshan, China. 2020-2024 Vice President of Fellow of Institute of Data Science and Artificial Intelligence (IDSAI) Since 2021 distinguished Fellow of Institute of Data Science and Artificial Intelligence.

Since March 2022 he is A Fellow of National Academy of Technology for his contributions to Information Electrical and Electronic Research http://www.usnat.org/fellows.html

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VIRTUAL CONFERENCE ON
MATERIALS SCIENCE & ENGINEERING
MAY 29-30, 2023

Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Green synthesis of multifunctional Cellulose/GO nanocomposites

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This study will report a green route for synthesizing a new cellulose/graphene oxide nanocomposite (CGN) flexible films for applications requiring UV protection using Lyocell fiber and graphene oxide (GO). For the solution casting process, a solvent system mediated by polyethelene glycol (PEG) was used. By cross-linking GO sheets with epichlorohydrin (ECH), a reactive interface was created between cellulose and oxygenic functionalized groups of GO sheets, improving their dispersion in a cellulosic matrix. The structure and surface morphology of CGN nanocomposite films underwent synergistic modifications as a result of the addition of GO sheets to the cellulose matrix. The correct cellulose-GO connection through hydrogen bonding is responsible for the enhanced GO sheet dispersion in CGN films that was seen in morphological analyses. This interaction significantly improved the mechanical and thermal properties. In comparison to the pure cellulosic film, the tensile strength and Young's modulus of CGN films with 2 wt% GO loading (CGN2) showed a significant improvement and reached to 89 MPa and 4.3 GPa from 55.6 MPa and 2.1 GPa, respectively. The CGN films also displayed impressive UV shielding properties, which improved with the addition of GO to the cellulose matrix. The CGN2 film (2 wt% GO loading) demonstrated nearly complete UV ray shielding (99%) in both the UV-B and UV-A regions and had exceptional absorbance in the wavelength range of 280 to 400 nm. In addition, the CGN2 film's ultraviolet protection factor outperformed the neat cellulose film by a factor of more than 80. The developed CGN nanocomposite film has excellent potential for use in UV protection.

What will audience learn from your presentation?

- In this presentation, there will be a discussion on the effect of graphene oxide (GO) on UV shielding, thermal and mechanical properties of cellulose/GO nanocomposite films prepared by a facile solvent casting route using a green solvent system.
- At first there will be a detail discussion on synthesis of GO and the characterization by different techniques such as HR-TEM, XPS, EDX, FTIR, Raman and XRD
- Then there will be a thorough discussion on – (i) the morphology of cellulose/GO nanocomposite films containing varying concentration of GO in cellulose matrix, (ii) effect of cross-linker (ECH) on morphology and properties of cellulose/GO nanocomposite films, (iii) mechanical and thermal properties cellulose/GO nanocomposite films and (iv) UV shielding mechanism and UV shielding performance of cellulose/GO nanocomposite films and (v) comparison of UV shielding performance of

prepared cellulose/GO nanocomposite films with other polymer nanocomposites reported in other literatures.

- This facile processing route and obtained properties of cellulose/GO nanocomposites have shown a great potential for low cost, environmentally and sustainable applications in the field of UV protection.
- There are very limited papers on cellulose/GO nanocomposites especially for improving UV shielding ability of cellulose/GO nanocomposite films. I think the novel approach, the systematic discussion on the effect of GO and cross-linker (ECH) on morphology and different properties of cellulose/GO nanocomposite film (especially the UV shielding property) and the obtained results will attract the audience of the conference.

Biography

Dr. Bapan Adak currently working as Research Fellow at the School of Material Science and Engineering, NTU Singapore. He completed his PhD and MTech both from IIT Delhi in 2019 and 2015, respectively. He has strong publication record which includes 1 Indian patent, 23 journal papers in high-impact peer-reviewed journals (mostly in Elsevier, ACS, RSC, Springer-Nature, and Wiley), 1 authored book, 1 edited book, 14 book chapters, and also presented in 14 conferences (Including four overseas conferences). His research interests include polymer nanocomposites (synthesis+application), functional and smart textiles, wearable electronics, thermoregulating textiles, 3D printing, flexible food packaging, and sustainable materials/technologies.

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VIRTUAL CONFERENCE ON
MATERIALS SCIENCE & ENGINEERING
MAY 29-30, 2023

Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Nanotechnology for COVID-19 Therapeutics Through Nasopharyngeal Inhalation Aerosols into the Lungs

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When respiratory infection occurs, such as COVID-19 infection, lungs are the main organ for drug delivery. Inhaled aerosols is then advised as an non-invasive effective administration method in addition to overcoming the serum-high-drug-concentration side effects through various nanotechnologies. Five-microns microparticles can be encapsulated into a aerodynamic size range and are delivered into the lungs either via dry power inhalers and pressurized metered-dose-solid-form inhalers or spraying colloidal dispersions. Liposome-composed-lipid nanoparticles are now commonly used nebulizers for respiratory system and body-mucosal-system delivery. Nevertheless, some of the disadvantages are leakages in the nebulizers and the stability of the drug molecules, but overcoming by a dry-power-form-liposome-drug development, whereas polymeric nanoparticles share advantages in increase of a slow and steady drug release into the lungs and the body mucosal system. Cationic liposomes for have been further studied for large-high-molecular-weight-peptide delivery. In conclusion, polymeric nanoparticles have less advantages than the cationic lipid nanoparticles, nevertheless, cationic-polymeric-drug-nanoparticle-delivery into the lungs need further study.

What will audience learn from your presentation?

- Explain how the audience will be able to use what they learn?

1. Application of the use of the micronanoparticle-drug-delivery into the lungs.
2. Application of the use of micronanoparticle-COVID-19-vaccine-delivery into the lungs.
3. Advantages and disadvantages of the micronanoparticle-drug/COVID-19-vaccine-delivery into the lungs.

- How will this help the audience in their job? Is this research that other faculty could use to expand their research or teaching? Does this provide a practical solution to a problem that could simplify or make a designer's job more efficient? Will it improve the accuracy of a design, or provide new information to assist in a design problem? List all other benefits.

This presentation will help the audiences in development of their jobs by simplifying their healthcare products including more efficiency and more cost-effective.

Biography

Dr. Cheepsattayakorn graduated Doctor of Medicine from Chiang Mai Medical School, Chiang Mai University, Chiang Mai, Thailand in 1986. He then further had trained in Internal Medicine, Pulmonology, and Radiology at Chiang Mai University Medical School. Recently, on October 26, 2019, he was bestowed the Gold Medal Award (First-Class Award) from the Chiang Mai University Medical School Alumni Association in Chiang Mai, Thailand for his academic and medical practice excellence for cerebrating the 60th Anniversary of the Chiang Mai University Medical School, Chiang Mai, Thailand that was established on October 28, 1959. He graduated numerous Fellowships from the Royal Colleges of Physicians of Edinburgh, London and Thailand, Royal College of Physicians and Surgeons of Glasgow, American College of Physicians, and American College of Chest Physicians. Presently, he serves both Editor and Editorial Board Member and also referee of several international journals. He has very high experience in the fields of Pulmonary Diseases and Tuberculosis including Infectious Diseases and Immunology. He has numerous scientific publications, more than 300 publications both in national and international journals and books, including authored textbook of COVID-19, " Thailand's and Global Perspectives of COVID-19 ", both the United Kingdom version (361 pages, first edition published by the Medical and Research Publications in 2021) and the United States of America version (367 pages, second edition published by the Science and Education Publishing in 2022). Recently, in 2022, he published a Book Chapter, entitled " COVID-19 and Respiratory System " in a Textbook, entitled " Chest Medicine in Perspective " published by Thammasat Printing House, Bangkok, Thailand (736 pages). He had been served a Director and Consultant in Respiratory Medicine of the 10th Zonal Tuberculosis and Chest Diseases Center, Chiang Mai, Thailand for a long time, a Director of the 5th Office of Disease Prevention and Control and Consultant in Respiratory Medicine, Ratchaburi, Thailand and presently serves as Consultant in Respiratory Medicine (Pulmonologist) at the 10th Zonal Tuberculosis and Chest Diseases Center, Chiang Mai, Thailand and Senior Expert Level 11 (Highest Level), Department of Disease Control, Ministry of Public Health, Thailand. He serves as Faculty Member of the Faculty of Medicine, Western University, Thailand. Currently, he also serves the International Regional Adviser (Advisory Board) for Thailand of the Royal College of Physicians of Edinburgh, United Kingdom and the Reviewer for the journals of the Royal College of Physicians of London, United Kingdom. He was appointed the Japan International Cooperation Agency (JICA)'s Advisor in 2021-2022. He was directly invited & proposed to the World Federation of United Nations Associations (WFUNA) Membership by the United Nations Former Secretary-General " H.E. Ban Ki-Moon ". Recently, he has been approved for the Membership of the WFUNA since 4 January 2022 (Ref. : UN-467-NYUN) and has been appointed the WFUNA Membership signed by the UN authorities (the UN Secretary-General, the UN President of the General Assembly, and the UN President of the Security Council) since January 15, 2022. Nationally, recently, he was appointed the chairman of the executive research ethical board committee for the health inspection region 4, Thailand Ministry of Public Health since September 5, 2022 and nationally, recently, he was appointed a board committee director for urban disease control academic planning since August 26, 2022.

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VIRTUAL CONFERENCE ON
MATERIALS SCIENCE & ENGINEERING
MAY 29-30, 2023

Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Synthesis and Analysis of Carbon-Based Quantum Dot

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With diameters under 10 nm, carbon quantum dots (CQDs) are a brand-new family of zero-dimensional carbon nanostructures. Aloe vera, rice, and sugar were used to create and study carbon-based quantum dots by the authors. These quantum dots were characterised using a UV-visible spectrophotometer. Chemically produced quantum dots are poisonous and dangerous for both people and animals. The carbon quantum dots (CQD) that have been created for this study are biocompatible, less poisonous, and have a high water dispersibility property. CQDs are employed in a wide range of applications, including photovoltaics, chemical sensing, bio-sensing, medical diagnosis, and bio-sensing. This research contributes to the scientific community's understanding of the nature of carbon quantum dots and provides a brief overview of appropriate building blocks for CQD.

What will audience learn from your presentation?

- Importance and significance of quantum dots
- Carbon based quantum dots and their synthesis
- Characterization of quantum dots via UV-visible spectrophotometer.
- Morphological analysis of quantum dots

Biography

Dr. Sunil Kumar Pradhan is presently working as Associate Professor in School of Electronics Engineering at Vellore Institute of Technology (VIT), Chennai. His areas of research are in the domain of Nano-Technology, VLSI, Nano-Electronics and materials-based devices. He has more than 8 years of postdoctoral teaching and research experiences and 2 years of industrial experiences. He is a life member of Electron Microscopy Society of India and Vacuum Electronic Devices and Applications Society. He is reviewer of the journals like Functional Composites and Structures, Royal Society of Science, Macromolecular Symposia. He is the editorial board member of Journal of Electronic Research and Application.

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VIRTUAL CONFERENCE ON
MATERIALS SCIENCE & ENGINEERING
MAY 29-30, 2023

Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Green synthesized Chitosan-ZnO nanocomposite for pharmaceutical applications

Munusamy Thirumavalavan

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Porous chitosan membrane was fabricated by casting method using silica particles. Simultaneously nano ZnO was synthesized by green-synthesis method by using tung ting oolong tea extract. In order to increase the antimicrobial activity, chitosan mem brane was combined with nano ZnO. The results obtained from various techniques such as XRD, SEM, FT-IR, UV–visible and fluorescence emission analysis, confirmed the incorporation of nano ZnO into the chitosan membrane. A blue shift (from 360 to 335 nm) was observed in the UV–visible spectrum of nanocomposite and fluorescence emission intensity of nanocomposite was considerably lower than that of nano ZnO. Gram-negative organism Klebsiella planticola (MTCC2727) and Gram-positive organism Bacillus substilis (MTCC3053) were used to test the antibacterial and antifouling activities of newly synthesized nanocomposite chi tosan/ZnO membrane. The nanocomposite chitosan/ZnO membrane promisingly inhibited the bacterial growth when compared with as-synthesized chitosan. Gram negative K. planticola (MTCC2727) was comparatively more susceptible for inhibition than that of Gram-positive Bacillus substilis (MTCC3053). Drug delivery studies indicated that it can be used as drug delivery system for both cancer and osteoarthritis treatment. In conclusion, nanocomposite obtained in this study showed enhanced antibacterial and antifouling activities. We believed that the enhanced physical properties of nanocomposite achieved by incorporating nano ZnO into the chitosan matrix could be beneficial for various applications.

What will audience learn from your presentation?

- This topic will be highly useful for the audiences from various disciplines. This will bridge nanotechnology, chemical technology and biotechnology in a single platform
- The audiences will better understand the nanocomposites and their applications.
- This might be useful for the other faculty to expand their research or teaching
- This provides the better approach to use chitosan-based nanocomposite for therapeutic applications

Biography

Dr. M. Thirumavalavan is a Faculty at Department of Chemistry, Saveetha Engineering College, Chennai, India and a Scientific Editor, Proofreader and Consultant at National Cheng Kung University, Taiwan. He is also an adjunct Faculty at Department of Science and Education, National Chung-Hsing University, Taiwan. Previously, Dr. Thirumavalavan served as a Faculty/Scientist at various countries working on multi-disciplinary fields of science and technology. He has earned his Ph.D. degree in Inorganic Chemistry from University of Madras, India working on synthesis and characterization of macro-bicyclic mono and binuclear metal complexes which showed multifunctional applications. He has nearly 25 years of experience in research, and teaching aiming to new cutting edges both in Science and engineering technologies. His recent research is focused on different nanomaterials to explore their wide applications in chemical, biotechnology and pharmacology fields and mainly for photo-catalysis. Notably, Dr. Thirumavalavan has authored more than 55 reputed publications and also being one of the editorial board members of several journals. His current research activity is devoted to design and manifest versatile multifunctional nano-biocatalysts (NBCs) for various bioprocessing and pharmaceutical applications. Apart from his academic career, he is a notable scholarly writer and speaker in Tamil having written many stories and poems and published few books in Tamil.

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VIRTUAL CONFERENCE ON
MATERIALS SCIENCE & ENGINEERING
MAY 29-30, 2023

Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Mucoadhesive microcapsules: A novel approach in Therapeutic Targeting!

Dr. Subas Chandra Dinda, *M.Pharm., Ph.D, F.I.C.*

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Problems associated with poor bioavailability through oral route of administration and difficulties through injectable routes promoted the impetus for exploring alternative routes for the delivery of such drugs. Application of dosage forms through mucosal surfaces may be able to benefit the drug molecules, which are not amenable to the oral route, such as those that undergo acid degradation or extensive first-pass metabolism. Trans-mucosal routes of drug delivery (i.e., the mucosal linings of the nasal, rectal, vaginal, ocular, and oral cavities) offer distinct advantages over peroral administration for systemic effect.

The rationale behind the designing of muco-adhesive dosage forms include: These dosage forms readily localize in the region applied, and improve the bioavailability of drugs; Facilitate intimate contact of the formulation with the underlying absorption surface, which allows modification of tissue permeability for absorption of therapeutic moieties as well as macromolecules, such as peptides and proteins; It prolongs the residence time at the site of application and absorption to permit Controlled and Sustained drug delivery. The targeting sites of Muco-adhesives Drug Delivery includes: Buccal Route; Sub-lingual Route; Vaginal Route; Rectal Route; Nasal Route; Ocular Route; Gastro Intestinal Tract; May target delivery at Stomach / Intestinal region.

Approaches followed to incorporate drugs into the bio adhesive polymers include: Microencapsulation; Granulation by matrix formulation; Palletization techniques, etc. Techniques used for Preparation of Mucoadhesive Micro-particle include: Coacervation / Phase separation technique; Air suspension techniques (Wurster); Cross-Linking / surface polymerization; Ionotropic Gelation by using CaCl2 / Chitosan; Emulsification and Solvent Evaporation; and Spray Drying / Congealing methods; etc.

Some successful research outcome using above techniques include:

Sl. No.	Name of the drug used	Pharmaco-kinetic advantage	Muco-adhesive Polymers used	Formulation Techniques used	Type of formulation	Ref
1.	Esmoprazole magnesium (Proton pump inhibitor)	Improve gastric residence time & oral bioavailability	HPMC, Sod. CMC, EC, Eudrgit	Emulsification & Solvent evaporation	Enteric coated mucoadhesive microcapsules	2
2.	Repaglinide (Anti-diabetic)	Sustained Re-lease	HPMC, Sod. Alginate	Emulsifica-tion & solvent evaporation	Mucoadhesive Microspheres	3
3.	Venlafexine HCl (anti-depressant)	Sustained release & increase oral bioavailability	Sod. Alginate, HPMC, MC, CMC	Ionic-gelation Technique	Mucoadhesive microcapsules	4
4.	Valacyclovir (Antiviral)	Controlled release	Sod. Alginate, HPMC, CMC, MC	Ionic-gelation technique	Mucoadhesive Micro-capsules	5
5.	Tolterodine Tartrate (Anti-muscarinic)	Sustained release	HPMC, Sod. CMC, Carbopol, Chitosan, EC.	Non-aqueous Solvent Evaporation	Mucoadhesive Microsphere	6
6.	Rabeprazole Sodium	Sustained Release	HPMC, CMC, HEC, HPC, EC, Eudragit	Emulsification & solvent evaporation	Enteric coated Microcapsule	7
7.	Sodium Valproate (Anti-convulsant)	Sustained release	Sod. Alginate, HPMC, Carbopol, Sod. CMC	Orifice-ionic gelation Technique	Mucoadhesive Microcapsules	8
8.	Aceclofenac	Sustained release	Sod. Alginate, Carbopol	Ionic-gelation technique	Mucoadhesive Microparticle	9

From the above successful research outcomes, it can be concluded that there is a wide scope to work with designing and development of stable muco-adhesive systems with several drugs, which shows poor bioavailability through oral route and the development of novel, highly-effective and mucosa compatible polymers is also a new horizon in creating new commercial and clinical opportunities in drug targeting research.

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Biography

Dr. Subas Chandra Dinda, presently working as Dean of Pharmacy, The Neotiaa University, India, did his Master degree in Pharmaceutical Technology from Andhra University, India in 1999 and Ph.D. in Pharmacy from Jadavpur University, Kolkata, India in 2008 honoured with life fellow, Institution of Chemists (India) in 2008. Dr. Dinda found to be having a wide research experience in the frontier of Drug Delivery and Drug Targeting Research covering the area of design and development of Matrix systems, Floating Drug delivery systems, Muco-adhesive microcapsules, and Nano-particle based formulations. He explored several poorly bio-available drugs through muco-adhesive as well as nano-particle based dosage forms and found to be very effective through oral route.

He also actively involved in guiding the scholars in the field of Drug Delivery System as well as interdisciplinary research covering the area of Drug Synthesis and Herbal Drug Research under the collaboration with the teachers from other University as well.

To date some of his research finding claimed patents and published in more than hundreds research articles in peer reviewed journals for the benefit of scientific community.

He is serving as reviewer of many journals including ELSEVIER, SPRINGER, and SCIENCE DIRECT publications. To his credit he supervised/awarded more than 22 Ph.D candidates in the field of pharmaceutical sciences for the professional development and having a vast administrative experience in establishing the new pharmacy institutions as well as designed new pharmacy course curricula as the chairperson of Board of Studies/Council for the development of pharmaceutical sciences at Berhampur University in India as well as Mekelle University in Ethiopia.

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VIRTUAL CONFERENCE ON
MATERIALS SCIENCE & ENGINEERING
MAY 29-30, 2023

Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Improving the Fatigue Design of Mechanical Systems such as Refrigerator

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To enhance the lifetime of mechanical system such as automobile, new reliability methodology – parametric Accelerated Life Testing (ALT) – suggests to produce the reliability quantitative (RQ) specifications—mission cycle—for identifying the design defects and modifying them. It incorporates: (1) a parametric ALT plan formed on system BX lifetime that will be X percent of the cumulated failure, (2) a load examination for ALT, (3) a customized parametric ALTs with the design alternatives, and (4) an assessment if the system design(s) fulfil the objective BX lifetime. So we suggest a BX life concept, life-stress (LS) model with a new effort idea, accelerated factor, and sample size equation. This new parametric ALT should help an engineer to discover the missing design parameters of the mechanical system influencing reliability in the design process. As the improper designs are experimentally identified, the mechanical system can recognize the reliability as computed by the growth in lifetime, LB, and the decrease in failure rate. Consequently, companies can escape recalls due to the product failures from the marketplace. As an experiment instance, two cases were investigated: 1) problematic reciprocating compressors in the French-door refrigerators returned from the marketplace and 2) the redesign of hinge kit system (HKS) in a domestic refrigerator. After a customized parametric ALT, the mechanical systems such as compressor and HKS with design alternatives were anticipated to fulfil the lifetime – B1 life 10 year

What will audience learn from your presentation?

- Parametric Accelerated Life Testing (ALT) for design alterations.
- Quantum/transport based generalized life-stress (LS) model
- Sample size formulation for generating reliability quantitative (RQ) specifications.

Biography

Dr Woo has a BS and MS in Mechanical Engineering, and he has obtained PhD in Mechanical Engineering from Texas A&M. He majors in energy system such as HVAC and its heat transfer, optimal design and control of refrigerator, reliability design of thermal components, and failure Analysis of thermal components in marketplace using the Non-destructive such as SEM & XRAY. In 1992.03–1997 he worked in Agency for Defense Development, Chinhae, South Korea, where he has researcher in charge of Development of Naval weapon System. He was working as a Senior Reliability Engineer in Refrigerator Division, Digital Appliance, SAMSUNG Electronics. Now he is working as associate professor in mechanical department, Ethiopian Technical University.

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VIRTUAL CONFERENCE ON
MATERIALS SCIENCE & ENGINEERING
MAY 29-30, 2023

Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Breaking a barrier of practical applications of sumanene: A magnetic nanoadsorbent for the effective removal of cesium cations from aqueous solutions

Artur Kasprzak

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Abstract: Removal of caesium cations from aqueous wastes is important from the viewpoint of human health and protection of the natural environment. The research intensified especially after the Fukushima-Daiichi nuclear plant disaster (2011), which was accompanied by an uncontrolled release of radioactive 137Cs to the environment including oceans and groundwater. In this talk, the innovative application of sumanene containing magnetic nanoadsorbent for the selective and effective removal of caesium cations from aqueous wastes will be presented. The applicability of those materials will be explicated by the removal of caesium salts from aqueous solutions simulating the concentrations of 137Cs in seawater or groundwater, or from liquid wastes generated from routine organic syntheses, and selected pharmaceutical processes. This research was funded by POB Technologie Materiałowe of Warsaw University of Technology within the Excellence Initiative: Research University (IDUB) programme.

What will audience learn from your presentation?

- Why environmental monitoring and removal of cesium cations is important.
- New ways of cesium cations removal from the aqueous wastes using nanomaterials.
- General application potential of magnetic nanomaterials.
- General information and application potential of sumanene molecule.

Biography

Dr. Artur Kasprzak is currently an assistant professor at the Faculty of Chemistry, Warsaw University of Technology, Poland. His major research interests include material chemistry, organic chemistry and supramolecular chemistry. He has been a co-author of 50 research papers (journals from the JCR list) of the total IF of more than 277, including Chemical Science, Chemical Communications, Journal of Materials Chemistry B, Biosensors and Bioelectronics and Carbohydrate Polymers.

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MATERIALS SCIENCE & ENGINEERING
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Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Synthesis of elements and solid structures in atomic-nuclear reactions in dense gases and dense gas – metal systems as a result of proper gamma quantum irradiation, theory of effects, possibility of production of the new solid objects and desired nuclei

Roland S. Wiśniewski[1,2] and **Gennady V. Mishinsky**[3]

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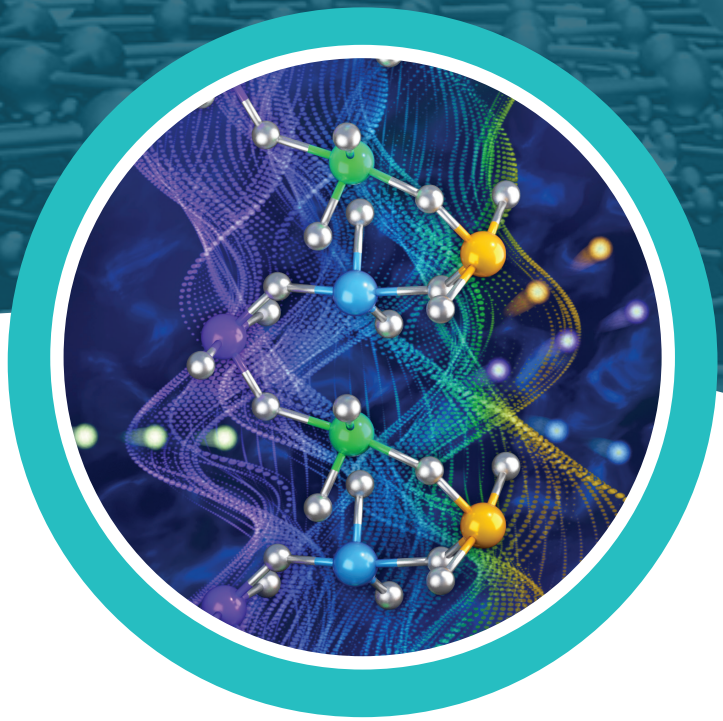
[3]*Joint Institute for Nuclear Research, Dubna, Russian Federation*

In nuclear physics, the procedure of irradiation with high-energy gamma quanta plays one of the basic roles in the study of objects - from individual atoms to cosmic masses, man, living and inanimate matter, in order to change the states of these objects, learn about their structure, as a spontaneous event, etc. This is done through the mechanism of ionizing atoms of selected parts of the object under study, changes in the structure of individual nuclei or accidentally many nuclei of a specific object. The use of gamma irradiation takes place in virtually every field of science, technology, medicine, art, in industrial, armaments and even entertainment technologies. Our research is distinguished by the irradiation of a dense gas (e.g.H2 at a pressure of 1-3 kbar) - with a solid object placed in it, e.g. very pure Pd (99.999wt%). By the force of the piston, the gas is compressed in a high-pressure chamber made of beryllium bronze (internal diameter 8-12mm) and the object is located axially in the back of the chamber. Remote continuous pressure and temperature measurement, observation of secondary radiation and the lack of external force fields other than gravitational were used. In various types of experiments, only pure gases or their mixtures were compressed and irradiated, or the object of irradiation were as complex systems: pure gas or gas mixes (D2,He,Xe) and a number of selected solid objects located as far as possible from the inlet of gamma quanta and in a specific order. Regular-shaped solid-body specimens were generally cylindrical. Braking gamma radiation (continuous) was used, using an electron accelerator (equipped with V-Al plates) with a maximum energy gamma quanta being before or within the range of giant nuclear dipole resonance of the studied bodies, with a relatively high intensity, maximum energy of gamma quanta (3 - 23MeV) and a known their spatial distribution. Almost all possible effects were observed – nuclear scale (new nuclei, absent before irradiation), atomic-molecular scale (new substances), nano, micro and macro dimensional objects – nano crystals, surface effects, micro protuberances. In the research, so far, sporadically, high-energy fluxes of free electrons have also been used. Theory of observed effects (including LENR) is under development. One might think that the range of interests programmed by the authors, presented below, are the fulfillment of certain omissions of previous researchers, great colleagues.

Biography

Dr hab.: professor, physicist; Warsaw, 01.10.1929; 1950 - 1955 Technical University of Warsaw, Faculty of Mechanical and Construction; 1954 - title of engineer; 1956, 1964 - Doctorate in Technical Sciences; 1974 - habilitation; 1983 - professor's title; 1952 - Warsaw University of Technology, Department of General Physics of the Faculty of Electrical Engineering; 1975 - Institute of Physics (Vice Director of Science 1987-1991); 1998 - Faculty of Physics; 2004 - 2014 National Centre for Nuclear Research, Otwock-Swierk, 2019 - Institute of Agricultural and Food Biotechnology, Warsaw; number of publications (usually as co-author) above 175 (including "Nickel hydride synthesis from nickel and hydrogen gaseous", Bull. Acad. Pol. Sci. Ser. Sci. Chem., 14, 4 (1966) 1273-1275. "Synthesis of new structures and objects in dense gases H2, D2, He irradiated with braking rays γ with max energy of 10MeV in CuBe2 pressure chamber", JPSA 6(4) (2016) 13-21, the first Polish book "High Pressures -Generation, Measurements, Applications" PWNT 1982, Chapter: "Synthesis of chemical elements and solid structures in atomic-nuclear reactions in dense gas-metal systems irradiated by gamma rays" in the book "Nuclear Engineering" , IntechOpen, London, UK, 2018, Significant contribution to the development of the field "High Pressure Processing Effects on Lipids Thermo physical Properties and Crystallization Kinetics, see Food Eng. Rev, 12. April 2016. Zulkurman at al; number of promoters 10, number of patents 21 (including "linear unbalanced DC bridge) " "High-pressure reometric liquid phase analyzer especially highly viscous"), number of conference occurrences above 50, number of operating years 70; National Education Commission Medal; Gold Badge of Merit for Warsaw University of Technology; Knight's Cross of the Order of The Rebirth of The Republic of Poland.



Virtual Conference on

MATERIALS SCIENCE & ENGINEERING

MAY 29-30, 2023

Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

Keynote Forum

DAY-2

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Chameleon Nanocarriers for Delivery of RNA Nanomedicines

Ernst Wagner[1,2]

[1]Pharmaceutical Biotechnology, Department of Pharmacy, Ludwig-Maximilians-Universität (LMU), Munich, Germany
[2]Center for NanoScience (CeNS), LMU, Munich, Germany

By early 2023, 24 gene therapy drugs and 21 RNA therapies reached the medical market. Targeted intracellular delivery remains the key requirement. For refinements of RNA nanocarriers we focus on a bioinspired, sequence-defined process including (i) use of artificial amino acids, (ii) precise assembly into sequences ('xenopeptides') by solid phase-assisted synthesis, and (iii) screening for delivery and selection of top candidates. A recent chemical evolution process combined aminoethylene amino acids as polar protonatable units with novel lipo amino fatty acids (LAFs) as hydrophobic protonatable motifs. These novel double pH-responsive nucleic acid carriers utilize intracellular delivery mechanisms of both cationic lipids and cationic polymers. The endosomal pH-dependent tunable polarity of LAF was successfully implemented by a central tertiary amine, which disrupts the hydrophobic character once protonated, resulting in drastic pH-dependent change in the logarithmic (octanol/water) distribution logD from around +1 (pH 7.4) to -1 (pH 5.5). This "molecular chameleon character" turned out to be highly advantageous for pDNA, siRNA, mRNA or CRISPER/Cas9 sgRNA delivery. Noteworthy, the efficiency of best performers was up to several 100-fold higher compared to previous carriers. Transfection activity of mRNA lipoplexes was maintained even in the presence of 90% serum and even at extremely low dosage of 3 picogram mRNA (~2 nanoparticles/cell), in the range of the viral potency. mRNA lipoplexes showed great in vivo performance in mice with high expression levels in spleen, tumor, lung, and liver upon intravenous administration of 1 µg luciferase mRNA. With this class of delivery carriers, also CRISPR Cas9 /sgRNA or siRNA can be delivered to therapeutically modulate cell functions.

What will audience learn from your presentation?

The audience will hear about:

- Synthetic formulations of therapeutic nucleic acids into nanoparticles
- Dynamic chemical properties ('chameleons') required for potent cellular entry
- precise solid-phase assisted assembly of novel carriers as xenopeptides.

Biography

Ernst Wagner is professor of Pharmaceutical Biotechnology and Center for Nanoscience at LMU Munich since 2001. From 1992-2001 he was Director Cancer Vaccines, Boehringer Ingelheim (first polymer-based gene therapy trial in 1994), 1987-1995 group leader at IMP Vienna and Vienna University Biocenter, 1985-1987 postdoc at ETH Zurich, in 1985 PhD in chemistry (TU Vienna). He is Academician of European Academy of Sciences, member of CRS College of Fellows, Board member of German Society for Gene Therapy. He has authored 497 publications, with 49 903 citations, h-index 112 (GS).

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4D Printing: Remote and Wireless Control of Implanted Material Shape and Size

Thomas J. Webster

Interstellar Therapeutics, Boston, MA, USA

3D printing has revolutionized numerous industries from automobile to construction to aerospace to medicine. 4D printing refers to the remote and wireless control of implantable 3D printed materials. This invited talk will discuss how 4D printing is revolutionizing medicine through the control of drug delivery, increasing pressure to increase tissue growth (such as bone and cartilage), straightening the spine for scoliosis victims, control of aging sphincters throughout the body which have weakened, cardiovascular applications, delivery of stem cells, injections into the intervertebral disk, and so much more. Promising in vitro and in vivo studies will be discussed with thoughts on what is needed in the future for 4D printing to truly revolutionize medicine.

Biography

Thomas J. Webster's (H index: 113; Google Scholar) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995; USA) and in biomedical engineering from RPI (Ph.D., 2000; USA). He has served as a professor at Purdue (2000-2005), Brown (2005-2012), and Northeastern (2012-2021; serving as Chemical Engineering Department Chair from 2012 - 2019) Universities and has formed over a dozen companies who have numerous FDA approved medical products currently improving human health. He is currently helping those companies and serves as a professor at Hebei University of Technology, Saveetha University, Vellore Institute of Technology, UFPI, and others. Dr. Webster has numerous awards including: 2020, World Top 2% Scientist by Citations (PLOS); 2020, SCOPUS Highly Cited Research (Top 1% Materials Science and Mixed Fields); 2021, Clarivate Top 0.1% Most Influential Researchers (Pharmacology and Toxicology); 2022, Best Materials Science Scientist by Citations (Research.com); and is a fellow of over 8 societies.

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Hygrothermal Durability of E-Glass/ Vinylester Composites

Vistasp M. Karbhari

Department of Civil Engineering and Department of Mechanical and Aerospace Engineering; University of Texas at Arlington; Texas 76006; USA

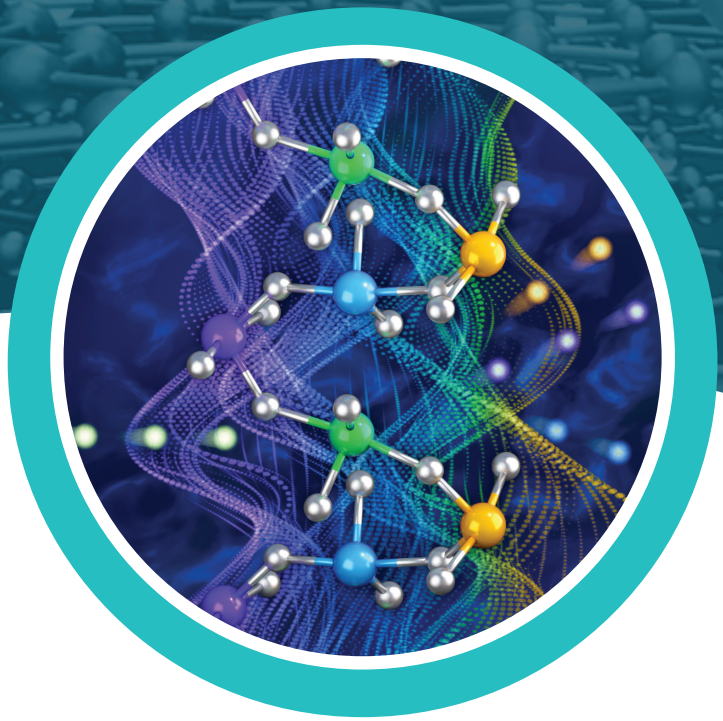
Fiber reinforced composites are increasingly used in marine, offshore, and energy applications requiring not just high specific performance attributes but also good durability and damage tolerance over extended periods of time. Exposure to varying levels of humidity and to immersive environments adds a level of complexity to their use. This research details mechanisms of deterioration and prediction of long term durability of E-glass/vinylester composites exposed to varying levels of humidity and periods of immersion at different temperatures to both mimic field applications and accelerated aging. Correlations that enable prediction of long-term durability are provided through a comprehensive study of moisture kinetics using both Fickian and combined diffusion-relaxation models, mechanical tests, and dynamic mechanical thermal analysis. The results are used to provide a comprehensive understanding of mechanisms and factors related to design.

What will audience learn from your presentation?

- Durability of composites and their effective use.
- Damage mechanisms and progression based on moisture kinetics and thermal analysis
- Correlation between moisture uptake and changes
- Long-term predictability of behavior

Biography

Engineering, and Mechanical and Aerospace Engineering, at the University of Texas at Arlington. An internationally reputed researcher, who has authored/co-authored over 500 publications and edited 6 books, Prof. Karbhari is an expert in the processing and mechanics of composites, durability of materials, infrastructure rehabilitation, and multi-threat mitigation. He is a fellow of the American Association for the Advancement of Science (AAAS); the National Academy of Inventors (NAI); the American Society of Civil Engineers; ASM International; the International Institute for Fiber-reinforced Polymers in Construction; the International Society for Structural Health Monitoring of Intelligent Infrastructure; ASCE's Structural Engineering Institute, and is an elected member of the European Academy of Science and Arts.



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Scientific Sessions

DAY-2

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Nonstoichiometric strontium ferromolybdate as an electrode material for solid oxide fuel cells

Gunnar Suchaneck[1]* and **Evgenii Artiukh[2]**

[1]TU Dresden, Solid-State Electronics Laboratory, 01062 Dresden, Germany

[2]SSPA "Scientific-Practical Materials Research Centre of NAS of Belarus", Cryogenic research division, 220072 Minsk, Belarus Receipt

This contribution is devoted to the application of $Sr_2FeMoO_{6-\delta}$ (SFM) and $Sr_2Fe_{1.5}Mo_{0.5}O_{6-\delta}$ ($SF_{1.5}M$) in $La_{1-x}Sr_xGa_{1-y}Mg_yO_{3-\delta}$ (LSGM)-based SOFCs. We consider the most relevant physical properties (crystal structure, thermodynamic stability, iron and molybdenum valence states, oxygen vacancy formation and oxygen non-stoichiometry, electrical conductivity), A- and B-site ion substitution, and the performance of $Sr_2Fe_{1+x}Mo_{1-x}O_{6-\delta}$ ($SF_{1+x}M$) SOFCs (polarization resistance, operation with hydrogen, operation with hydrocarbons and methanol). $SF_{1+x}M$ materials are excellent catalysts in hydrocarbon oxidation and can prevent carbon deposition due to the ability to exchange lattice oxygen with the gaseous phase. Moreover, they are sulfur tolerant. This opens the way to direct hydrocarbon fueled SOFCs, eliminating the need for external fuel reforming and sulfur removal components. Such SOFCs can be greatly simplified and operate with much higher overall efficiency thus contributing to the solution of the lack of energy problem in our modern world.

Summarizing crystal structure, thermodynamic stability, Fe and Mo valence state, and oxygen vacancy formation generation energy, SF1.5M is a compromise that provides a cubic crystal structure, generates an electronic structure as well as oxygen vacancies that promote suitable electrical transport properties and catalytic activity in oxidizing and reducing atmospheres. With regard to thermodynamic stability considered above, the ideal Fe to Mo ratio should be around two. The electrocatalytic properties of $SF_{1.5}M$ may be further improved by partial substitution of A-site and B-site ions.

The partial substitution of A and/or B site elements is an effective way to improve the performance perovskite-type materials. The additional introduction of alkali earth metal elements on the A-site and transition-metal elements on the B-site affects the cation valence and oxygen-vacancy concentration, and thus improves the electronic or ionic conductivity of the material as well as its catalytic properties.

Nevertheless, there are still some problems that need to be solved for commercial application: (i) A vapor phase deposition technology for $SF_{1+x}M$ deposition with a reproducible composition has to be developed, (ii) The composition of a $SF_{1+x}M$ cathode should be adapted to the used electrolyte. It will be different in the case of LSGM and yttria-stabilized zirconia (YSZ) electrolytes. (iii) A vapor phase deposition method of porous, composite anode deposition is required. Catalytic properties may be further improved by impregnation and exsolution methods. (iv) An appropriate carrier material of the SOFC thermally matched to the electrodes and the electrolyte must be selected.

Biography

Dr. Gunnar Suchaneck was Senior Researcher and Chief Assistant of the Solid State Electronics Laboratory at TU Dresden. He received his Ph.D. in physico-mathematical sciences from the Electrotechnical University - LETI, St. Petersburg, Russia, in 1983. Dr. Suchaneck has been retired since March 2021 but continues to work on a part-time basis. His current research interests include solid state sensor technology: ferroelectric thin film materials, metal oxide thin films, thin film deposition by reactive sputtering and plasma enhanced chemical vapor deposition, characterization of thin films by optical and electrical measurements. He has coauthored more than 280 technical publications in books, scientific journals, and conference proceedings, and has coauthored 15 patents.

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The I-V curve of a PV panel: Characterization and parameter extraction

Klaus-Ulrich Neumann[1,2] and **Michael Hartmann**[1,2]

[1]*Institue of Innovative Technologies, SRH University, Ernst-Reuter Platz 10, D-10587 Berlin*

[2]*SRH University, Ernst Reuter Platz 10, 10587 Berlin, Germany*

The behaviour of a PV panel or PV module is represented by the I-V curve. It is obtained experimentally by connecting the PV panel to a variable load and by measuring the current and voltage supplied by the PV panel as a function of the load resistance. The curve is modelled using the Schottky equation for a diode, possibly including a series and a parallel resistance of the panel.

A simple method is presented for characterising the panel as either confirming to the ideal diode behaviour or its modifications according to series and parallel resistances of the panel. A simple analysis method is presented to extract model parameters from experimental I-V curves.

What will the audience learn from your presentation?

- Modelling of a PV panel.
- Using a straight line fit for extracting model parameters. For this particular situation a straight-line fit may be used, even so the model has more than 2 parameters.
- Renewable energy - photovoltaic

Biography

Klaus-Ulrich Neumann is professor at the SRH University of Applied Sciences in Berlin. His interests include material science and wave and scattering phenomena, in particular neutron scattering. With work in areas of theory as well as experiment the author is well equipped for the investigation of novel wave phenomena and their applications.

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Thermoelasticity Superelasticity and Lattice Reactions in Shape Memory Alloys

Osman Adiguzel

Department of Physics, Firat University, Elazig, Turkey

Shape memory alloys take place in a class of adaptive structural materials called intelligent or smart materials by exhibiting a peculiar property called shape memory effect, by giving stimulus response to changes in the external conditions. These alloys are functional materials with these properties and used as shape memory elements in many interdisciplinary fields. These alloys exhibit dual characteristics, thermoelasticity and superelasticity with the recoverability of two shapes at different conditions. Shape memory effect is initiated thermomechanical treatments by cooling and deformation and performed thermally on heating and cooling. Therefore, this behavior can be called Thermoelasticity. Deformation in low temperature condition is plastic deformation, with which strain energy is stored in the materials and released on heating by recovering the original shape. This phenomenon is governed by the thermomechanical reactions, thermal and stress induced martensitic transformations. Thermal induced martensitic transformations occur on cooling with cooperative movement of atoms in <110 > -type directions on a {110} - type plane of austenite matrix, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures. The twinned structures turn into detwinned martensite structures by means of stress induced martensitic transformations with deformation.

Superelasticity is performed in only mechanical manner by stressing and releasing the material and in elasticity limit at a constant temperature in the parent austenite phase region, and shape recovery occurs instantly and simultaneously upon releasing, by exhibiting elastic material behavior. Superelasticity is also result of stress induced martensitic transformation, with which the ordered parent phase structures turn into the detwinned martensite structures by stressing. Superelasticity is performed in non-linear way, unlike normal elastic materials behavior, loading and releasing paths are different, and cycling loop refers to the energy dissipation.

Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures. Lattice invariant shears and twinning are not uniform in these alloys, and the ordered parent phase structures undergo the non-conventional layered structures with martensitic transformation. These layered structures can be described by different unit cells as 3R, 9R or 18R depending on the stacking sequences. Periodicity and unit cell is completed through 18 layer in 18R structure in ternary copper based shape memory alloys.

In the present contribution, x-ray diffraction and transmission electron microscopy studies were carried out on copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections inherited from parent phase due to the displacive character of the transformation. X-ray diffractograms taken in a long-time interval

show that diffraction angles and intensities of diffraction peaks change with the aging time at room temperature. This result refers to a new transformation in diffusive manner.

Keywords: Shape memory effect, martensitic transformation, thermoelasticity, superelasticity, lattice twinning and detwinning

What the audience learn from the presentation

Shape memory alloys are multifunctional materials and used in many fields from biomedical application to the building industry. I will introduce the basic terms and definitions about shape memory effect and crystallographic transformations, and introduce the experimental results performed on two copper-based shape memory alloys.

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. His academic life started following graduation by attending an assistant to Dicle University in January 1975. He became professor in 1996 at Firat University in Turkey, and 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 level with contribution. He served the program chair or conference chair/co-chair in some of these activities. Also, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Additionally, he joined over 120 online conferences in the same way in pandemic period of 2020-2022.

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)

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Gate tunable anomalous Hall and Edelstein effect at oxide interfaces

C.A. Perroni[1], M. Trama[3] and R. Citro[2,3]

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[2]CNR-SPIN, Udr Napoli

[3]Department of Physics, Università di Salerno

Converting charge current into spin current is one of the main mechanisms exploited in spintronics. One prominent example is the Edelstein effect, namely, the generation of a magnetization in response to an external electric field, which can be realized in systems with lack of inversion symmetry. If a system has electrons with an orbital angular momentum character, an orbital magnetization can be generated by the applied electric field, giving rise to the so-called orbital Edelstein effect. Oxide heterostructures are the ideal platform for these effects due to the strong spin–orbit coupling and the lack of inversion symmetries. Beyond a gate-tunable spin Edelstein effect, we predict an orbital Edelstein effect an order of magnitude larger then the spin one at the (111) LaAlO3/SrTiO3 interface for very low and high fillings. We model the material as a bilayer of t2g orbitals using a tight-binding approach, whereas transport properties are obtained in the Boltzmann approach. We give an effective model at low filling, which explains the non-trivial behaviour of the Edelstein response, showing that the hybridization between the electronic bands crucially impacts the Edelstein susceptibility.

We present the theoretical prediction of a gate tunable anomalous Hall effect (AHE) in an oxide interface as a hallmark of spin-orbit coupling. The observed AHE at low-temperatures in the presence of an external magnetic field emerges from a complex structure of the Berry curvature of the electrons on the Fermi surface and strongly depends on the orbital character of the occupied bands. A detailed picture of the results comes from a multiband low-energy model with a generalized Rashba interaction that supports characteristic out-of-plane spin and orbital textures. We discuss strategies for optimizing the intrinsic AHE in (111) SrTiO heterostructure interfaces.

What will audience learn from your presentation?

- Explain how the audience will be able to use what they learn?
- How will this help the audience in their job? Is this research that other faculty could use to expand their research or teaching? Does this provide a practical solution to a problem that could simplify or make a designer's job more efficient? Will it improve the accuracy of a design, or provide new information to assist in a design problem? List all other benefits.

Biography

Prof. Perroni studied Physics at the University of Naples "Federico II", got the degree in Physics cum laude. Eventually he became associate professor od condensed matter theory in 2019.

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Resilient Nanotechnologies in Intelligent Buildings

Mocerino Consiglia *PhD, PDTA*

Faculty of Architecure, Sapienza University of Rome, Rome, Italy

In the various articulations of the building process, broad perspectives of sustainability are outlined which, investing above all scientific research, R&D, universities, with studies in many environmental, economic and social sectors, and promoting a strong international debate, aim at technological innovation and efficiency with intelligent interactive and resilient enclosures for user well-being.

The goals are sustainability and efficiency in high performance contextualized architectures, with the use of innovative resilient nanotechnologies which, from applications in various sectors, such as electronics, mechanical engineering/physics, biomedical, materials science, chemistry, physics, architecture, restoration of monuments and conservation of works of art, etc. highlight in the construction sector and in intelligent buildings, high performance of energy efficiency.

In fact these promising resilient nanotechnologies based, mainly on the properties of carbon nanotubes, are characterized by versatility, resistance to the strong impact of nanoparticles, efficiency, safety for stability by high mechanical resistance to thermodynamic actions, reliability with reactive chemical stability which is amplified with decreasing size, (a nanometre-nm is a billionth of a meter corresponding to 10−9 m) in buildings whose smart technical management on the BMS interacts with the user and the environment.

The criteria are to integrate the intelligence of technical management systems into buildings especially in the three macro areas of building materials, for thermal insulation and surface coating, etc, with structured nanomaterials integrated with IT and ICT with intelligent buildings and GEB (Grid-interactive Efficient Buildings), with zero or low energy consumption and CO2 reduction , in line with New Technology, Cleantech of COP27, UNFCCC, Paris Agreement and more.

The methodologies are based above all on the application of nanotechnologies of ultra-light, heat- strength nanostructured materials and dinamic nano-architectured/hierarchical materials, engineered materials made with carbon nanotubes (CNT) on nanometric basis, graphite-carbon nanotube with multi-walled MWCNT (Multi-Walled Carbon NanoTube) and SWCNT (Single-Walled Carbon NanoTube) graphene-carbon nanotube. The latter has high properties of flexibility, mechanical strength, superior to steel, thermal and electrical conductivity superior to copper, allowing the production of durable, transparent conductive materials, with excellent electromechanical, biological, chemical and electrochemical, thermal and thermoelectrics of lightness and integration. In addition, low-emission cellulose nanotubes, with aerogels, perovskite photovoltaic cells, and more.

The strategies are identified in the adoption of new production processes of innovative nanostructured materials that increase both

productivity and resilience, which leads to sustainability and in particular to the energy efficiency of smart buildings. Such as the CVD synthesis process for very transparent graphene films with 0.34 nm nominal layer thickness, for transparent, light and energy efficient envelopes, with slabs and concrete reinforcement for constructions with concretene, a liquid concrete with graphene- 2D two-dimensional material that represents the future of construction, reinforcing the standard RC30 concrete by about 30% (asphalt for the new flooring of the Polcevera bridge, Amesbury gymnasium slab, and more), such as smart envelopes with nanotech digital biosensor systems also for smart building management, nanotechnological devices for waste recycling, and more. The challenge is that of dematerialization and digitization with the use of recyclable smart nanotechnologies in smart buildings for resilience and sustainability.

What will audience learn from your presentation?

The Research:

- Can stimulate the public to the novelties of nanotechnologies production with energy saving, efficiency and healthiness in the habitat
- Could be of interest to the public and designers for the best choices in terms of sustainable design in which to live, or in the workplace
- It can be a stimulus for the didactic learning of new nanotechnologies in the field of Architecture, Engineering, etc. and for new sector research with innovative planning and in Design.

Biography

Arch. PhD. Mocerino Consiglia, Faculty of Architecture, Sapienza University of Rome, Italy: already adjunct professor and PhD in Technology of Architecture, Specialist in Restoration of Monuments, scientific research contractor, Subject Expert-3rd member of the examination Commission. Collaboration in scientific research and Master 2 Materials and Energy-University Jules Verne. Member BIESA-ITI, IKnowD's Advisory Board, University of Madeira. Editorial board member, author of 52 scientific publications. Main scientific researches on technological innovation, AI, energy efficiency, sustainability, new materials, smart buildings, bio-inspired systems, nanotechnologies. She obtained architecture awards, participates in international conferences as speaker, chair, keynote speaker, member of the organizing committee.

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Impact of grain orientation on the generation of surface nanostructures on polycrystalline metals using a 300 ps UV laser

L. Porta-Velilla[1], A. Frechilla[1], M. Castro[1], E. Martínez[1], G. F. de la Fuente[1], J. Bonse[2] and L. A. Angurel[1]

[1]Instituto de Nanociencia y Materiales de Aragón (CSIC-University of Zaragoza), C/María de Luna 3, 50018 Zaragoza, Spain

[2]Bundesanstalt für Materialforschung und -prüfung (BAM), Unter den Eichen 87, 12205 Berlin, Germany

When metals are irradiated with pulsed lasers under their ablation threshold, it is possible to generate surface periodic structures. These structures are very interesting due to their capacity to modify material properties such as colour, hydrophobicity, antibacterial activity or superconducting properties, among others. In recent years, the use of antibiotics has led to the appearance of multi-resistant bacteria. Thus antibacterial surfaces have gained interest as a non-antibiotic alternative to fight against these microorganisms. The nanostructures shape and period are related not only with the intrinsic characteristics of the electromagnetic radiation like laser pulse duration and its wavelength but also the material structure takes part in the formation process.

In this work, two metallic biomaterials, stainless steel and nickel, have been treated with a 300 ps pulsed UV laser irradiating under a laser line scanning configuration. The complex nanotextured surfaces were characterized using both electron microscopy and back scattering diffraction (EBSD) on the same areas. A new characterization method was employed in order to translate the information provided by the EBSD analysis in order to compare different laser treatments.

The new analysis method paves the way to appreciate previously unnoticed material dependences. The results obtained demonstrate a significant correlation between crystallographic grain orientation and the generated surface nanostructures. Nanostructure formation has been modified by controlling the laser polarization direction, the plane of incidence and the incidence angle. All of these enable changing the affected grains, depending on their crystallographic orientation. Differences in the period, shape, intensity and type of nanostructures are reported for the studied materials.

What will audience learn from your presentation?

In this presentation, a new analysis method will be explained which combines the three-dimensional information on grain orientation obtained from EBSD with the topographic information obtained from electron microscopy. The generated maps enable clear identification of changes within grains, as well as how grains with different crystallographic orientation are affected.

In addition to the commonly described ripples, other 1D and 2D periodic structures are described in this presentation. Moreover,

multiple micrographs will illustrate the different nanostructures observed depending on grain crystallographic orientation.

The attendants will learn about new phenomena regarding surface nanostructure generation on metallic surfaces with identification of different types of nanostructures. This diversity of nanostructures has not been observed when femtosecond lasers are used for similar purposes.

Biography

Mr. Luis Porta-Velilla is completing his PhD at the University of Zaragoza. His research interests include the application of laser technologies in the field of biomedicine in order to produce antimicrobial surfaces and the study of the photothermal properties of nanoparticles under laser irradiation.

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InSe-based van der Waals heterostructures for emerging technologies

Nilanthy Balakrishnan

School of Chemical and Physical Sciences, Keele University, Keele, Staffordshire, United Kingdom

Among the 2D semiconducting materials, indium selenide (InSe) compounds are attracting great attention due to their desirable electronic and optical properties. Indium selenide compounds can exist with different stoichiometries (e.g. InSe, In2Se3 and In4Se3) and polytype phases (α, β, γ, etc.), providing band gaps tunable from the near infrared to the visible range (1.2 - 2 eV) of the electromagnetic spectrum, a high electron mobility at room temperature (> 0.1 m2V-1s-1), room temperature ferroelectricity and strong carrier correlations in atomically thin layers due to an inverted "Mexican hat" valence band. Here, I present our recent work on InSe based van der Waals heterostructures of interest for optoelectronics, thermoelectric and nanoelectronics. Both InSe/GaSe and InSe/In2O3 heterojunctions exhibit room temperature electroluminescence and spectral response from the near-infrared to the visible and near-ultraviolet ranges. On the other hand, the nanoscale thermal properties of InSe layers shows an anomalous low and anisotropic thermal conductivity, which is smaller than that of low-κ dielectrics, such as silicon oxide. The thermal response of free-standing InSe layers and layers supported by a substrate, reveals the role of interfacial thermal resistance, phonon scattering, and strain. These thermal properties are critical for future emerging technologies, such as field-effect transistors that require efficient heat dissipation or thermoelectric energy conversion with both low thermal conductance and high electron mobility 2D materials, such as InSe. Furthermore, we report on the ferroelectric semiconductor α-In2Se3 embedded between two single-layer graphene electrodes. We show how the ferroelectric polarization of the In2Se3 layer can modulate the transmission of electrons across the graphene/In2Se3 interface, leading to memristive effects that can be controlled by applied voltages or by light.

Biography

Dr Nilanthy Balakrishnan is a Lecturer in Physics at the School of Chemical and Physical Sciences, Keele University, UK (October 2019 - now). She obtained BSc Hons degree in Physics from the University of Jaffna, Sri Lanka in 2008, and an MSc by Research and a PhD in Condensed Matter Physics from the University of Nottingham in 2012 and 2015, respectively. Following her PhD, she worked as a postdoctoral researcher for 3 years at the University of Nottingham and 18 months at the University of Manchester. Dr Balakrishnan's main areas of expertise are semiconductor physics, material science, and nanotechnology. Her research focuses on understanding the fundamental properties and applications of novel 2D materials.

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Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

N-Doped Graphene from PET Bottles Waste as an Effective Electrocatalyst Support

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The finite reserves of existing fuels and the environmental pollution caused by excessive energy production are critical problems for the world. Therefore, it is urgent to seek alternative clean energy sources. Fuel cells (FCs) directly convert chemical energy into electricity and are attracting attention from researchers as sustainable power sources. FCs are intrinsically efficient, non-polluting, silent, and reliable. Alkaline fuel cells (AFCs) are advantageous in several aspects as they enable using low-cost non-noble metals in electrocatalysts, thus reducing the amount of used noble metal. Additionally, the problems related to hydrogen transportation and storage can be overcome by using liquid fuels.Moreover, direct borohydride fuel cells (DBFCs), using sodium borohydride (NaBH4) as a liquid fuel, can attain high power densities. However, the high catalyst cost requires the development of sustainable catalysts with high activity and lower prices.

This work aims to design efficient and inexpensive nanostructured catalysts for application in low-temperature AFCs. Nitrogen-doped graphene (NG) prepared by thermal decomposition of PET bottles waste with urea was assessed as a sustainable carbon support for electrocatalysis. The different palladium-nickel (PdNi) catalysts were prepared by anchoring Ni nanoparticles on the NG and doping with different (5 to 15 wt.%) amounts of Pd. Several analysis methods were employed to characterize the prepared catalysts, including ICP-OES, XRD, XPS, SEM-EDS, TEM, N2-sorption analysis, FTIR, and Raman spectroscopy.

Cyclic voltammetry was used to assess the electrocatalytic activity of the prepared catalysts for borohydride oxidation reaction (BOR) in 0.03 M NaBH4 in aqueous alkaline media (2 M NaOH). Additionally, the materials were analyzed for oxygen reduction reaction in alkaline media, as the cathodic reaction in DBFCs. The studies showed that the prepared PdNi@NG catalysts have good electrochemical activity and stability in alkaline NaBH4 solutions. The PdNi@NG catalyst with the highest Pd doping exhibited the best electrocatalytic activity for the borohydride oxidation and oxygen reduction reactions. The prepared PdNi@NG catalysts seem promising anodic and cathodic materials for application in DBFCs.

What will audience learn from your presentation?

- The audience will learn about the benefits of renewable energy use, including less global warming, stable energy prices, improved public health, inexhaustible energy, job

creation and other economic benefits, and reliability and resilience.

- The audience will be introduced to fuel cells and their applications as sustainable power sources.
- The audience will hear about the electrochemical activity of newly prepared materials for low-temperature fuel cells, including the benefits of using sustainable electrocatalyst supports based on nitrogen-doped graphene prepared by the thermal decomposition of PET bottles waste.

Biography

Diogo M.F. Santos is an Invited Assistant Professor at IST-ULisboa and a Researcher at CeFEMA, studying electrodes and membranes for application in fuel cells and electrolyzers. D.M.F. Santos has authored over 170 papers; his current h index is 33. He is on the "World's Top 2% Scientists list" of Stanford University for the impact in 2020 and 2021. He has presented over 70 oral communications and 80 posters at international conferences. His main research interests are related to electrochemical energy conversion and storage.

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Complex permitivity method to determine the devitrification process in a glassy matrix.The correlation between the a.c. electrical behaviour and the non isothermal nucleation

Marisa A. Frechero

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The electrical behavior of a bismuth-phosphate glass lithium-ion conductor is studied in a very wide temperature range, from 39K to 843K, encompassing the glassy state, passing through the glass transition temperature, and reaching devitrification. The relationship between the structural changes caused by the thermal treatment and the resulting electrical response is interpreted through the dc conductivity and ac permittivity. An isothermal and a non- isothermal treatment allows to propose a simple analysis of the energy distribution and atoms rearrangement times involved in devitrification, using a Gaussian approximation method considering the fundamental elements in the M. Avrami's generalized theory.

What will audience learn from your presentation?

- The studied material is suitable for containing a large amount of mobile lithium ions, which enhances the ionic conductivity of the solid. It is focused on the importance of the correlation between the electrical behavior with the thermal behavior in a very wide temperature range: from 39K to 843K. The fundamental motivation is the crucial role in the technological application of glassy ion conductors as solid electrolytes.
- Today, many materials are proposed as potentially useful in such devices. However, thermal aging processes that normally take place are many times underestimated. Because of that, to encompass the study of different phenomena that are feasible in a vitreous material, contemplating glass transition, and devitrification is fundamental.
- A correlation between the detailed structural changes through an isothermal and a non- isothermal treatment using DSC and the electrical behavior using impedance spectroscopy is possible to achieve.
- Even more interesting is the evidence provided by a simple analysis of the energy distribution involved in devitrification using a Gaussian approximation method considering the fundamental elements in the M. Avrami's generalized theory that supports the fact that crystallization phenomenon is a non-instantaneous and non-sequential process.

Biography

Dr. Marisa A. Frechero is Full Professor at the Chemistry Department in the Universidad Nacional del Sur, Bahía

Blanca, Buenos Aires, Argentina and Senior Researcher of the CONICET, Argentina. She received her Ph.D. degree in Chemistry Science (Universidad Nacional del Sur) and has published numerous book chapters in Material Science and more than 80 remarked publications related to solid ionic conductor materials. Her work is both experimental and theoretical focused on solid ionic conductors. In addition, she has presented more than 190 conference papers.

Dr. Marisa A. Frechero's research interest is related to developing materials for new generation of green energy sources with low environmental impact.

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Theme: "Outlining the forefront research in the field of materials science and nanotechnology."

The Formula of Dependence of Mechanical Characteristics of Materials on Crystalline Phase Composition in the Matrix

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Goal: For materials science and generally, for long-term operation of work-pieces in industry the significant role is attributed to dependence of macro-mechanical properties of consolidated body on crystalline phase composition, its dimensions, form, distribution in matrix and the form factor. While working in responsible fields of technology of ceramics and ceramic composites the above referred properties are attributed extremely great role with the view of durability and endurance at the terms of heavy mechanical loads. For description of the resistance of any concrete type work-piece, the crystalline phase plays the greatest role in mechanical strength or deformation of any material. It plays the important role in correlative explanation of materials mechanics and matrix properties. In our case, in the process of destruction of ceramic materials and composites, which will give us exhaustive response to the role of macro- and micro-mechanical properties of materials, the role of a macro- and micro-structural component, that is, of crystalline phase in the process of transition of stable state of materials into meta-stable state is extremely big. Our study aims to develop a formula of dependence of macro-mechanical properties of ceramic and ceramic composites on crystalline phase, the most powerful component of their structure, which will enable theorists and practitioners to select and develop technologies and technological processes correctly.

Method: On the basis of the study of micro- and macro-mechanical properties of ceramics and ceramic composites and the morphology of crystalline phase and the analysis of the study we determined and created parameters of the formula.

Results: The formula covers macro-mechanical properties, that is when the work-piece is thoroughly destructed: mechanic at bending at three and four-point load, mechanic at contraction; among morphological characteristics: composition of crystalline phase and their spreading in matrix, their sizes, form factor; correlative dependence of the above listed properties. Absolutely new definition of a factor of spreading of crystalline phase in matrix is offered. Based on the above, we considered it necessary to offer a formula for the correlational dependence of the influence of the crystalline phase 1 [15] on the mechanical properties of materials:

$$\sigma_d = \frac{P.F_{kd}}{.Km\ Kv\ F_{kf}},$$

where: P -is loading MPa; Km–mean size of the crystalsμM; Kv - volumetric share of crystals in the matrix %; Fkd–factor of distribution of crystals in the matrixis defined by a researcher. In case of equal distribution = 1, in case of unequal distribution = $0.9F_{kf}$–shape factor of the crystals is taken as the ratio of the largest characteristic size of the crystal to the smallest, which allows us to characterize the shape of a given combination of crystals

Conclusion: The created formula is of consolidated nature and it can be used in technology of any ceramic material and ceramic composites. The formula will help practitioners to plan correctly and fulfill accurately all positions of technology of production of work-pieces, to carry out the most responsible thermal treatment process of technology of manufacture of work-pieces; to determine correlation between mechanical and matrix properties of materials.

Keywords: crystalline phase; macro-mechanical properties; mechanic at bending; mechanic at compaction; factor of spreading of crystalline phase in matrix.

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The Scientific Basis of Our Reactive Metals Based Civilization

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Our civilization is based upon the reactive metals, such as aluminum, iron, nickel, chromium, titanium, and so forth. These metals and their alloys react with oxygen and water with considerable negative changes in the Gibbs energy, indicating that the reactions are thermodynamically spontaneous and many of the reactions occur at considerable rates; some violently so (e.g., the burning of Al or Mg in air). In other cases, the reaction is muted, allowing the metals and their alloys to be used in fabricating machines that require close tolerances. Nevertheless, the resulting corrosion exacts an enormous cost on society that has been estimated at about 3.5 % of the GDP for industrialized nations. Given that the GDP of the US is about $21 trillion ($21x1012), the annual cost of corrosion is approximately $735 billion.

Corrosion is an electrochemical process comprising at least two partial reactions, one of which is the electrodissolution (destruction) of the metal or alloy substrate to produces electrons that are quantitatively consumed by a cathodic partial reaction, such as the reduction of oxygen or the evolution of hydrogen via the reduction of water. The rate of the electrodissolution reaction in the active state increases exponentially with the electrochemical potential, so that even modest changes in the potential can result in massive changes in the rate. Fortunately, once the potential exceeds a critical value, known as the Flade or passivation potential, the rate drops precipitously to values that are sufficiently low (< 1 μm/a) that the metals and their alloys may be used to fabricate machines that retain their precise dimensions over useful service lifetimes (40 – 100 a). This if known as the passive state in which the thermodynamically highly reactive metals attain kinetic stability because of the formation of an oxide film on the surface that is commonly no more than 1-3 nm thick and that separates the reactive substrate from the corrosive environment.

In this presentation, I will review the scientific basis for the phenomenon of passivity within the framework of the Point Defect Model (PDM) and define precisely the condition that must be achieved for passivity to occur. Indeed, the occurrence of our metals-based civilization can be expressed as a simple inequality that has profound implications for life as we know it. I will also discuss how the PDM predicts the breakdown of passivity that is responsible for the $2.2 trillion annual cost of corrosion. These predictions will be illustrated with practical examples, such as the corrosion and failure of airframes, the failure of oil/gas pipelines, and the failure of nuclear reactor coolant piping.

The material given in this presentation will allow the listener to understand the phenomenon of passivity and hence to select the most

cost-effective metals and alloys for specific applications to ensure that passivity is achieved. The presentation will also instruct the audience on the limits of passivity in the form of aggressive anion passivity breakdown and the nucleation of pits that may then act as sites for the nucleation of other forms of localized corrosion, such as stress corrosion cracking and corrosion fatigue.

Biography

The author is a Professor in Residence in the Departments of Nuclear Engineering and Materials Science and Engineering at the University of California at Berkeley. His research interests lie in developing the theory of passivity in the form of the Point Defect Model, in developing the theories for the propagation of localized corrosion in the forms of the Coupled Environment Models for pitting, stress corrosion cracking, and corrosion fatigue, and in the development of the deterministic protocol Damage Function Analysis for predicting the evolution of localized corrosion damage in complex industrial systems such as nuclear power reactors.

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Nanoassembly of amyloid proteins at the membrane-liquid interface

Yuri Lyubchenko and **Mohtadin Hashemi**

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The aggregation of amyloid beta (Aβ) is a self-assembly process that results in the production of fibrillar structures along with neurotoxic aggregates. However, in the vast majority studies in vitro the required Aβ concentrations is several orders higher of the physiological relevant concentrations of Aβ; no aggregation is observed at physiological low nanomolar range of Aβ. This suggests that the assembly of Aβ in aggregates in vivo utilizes pathways different from those used in experiments in vitro. We have discovered recently that surface plays a role of catalyst allowing the self-assembly of amyloid aggregates to occur at physiologically relevant concentrations. We proposed a model in which the monomers transiently immobilized on the surfaces work as nuclei for the next aggregation step. The model was verified by experimental time-dependent AFM measurements. AFM studies of aggregation of Aβ on supported phospholipid bilayer revealed a strong effect of the membrane composition on the surface aggregation catalysis. We combined AFM experimental studies with all-atom molecular dynamic (MD) simulations to characterize the on-surface self-assembly process of amyloid proteins. MD simulations show that the surface-protein interactions induce a conformational transition of the monomer facilitating binding of another molecule. A membrane-mediated aggregation catalysis explains a number of observations associated with the development of Alzheimer's disease. The affinity of Aβ monomers to the membrane surface is the major factor defining the aggregation process rather than Aβ concentration. Therefore, the development of potential preventions for the interaction of monomeric amyloids with membrane can help control the aggregation process.

Biography

Dr. Yuri L. Lyubchenko is Professor of Pharmaceutical Sciences University of Nebraska Medical Center, Omaha, NE. His research spans a broad range of biomedical problems aimed at unraveling molecular mechanisms of such diseases as cancer, Alzheimer's and Parkinson's diseases. He has authored 320 research articles/book chapters. He was named UNMC distinguished scientist (2008). He is an Academic Editor for Nature-Scientific Reports, associate editor for New Journal of Science, Frontiers in Bioscience, Journal of Molecular Pharmaceutics and Precision Nanomedicine and serves as editorial member of a number of reputed journals. He also serves on NIH and NSF grant proposal review panels.

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Microfluidic-based 3D bioprinting of vascular endothelial networks for tissue engineering applications

Ying Betty Li[1,3], Caroline Sodja[1], Marina Rukhlova[1], Jordan Nhan[2], Joshua J.A. Poole[3], Harry Allen[4], Selam Yimer[5], Ewa Baumann[1], Erin Bedford[6], Hannah Prazak[2], Will J Costain[1], Sangeeta Murugkar[4], Jean-Philippe St-Pierre[2], Leila Mostaço-Guidolin[3] and **Anna Jezierski[1,7]***

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4 Carleton University, Department of Physics, Faculty of Science, Ottawa, ON
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6 Aspect Biosystems Inc, Vancouver, BC
7 University of Ottawa, Department of Biochemistry, Microbiology and Immunology, Faculty of Medicine, Ottawa, ON

Angiogenesis plays a pivotal role in development and tissue growth, as well as in pathological conditions such as cancer. Being able to understand the basic mechanisms involved in the vascularization of tissues and angiogenic network formation provides a window to advance the development of in vitro tissue models and enhance tissue engineering applications. In this study, we leveraged a novel microfluidic-based three dimensional (3D) bioprinting technology and alginate-collagen type I (AGC) bioink, to develop a 3D bioprinting strategy to enable the biofabrication of complex angiogenic networks within the 3D structure. These networks were comprised of simian vacuolating virus 40 (SV40) transformed adult rat brain endothelial cell (SV-ARBEC)-laden hydrogel rings. With mechanical properties relevant for vascular tissue engineering applications, these bioprinted constructs formed spontaneous vascular networks, reminiscent of anisotropic tissue-like structures, while retaining high cellular viability. The vascular network formation was accompanied by extracellular matrix (ECM) remodeling, confirming sequential SV-ARBEC mediated collagen type I fiber deposition and reorganization. Treatment with broad spectrum matrix metalloproteinase (MMP) inhibitor supressed SV-ARBEC angiogenic sprouting, highlighting requirements of ECM remodeling in angiogenic network formation. This novel 3D microfluidic bioprinting technology and biocompatible AGC hydrogel fiber rings supported robust SV-ARBEC angiogenesis and corresponding ECM remodeling, allowing us to present a strategy suitable to advancing applications in vascular research and supporting the further development of disease models, novel testing beds for drug discovery and tissue engineering applications.

What will audience learn from your presentation?

- Collagen deposition and ECM remodeling
- 3D bioprinting and bioink formulation
- Angiogenesis and vascular network formation

Biography

Dr. Betty Li received her bachelor's degree in Engineering Science major in Nanoengineering, University of Toronto. Followed by Masters of Engineering Science in Chemical and Biochemical Engineering at Western University. She then focused her PhD on natural polymer-based biomaterials synthesis and characterization for tissue regeneration and biomedical devices. She just finished her postdoctoral fellowship in the Human Health Therapeutics Research Center at the National Research Council of Canada and now she is a Research Associate with the department. She is involved in developing Organ-on-Chip blood brain barrier (BBB) model platform by integrating human stem cell technologies, 3D bioprinting, synthetic biomaterials, microfluidic design and microfabrication to recapitulate the structural and functional complexity of the human BBB in vitro.

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Controlling Exciton Polarization in Plasmonic Semiconductor Nanocrystals

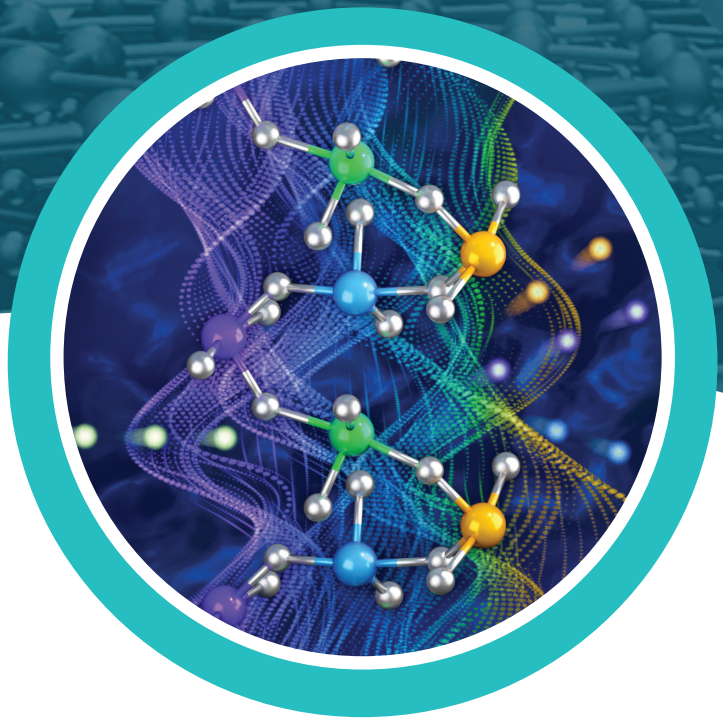
Penghui Yin, Bharat Tandon, Aaron Kenny-Wilby, Gyorgy Jaics and **Pavle V. Radovanovic**

Department of Chemistry, University of Waterloo, Waterloo, Ontario, Canada

Degenerately doped semiconductor nanocrystals with tunable localized surface plasmon resonance (LSPR) have attracted significant attention in recent years due to their unique optoelectronic properties. Unlike noble metal nanoparticles, colloidal plasmonic semiconductor nanocrystals have LSPR frequencies tunable in the infrared region, which makes them appealing for terahertz imaging, heat-responsive devices, and surface-enhanced infrared spectroscopic measurements. Besides expanding the range of potential applications, plasmonic semiconductor nanocrystals could enable numerous other opportunities related to plasmon-exciton interactions. However, the LSPR and exciton in semiconductor nanocrystals are generally not resonant, which has been a major obstacle toward realizing such opportunities. In this talk I will discuss the results of our recent work on the plasmonic properties of colloidal semiconductor nanostructures, and will particularly focus on magneto-optical studies of this class of materials. Using magnetic circular dichroism spectroscopy we demonstrated robust excitonic Zeeman splitting in a range of plasmonic semiconductor nanocrystals enabled by the angular momentum associated with the cyclotron motion of free charge carriers in an external magnetic field. This phenomenon allows for a new way of realizing carrier polarization in semiconductor nanocrystals. Furthermore, the ability to control the type of charge carriers and the degree of their delocalization, as well as the nanocrystal morphology, allows for further manipulation of the excitonic splitting pattern and quantum states in semiconductor nanostructures. Possible applications of this emerging class of multifunctional materials for new electronic and quantum information technologies will also be discussed.

Biography

Dr. Pavle Radovanovic received his Ph.D. degree from the University of Washington, Seattle. Following his graduate studies, he carried out his postdoctoral research at Harvard University. He subsequently joined the faculty at the University of Waterloo, where he is now a Full Professor in the Department of Chemistry. Radovanovic's research program focuses on the design, physical and chemical properties, and novel applications of multifunctional low-dimensional inorganic and hybrid materials. His work has been recognized by a number of honors and awards, including Research Excellence in Materials Chemistry and Keith Laidler Award (Canadian Society for Chemistry) and Canada Research Chair.



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Poster Presentations

DAY-2

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Positron Annihilation Spectroscopy applied to CuCrFeVTi High-Entropy Alloy

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High Entropy Alloys (HEA) are widely studied because their high-performance properties. A 5%Cu-35%Cr-35%Fe-20%V-5%Ti HEA has been produced by vacuum arc-melting under a low-pressure He atmosphere, melting the sample at least five times to ensure high chemical homogeneity. Isochronal vacuum thermal treatments up to 900 ºC were performed, and samples were characterized by Positron Annihilation Spectroscopy (PAS) (Doppler Broadening Spectroscopy (DBS) and Positron Lifetime Spectroscopy (PLS) techniques).

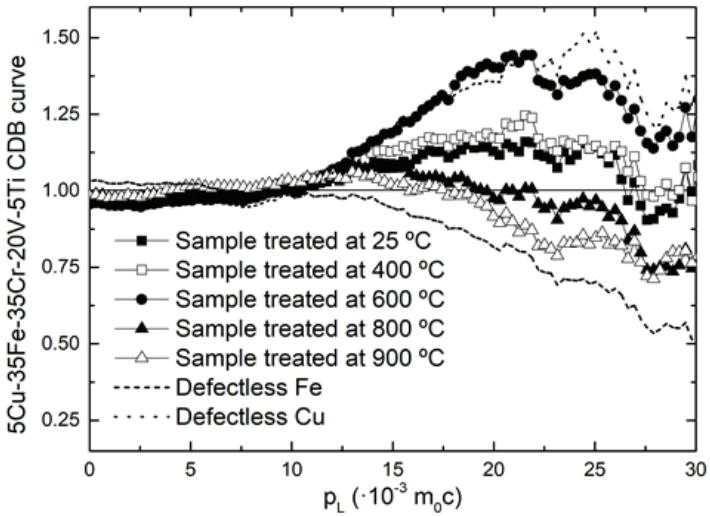

Figure 1.- 5%Cu-35%Cr-35%Fe-20%V-5%Ti sample CDB curves for selected temperatures reference to 5.26%Cu 36.84%Cr 36.84%Fe 21.05%V sample. Pure Cu and Fe CDB curves are shown for comparison purposes.

Previous studies show that this alloy presents a dendritic microstructure, with a Cr-enriched dendritic region with a fine distribution of nanometer spherical Cu particles; and the interdendritic regions consist of two phases: Ti and Fe enriched phase and Cu enriched phase. Ti precipitates can be observed homogeneously distributed in the sample. The microstructure is stable with temperature, and the only noticeable change is the growth of the Cu particles in the dendritic region. A "base" 4-element alloy (5.26%Cu 36.84%Cr 36.84%Fe 21.05%V) has been used to reference the

CDB measurements in order to highlight the contribution of Ti. Figure 1 shows the studied samples CDB curves referenced to the 4-element alloy for selected temperatures, and pure annealed defect-less Cu and Fe CDB curves (for comparison purposes). CDB curves show that the environment of the vacancy-type defects is mainly associated to Cu in the low and mid temperature range. In the low temperature range (25 º C – 400 ºC) its contribution is relatively low, while in the mid temperature range (500 ºC to 700 ºC) it increases significantly. In opposition, in the high temperature range (800 ºC – 900 ºC) this significantly changes revealing the main contribution of Fe to the vacancy grouping. This change is also evidenced by PLS results by an increase in the mean lifetime from 138(1) ps to 150(1) ps.

What will audience learn from your presentation?

- Introduction to Positron Annihilation Spectroscopy (PAS) techniques.
- Introduction to High Entropy Alloys (HEA).
- Information about open-volume defects evolution with temperature in studied alloy.
- Information about the chemical environment of the open-volume defects in the studied alloy.
- Preliminary results about the CuCrFeV-X High Entropy Alloy family.

Biography

Degree on Physics by Universidad Complutense de Madrid, and PhD on Nuclear Physics by Instituto de Estructura de la Materia (CSIC). Started at Universidad Carlos III de Madrid in a postdoctoral position, and stayed as Researcher Professor. Current research on Materials Science characterizing materials for Nuclear Applications by the use of Positron Annihilation Spectroscopy (PAS) techniques (Coincidence Doppler Broadening (CDB) spectroscopy and Positron Lifetime Spectroscopy (PLS)); and research on Solar Cells simulation and modeling using a 3-D distributed model. Additional research on tools for the integration of persons with disabilities in the educational system and access to the emergency services.

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A POLYMER LOADED WITH POMEGRANATE PEEL AS A PROMISING ANTIUCLEROGENIC BIOMATERIAL

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[3]Department of Mathematics, Physics & Statistics, University of Guyana, Turkeyen Campus, Georgetown P.O. Box 10-1110, Guyana

The antiulcerogenic property of dressing based on natural compound-derived substances were extensively investigated as alternatives therapeutic for the treatment of gastric ulcer. In the present work, a gastric dressing composed of gelatine (GEL), chitosan (CH), and pomegranate peel (PP) extract was synthesized and investigated. The effect of gamma rays on these bioactive dressing, physicochemical and in vitro biological analyses of the produced dressing were evaluated. After irradiation, due to the cross linking phenomena, The Fourier transform infrared spectroscopy (FTIR) measurements showed an increase in peak intensity at C-H chains and C=O carboxyl groups at 10 kGy. A low change in crystallinity between the range of 2 (15- 30°) is revealed by XRD examination. Antibacterial and anti-biofilm activities were significantly determined. In fact, the GEL–CH–PP dressing showed different behaviours and effects against bacteria biofilm. The hemolysis rates were, indicating a good degree of hemocompatibility, and the in vitro anti-inflammatory efficacy was significantly high. The loading of bioactive agents into polymer-based dressings improved antiulcerogenic therapeutic properties.

Keywords: Chitosan, Gelatine, Pomegranate Peel, γ-irradiation, Gastric Dressing.

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Potential Floquet states in 2D topological insulators

David Carroll

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We present xciting new evidence for potential floquet states in the 2D chalcogenide BiTe. Using fast pump probe techniques we establish a spin polarized perimeter current and then convert this to rotating superposition state of the Block sphere using an applied magnetic pulse. These are known as rotating cat states, and at a critical period within the pumping sequence a second realignment pulse is added which forms a spin echo multi-body accumulation phase in the system. Based on this sequencing we can show period doubling and other aspects associated with the so called time -crystal behavior.

What will audience learn from your presentation?

The audience will be introduced to:

- Unique aspects of symmetry breaking in topological insulators
- Geometrical considerations in topological objects
- Time development of topological states

This will aid the audience in visualizing the function of some of the components of the rapidly emerging world of quantum computing.

Biography

Prof. Carroll earned his PhD in Physics at Wesleyan University in CT and did his postdoctoral training at UPENN in Philadelphia as well as the Max-Planck-Institut fur Metallforschung in Stuttgart Germany. He has published over 400 papers, 3 textbooks, and holds 44 patents. He is now the director of Wake Forest University's Center for Nanotechnology and a Fellow of the American Physical Society.