PEERS ALLEY MEDIA

5TH EDITION OF

ADVANCED MATERIALS SCIENCE WORLD CONGRESS

March 27-28, 2023 | Barcelona, Spain

ADV. MATERIALS SCIENCE 2023

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PROGRAM-AT-A-GLANCE

ADV. MATERIALS SCIENCE

2023

DAY 1

MARCH 27, 2023

Scientific Program

08:00-08:20	**Registrations**
08:20-08:30	**Opening Ceremony**

Keynote Forum

08:30-08:55	**Title: Polyethylenimine-based materials: Novel heterogeneous catalysts for sustainable organic transformations** **Alessandro Sacchetti,** *Politecnico di Milano, Italy*
08:55-09:20	**Title: Sample preparation for microstructural analysis using 3D printed tools** **Lawrence Whitmore,** *Paris Lodron University of Salzburg, Austria*
09:20-09:45	**Title: Large electrocaloric effect in $Pb(Sc_{0.25}In_{0.25}Nb_{0.25}Ta_{0.25})O_3$ medium-entropy ceramics** **Qi Zhang,** *Basque Center for Materials, Applications and Nanostructures, Spain*

Distinguished Speaker Talks

Chair	**Alexander S. Mukasyan,** *University of Notre Dame, USA*
Chair	**María Yesenia Díaz Cárdenas,** *Technologic of Higher Studies of Coacalco, Mexico*
09:45-10:05	**Title: Materials science wish list for renewable energy** **John J. Kilbane II,** *Ilinois Institute of Technology, USA*
10:05-10:25	**Title: Technology to product design process for design education** **Byungsoo Kim,** *Kansas State University, USA*

Refreshment Break 10:25-10:40

10:40-11:00	**Title: Biopolymer-based active surfaces for novel tribo-electric nano generators (TENGs)** **Fernando G. Torres,** *Pontificia Universidad Catolica del Peru, Peru*
11:00-11:20	**Title: Engineering of wood-based membranes with excellent permeability/selectivity properties for forward osmosis process** **Masoud Rastgar,** *China University of Mining and Technology, China*

11:20-11:40	**Title: Fracture simulation of brittle materials in tension and compression using cohesive elements** **Raul Dario Durand Farfan,** *University of Brasilia, Brazil*
11:40-12:00	**Title: CuCrFeVTi high-entropy alloy studied by positron annihilation spectroscopy** **Ricardo Domínguez-Reyes,** *Universidad Carlos III de Madrid, Spain*
12:00-12:20	**Title: Reactive spark plasma sintering of advanced materials** **Alexander S. Mukasyan,** *University of Notre Dame, USA*
12:20-12:40	**Title: Materials for energy storage device – Na-based batteries** **Claudia D'Urso,** *CNR-ITAE, Italy*
Group Photo	
Lunch Break 12:40-13:10	
13:10-13:30	**Title: Oxidative and antimicrobic effects of iron, titanium oxide nanoparticles and thalicarpine** **Elitsa L. Pavlova,** *Sofia University St. Kliment Ohridski, Bulgaria*
13:30-13:45	**Title: Light-controlled disorder-engineering for functional optical metasurfaces** **Maximilian Buchmüller,** *University of Wuppertal, Germany*
13:45-14:05	**Title: Synthesis of chiral-at-metal rhodium complexes from achiral tripodal tetradentate ligands** **Ricardo Rodríguez,** *Universidad de Zaragoza, Spain*
14:05-14:25	**Title: Real-time monitoring of *Staphylococcus aureus* biofilm sensitivity towards antibiotics with isothermal microcalorimetry** **Willem J. B. van Wamel,** *Erasmus University Medical Center, Netherlands*
14:25-14:45	**Title: New space tourism industry and sustainable development** **Annette Toivonen,** *Haaga-Helia University of Applied Sciences, Finland*
14:45-15:05	**Title: A derivative of chalcone as green corrosion inhibitor for copper** **María Yesenia Díaz Cárdenas,** *Technologic of Higher Studies of Coacalco, Mexico*
15:05-15:25	**Title: Bionate biocompatibility: *In vivo* study in rabbits** **Maria D (Amparo) Vanaclocha-Saiz,** *Universitat Politecnica de Valencia, Spain*

Refreshment Break 15:25-15:40

15:40-16:00	**Title: A review of recent developments in biomaterials used in total hip implants** **Mohammed Zwawi,** *King Abdulaziz University, Saudi Arabia*
16:00-16:20	**Title: Oxide TFTs: Towards transparent & flexible pixel circuits for AMOLED displays** **Kavindra Kandpal,** *Indian Institute of Information Technology, Allahabad, India*
16:20-16:40	**Title: Ferromagnetic materials for energy efficient computing** **Prasanna Kumar Misra,** *Indian Institute of Information Technology, Allahabad, India*
16:40-17:00	**Title: Design of biocompatible energy harvesting device for low frequency operation** **Surya Prakash,** *Indian Institute of Information Technology, Allahabad, India*
17:00-17:20	**Title: Simulation based reinforcement learning algorithms for material design and optimal chemical reactions** **Rahul Meshram,** *Indian Institute of Information Technology, Allahabad, India*
17:20-17:40	**Title: A single electron transistor nanopore as toxic gas sensor: First principles investigation** **Boddepalli SanthiBhushan,** *Indian Institute of Information Technology, Allahabad, India*
17:40-18:00	**Title: Climate system : A global sensitivity approach** **Liban Ismail,** *Université Clermont Auvergne, France*
Poster	**Title: Microstructure, mechanical and biophysical properties of pure ultra-fine grain Titanium** **Krzysztof Wierzbanowski,** *AGH University of Science and Technology, Poland*

Panel Discussions

End of Day 1

DAY 2

MARCH 28, 2023

Scientific Program

08:00-08:20	Registrations
08:20-08:30	Opening Ceremony

Keynote Forum

08:30-08:55	**Title: Multicoloured Jacquard artworks reproduction with CMYK channels to improve colour accuracy** **Ken Ri Kim,** *Loughborough University, United Kingdom*
08:55-09:20	**Title: Optical sensors based on symmetric waveguide gratings** **Patrick Görrn,** *University of Wuppertal, Germany*
09:20-09:45	**Title: Magnesium screws for fracture treatment in Trauma surgery: 3.5-Year clinical results after medial malleolus fracture fixation and Computed Tomography (CT)** **Patrick Holweg,** *Medical University of Graz, Austria*

Distinguished Speaker Talks

Chair	**Yamin Leprince-Wang,** *Université Gustave Eiffel, France*
Chair	**Taisei Kaizoji,** *International Christian University, Japan*
09:45-10:05	**Title: On adaptive multi-objective optimization for greener wired networks** **Hatem Yazbek,** *Nova Southeastern University, USA*
10:05-10:25	**Title: Green algae-based biopolymers for green energy storage devices** **Fernando G. Torres,** *Pontificia Universidad Catolica del Peru, Peru*

Refreshment Break 10:25-10:40

10:40-11:00	**Title: A theory of speculative bubbles and crashes** **Taisei Kaizoji,** *International Christian University, Japan*

11:00-11:20	**Title: Clinical significance of 'Hepcidin inducer Laennec and Porcine' in the treatment of Hereditary Hemochromatosis, NASH, and other iron loading chronic liver diseases complicating with Type2 DM** **Yuki HAMADA,** *HAMADA Clinic for Gastroenterology and Hepatology, Japan*
11:20-11:40	**Title: Dual-segment continuum robot with rotational motion along the deformed backbone** **Qingxiang Zhao,** *Chinese Academy of Sciences, China*
11:40-12:00	**Title: Development and application of a hydraulic impact test machine for simulating rockburst conditions** **WANG Jie,** *Liaoning Technical University, China*
12:00-12:20	**Title: Photocatalytic activity of nanostructured ZnO for water and air purification: From microfluidics to smart city applications** **Yamin Leprince-Wang,** *Université Gustave Eiffel, France*
12:20-12:40	**Title: Integration of smart, ultrathin and flexible cellulose-based printed sensors for process control and health monitoring** **Mohammed Khalifa,** *Kompetenzzentrum Holz GmbH, Austria*
Lunch Break 12:40-13:10	
13:10-13:30	**Title: Unidirectional flow of composite bright-bright solitons through asymmetric double potential barriers and wells** **Amaria Javed,** *New York University Abu Dhabi, United Arab Emirates*
13:30-13:50	**Title: Development and comparison of airplane fuselage panel assembly system alternatives using axiomatic design principles and simulation methodology** **Osman Emre CELEK,** *Turkish Aerospace Industries Inc., Turkey*
13:50-14:10	**Title: Anti-icing and anti-fouling properties of pitcher plant inspired coatings** **Esra Kasapgil,** *Izmir Bakircay University, Turkey*
14:10-14:30	**Title: Polyphenolic extracts from the xerophyte Rhamnus lycioides as a radiation biodosimeter** **Sihem Guesmi,** *National Agronomic Institute of Tunisia, Tunisia*
14:30-14:50	**Oral Talk:- Title: Advanced nano-materials for electrochemical COVID detection** **Angeliki Brouzgou,** *University of Thessaly, Greece* **Poster:- Title: Titanium nano-columns on graphene monolayer/Cu electrode for electrochemical dopamine detection** **Angeliki Brouzgou,** *University of Thessaly, Greece*

14:50-15:10	**Title: Numerical analysis of topological metamaterials as one dimensional photonic crystals** **Akhilesh Tiwari,** *Indian Institute of Information Technology, Allahabad, India*
15:10-15:30	**Title: An IoT based intelligent driver assistance system (i-DAS)** **Ashok G. Verghese,** *Hindustan Institute of Technology and Science, India*
Refreshment Break 15:30-15:45	
15:45-16:05	**Title: Geostatistics for mineral deposit grade assessment** **Bhabesh C Sarkar,** *IIT(ISM) Dhanbad, India*
16:05-16:20	**Title: Tungsten oxide–reduced graphene oxide composites for photoelectrochemical water splitting** **Shahzad Munir Ansari,** *Federal Urdu University of Arts, Science and Technology, Pakistan*
16:20-16:35	**Title: On log dagum weibull distribution: Applications on lifetime data** **Aneeqa Khadim,** *Mirpur University of Science and Technology, Pakistan*
16:35-16:55	**Title: Experimental observation of temperature variations in the bone due to certain physical parameters during bone drilling process** **J.G. Tsiagadigui,** *University of Yaoundé 1, Cameroon*
16:55-17:15	**Title: An improved multigrid solver and a novel visualization strategy for the p-version finite element method** **Janitha Gunatilake,** *University of Peradeniya, Sri Lanka*
17:15-17:35	**Title: Development of B-cell reference materials for comparable and quantitative cytometric expression analysis** **Lili Wang,** *National Institute of Standards and Technology (NIST), USA*
17:35-17:55	**Title: Analysis of the solidus temperature of multicomponent steel** **Toshio Fujimura,** *JFE Techno Research Corp, Japan*
17:55-18:15	**Title: Diagnostic performance of acoustic radiation force impulse imaging in evaluating liver fibrosis in patients with chronic hepatitis B infection: A cross-sectional study** **Chuong Dinh Nguyen,** *University Medical Center of HCMC, Vietnam*

18:15-18:35	**Title: Surfaces of carbon nanotubes as revealed by thermogravimetric and solvent extraction techniques** **Mark A. Banash,** *Neotericon LLC, USA*
18:35-18:55	**Title: The zygoma anatomy-guided approach (ZAGA) for rehabilitation of the atrophic maxilla** **André Sakima Serrano,** *Private Practice at ZAGA Center São Paulo, Brazil*
18:55-19:15	**Title: A new type of silica-induced "moundless" pitting corrosion in copper observed in Japan** **Masahiro Sakai,** *Muroran Institute of Technology, Japan*
19:15-19:35	**Title: The advanced use of Calphad databases and methods in computational thermodynamics** **Bo Sundman,** *OpenCalphad*
19:35-19:55	**Title: Investigation on fracture behavior of cementitious composites reinforced with aligned hooked-end steel fibers** **Sujjaid Khan,** *Hebei University of Technology, China*
19:55-20:15	**Title: Chitosan nanoparticles and their application in agriculture** **Divya Koilparambil,** *Apple International School, UAE*
20:15-20:35	**Title: Classification of fungal diseases in plant based on deep learning techniques** **Mallikarjun Hangarge,** *Karnatak Arts, Science and Commerce College, India*
E-Poster	**Title: A bio-resourced and superhydrophobic dry water extinguishing agent for pool fire based on phytic acid and silicon** **Haoran Jiang,** *University of Science and Technology of China, China*

Panel Discussions

End of Day 2 & Conference

Closing Remarks

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KEYNOTE PRESENTATIONS

DAY 1

5th Edition of

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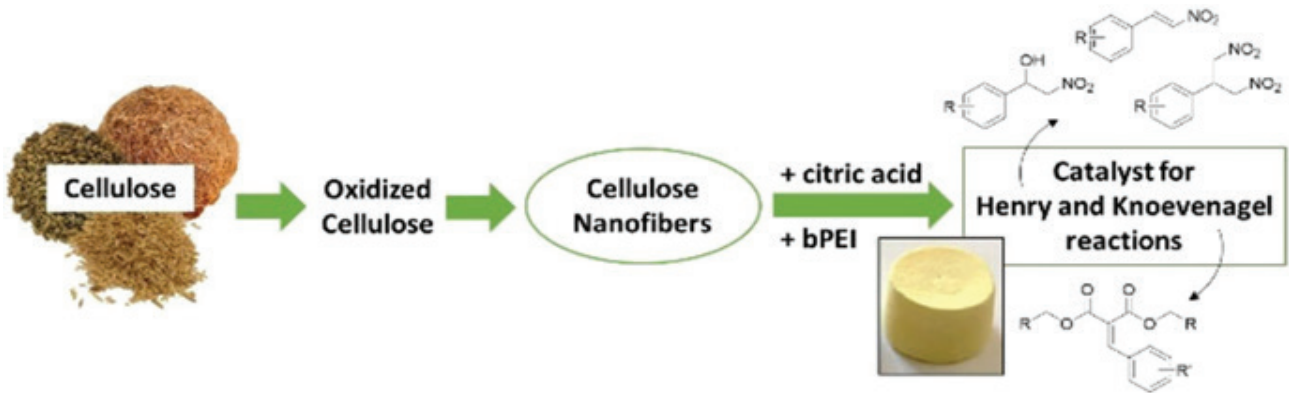
BIOGRAPHY

Alessandro Sacchetti graduated in Chemistry in 1998 and got a PhD in Chemical Science in 2002 at the University of Milan. Since 2008 is an associate professor of the department of Chemistry, Material and Chemical engineering "G. Natta" at Politecnico di Milano. Research interests are in the field of the synthesis of organic molecules as biological active compounds and heterocyclic ligands for metal catalysis. More recently he become interested in the chemical modification of polymer for the production of biomaterials for drug release and of functional materials for heterogenous catalysis. He also has a strong collaboration with many chemical companies for the development of new products and procedures in the view of technology transfer. He is coauthor of more than 110 peer reviewed publications.

Alessandro Sacchetti
Politecnico di Milano, Italy

Polyethylenimine-based materials: Novel heterogeneous catalysts for sustainable organic transformations

Polyethyleneimine (PEI), thanks to the presence of nitrogen atoms, is known to be a suitable material for catalysis. In most cases, PEI is used as a grafting agent or as a support for catalytically active metal species whereas only few cases report its use in amine-catalyzed organic transformations. In our team, we developed a new class of cellulose-PEI-based materials obtained by the combination of TEMPO-oxidized cellulose nanofibers (TOCNF) with branched polyethyleneimine (bPEI) and citric acid (CA). The result is a nano-porous material with the characteristics of a Cellulose-based Nano-Sponge (CNS) to be used as catalyst for organic reactions. In this contest, the preparation of heterogenous catalysts from biomass sources is of great interest: beside



the use of cellulose from renewable sources, the possibility to employ raw materials and waste as a source has been also explored, thus moving forward to reducing environmental impacts of organic transformations. Herein we report on the use of PEI based CNSs as heterogenous catalyst for organic reactions, with particular attention to the synthesis of precursors of interest for the pharmaceutical industry. In a first work, the CNSs have been used as basic amine catalyst for the Henry and Knoevenagel reactions, affording the products in good yields and selectivity. Then, exploiting the coordinating capability of PEI, the material has been loaded with metals, namely copper, zinc and palladium. These new catalysts proved to be very effective in metal catalyzed organic reactions as acetal formation and Suzuki-Miyaura coupling between aryl halides and phenyl boronic acid in water.

BIOGRAPHY

Whitmore was educated in Pure Physics at the University of Surrey, graduating in 1994 with a doctorate degree, and has worked in both industry and academia. Since 2007 he has been working as a research scientist in Austria and Romania and is currently based at the Paris Lodron University of Salzburg carrying out research on magnesium alloys on an FWF project (I 4782-N) in collaboration with colleagues at the University of Applied Sciences, Landshut.

Lawrence Whitmore

Paris Lodron University of Salzburg, Austria

Sample preparation for microstructural analysis using 3D printed tools

The combination of internet cloud-sourced designs, open-source control interfaces and 3D printing technology, has made possible a new paradigm of science in which tools and components can be prepared as needed on-site. With the use of naturally-sourced, biodegradable filaments and recycling of waste and old prints, research labs can reach their sustainable development goals as outlined by the United Nations 2030 Agenda for Sustainable Development.

A series of low-impact devices for preparation of samples for microstructural analysis have been developed. A core drill and a dimple grinder/polisher for preparing electron transparent samples for transmission electron microscopy (TEM), a manual grinding tool for preparing samples of uniform thickness, and a vibratory polishing machine for preparing low-damage surfaces for metallography and electron backscatter diffraction (EBSD). These devices have been made using 3D printing and can be prepared by any lab with a 3D printer.

The inherent weaknesses of 3D printing, such as dimensional reproduction, surface roughness and printing irregularities, have been overcome by innovative design principles, and subsequently the devices are capable of precise application.

Figure shows the high quality of results possible using the 3DP tools. In a) and f) a 3DP core drill has been used to extract a 3 mm diameter disc from aluminium, in b) and e) a manual grinding tool has been used to thin a silicon disc to 8 µm thickness, and in c) and f) a vibrational polishing machine has been used to prepare a magnesium alloy surface for EBSD investigation.

Although there are general guidelines for preparation, the exact process needs to be developed and refined for each specific material. The devices are not intended to compete with existing commercial products; however, they illustrate the potential of a new paradigm of science aimed at reducing carbon emissions and preserving the natural environment.

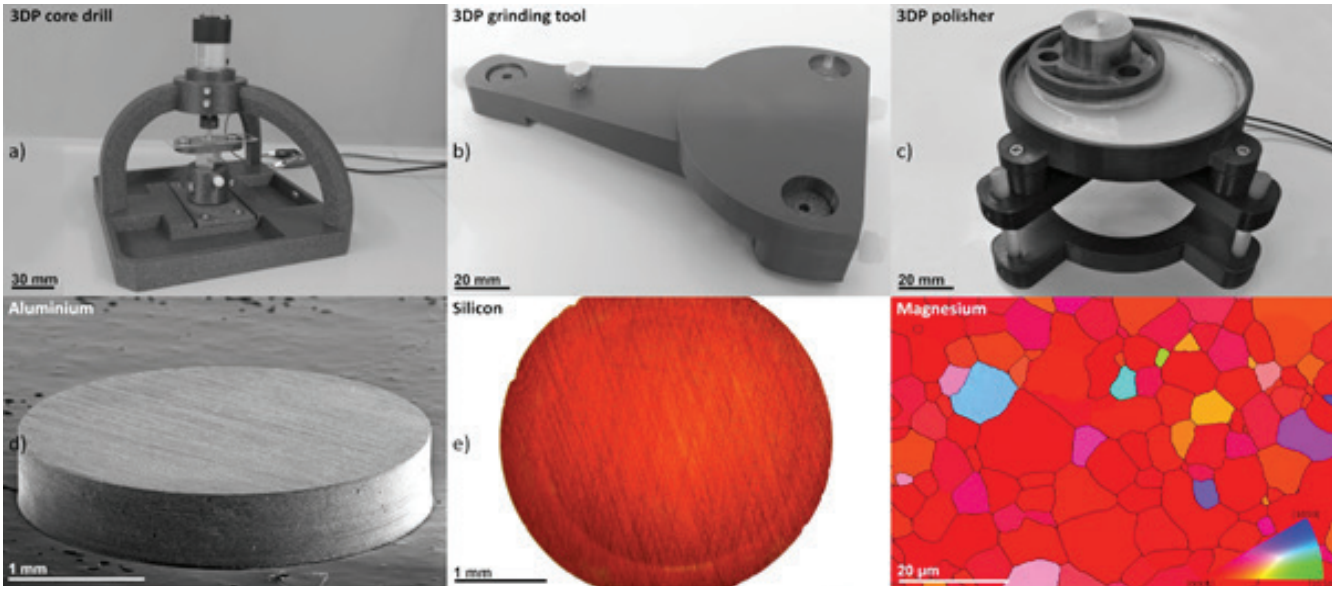


Figure: *3DP tools and typical samples prepared for microstructural analysis.*

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BIOGRAPHY

Qi Zhang has been an Ikerbasque research professor in BCMaterials since 2020. Before that, he worked in Cranfield University, UK as a research fellow in 1996, a senior research fellow in 1998, a senior lecturer in 2007. He was a full professor in Wuhan University of Technology, China since 2012. He is a fellow and charted scientist of Institute of Materials, Minerals & Mining. He is acting as a chief scientist in three international companies. His research work is focused on the areas of functional materials for energy storage and electrocaloric cooling, as well as on lithium batteries and on coatings for surface engineering. He has published more than 220 peer reviewed papers and 5 chapters in books, with a total citation of > 7500 and H-factor of 40. Some of his publications appeared in journals with high impact factors, such as, Science, Energy & Environ. Sci., Mater. Sci. and Eng. R: Report, Adv. Funct. Mater., Nano Energy and Nano Lett., among others. In addition, he co-edited the book entitled Electrocaloric Cooling (EC). He received Brian Mercer Feasibility Award, 2009, The Royal Society, UK.

Qi Zhang

Basque Center for Materials, Applications and Nanostructures, Spain
IKERBASQUE, Basque Foundation for Science, Spain

Large electrocaloric effect in $Pb(Sc_{0.25}In_{0.25}Nb_{0.25}Ta_{0.25})O_3$ medium-entropy ceramics

Next generation EC cooling devices using electrocaloric effect of ferroelectric materials have been attracting more and more attentions. It is very desirable for a bulk ferroelectric ceramic to have a large electrocaloric (EC) effect at a very low electric field. However, limited to the low dielectric breakdown strength and the low pyroelectric effect, there is almost no breakthrough in a long period of time for the EC effect of bulk ceramics since the EC effect was found in 1930s. Although the large electrocaloric temperature change (ΔT) could be obtained in some ferroelectric ceramic thin films, their EC strengths ($\Delta T/\Delta E$) are too small and unappreciable compared with bulk ceramics. Therefore, it is urgent to design and make ferroelectric bulk ceramics that a large EC effect at a relatively lower electric field can be obtained. In this work, two medium entropy-like, $Pb(Sc_{0.25}In_{0.25}Nb_{0.25}Ta_{0.25})O_3$ (PSINT) ceramics were successfully synthesized by one-step or two-step spark plasma sintering (SPS) processing technology. When the configurational entropy of B-site ions is enhanced, the dipolar entropy could also be increased simultaneously. Therefore, it is reasonable to believe that a large EC effect can be achieved in medium-entropy and high-entropy ferroelectric ceramics, especially when the ceramics is relaxor ferroelectrics because a lot of polar nano regions (PNRs) existed in the ceramics. For the two-step-SPS processed sample, a high EC strength ($\Delta T/\Delta E \sim 0.021$ K.cm/kV) and a large EC effect ($\Delta T \sim 0.85$ K) with around room temperature are obtained at a very low electric field ($\sim$ 40 kV/cm). Moreover, the working temperature range is also very broad ($\sim$ 120 K), which is attributed to the high-degree relaxation of the dielectric peak.

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DISTINGUISHED SPEAKER TALKS

DAY 1

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Materials science wish list for renewable energy

John J. Kilbane II
Ilinois Institute of Technology, USA

Biotechnology will make increasingly important contributions to renewable energy in the future, facilitated by innovations in materials science. This presentation will seek to describe the problems being addressed by the development of microalgae to produce renewable energy and how materials science can contribute. The utilization of sunlight by microalgae has much in common with the utilization of sunlight to produce electricity. Improved materials are needed to sustainably produce photovoltaic cells and energy storage technologies. But large-scale growth of microalgae will present unique challenges and opportunities. Microalgae utilize only select wavelengths of solar energy; internally illuminated surfaces are needed to grow microalgae as biofilms and to facilitate the collection of biomass. Improved LEDs that efficiently emit light in the photosynthetically active range are needed. Microalgae biomass can not only be used to produce biodiesel, it can also be processed to produce biodegradable plastics. Harmful algae blooms result from the release of nutrients into the environment due to insufficiently treated wastewater and agricultural runoff. Future wastewater treatment processes employing microalgae can prevent environmental problems by enabling the recycling of nutrients needed by agriculture. Light-activated enzymes will be increasingly used in biotechnology and optical fibers, with attached photoenzymes, are needed to enable catalysis in turbid solutions. The world is facing environmental problems of eutrophication (nutrient pollution resulting in harmful algae blooms) and plastics pollution, food insecurity exacerbated by fertilizer availability/cost, and the need for environmentally sustainable energy sources and environmentally sustainable industrial processes. The industrial scale growth of microalgae addresses each of these concerns, and improved materials will be crucial to these efforts.

Biography

Kilbane is Professor of Biology (Emeritus) at the Illinois Institute of Technology, and a Petroleum Microbiology consultant at Intertek since 2010. He received a Ph.D. in Molecular Biology & Microbiology from Tufts University and has devoted his career to the application of biotechnology to various topics in the energy industry. Research topics have included converting waste materials into biofuels (methane, ethanol, and biodiesel), the remediation of hydrocarbon-contaminated soil and water, the development of novel biocatalysts, the detection and control of microbiologically influenced corrosion, and the biodesulfurization of petroleum.

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Technology to product design process for design education

K. Byungsoo
Kansas State University, USA

A new product is developed using one of two approaches, either from market and customer needs (market and user-centered innovation) or from technology (technology-driven innovation). Industrial Design (ID) education provides numerous opportunities for students to learn market- and user-centered approaches; however, this discipline appears to lack curriculum in technology-driven approaches. Many companies place a great deal of effort and funding into the technology-driven approach. To improve the contribution of design education to the industry, university students should be taught how to understand a technology and to apply the knowledge that they have acquired. The purpose of this study is to understand which processes and skill sets, including design methods and tools, are necessary to achieve successful technology-driven innovation, and to develop ideas concerning how those processes and skills can be incorporated into a curriculum designed to facilitate a rapid and seamless transition from the classroom to the workplace.

In order to gain a better understanding of how design educators and practitioners teach, guide, and mentor ID students and novice industrial designers, a grounded theory approach was used. In order to understand the teaching/mentoring experience of ID educators and practitioners in technology-driven design projects as well as ID students' and recent graduates' experience in technology-driven design projects, primary (syllabi and class activities) and secondary (semi-structured interviews and surveys) data were collected and reviewed. As a result of analyzing and synthesizing both primary and secondary information, a technology-driven process model was developed. This model will provide guidance to ID students and novice designers on how to teach and mentor within a technology-driven environment.

Biography

Byungsoo Kim is an Assistant Professor in the Department of Interior Architecture & Industrial Design at Kansas State University. He earned his bachelor's degree in Product Design from Hong-ik University (2012), master's degree in Industrial Design (2016) and Ph.D. degree in Design at North Carolina State University (2020). His research interests are usability study, technology and design, Universal Design, and interdisciplinarity in design. His research work was published as journal papers, received a paper award, and has been presented at national and international conferences. He has worked for multinational corporations, such as General Motors (GM) and JLG Industry (an Oshkosh Corporation company). He also has been working as a design consultant at Design Paradigm and Conifer research firm for various clients. He is a global design awards winner, including the GM Interactive Design Competition, iF Design Award, Red Dot Design Award, and other national and international awards.

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Biopolymer-based active surfaces for novel tribo-electric nano generators (TENGs)

Fernando G. Torres[1], Omar P. Troncoso[1], Gianfranco Cornejo[1] and **Edwin Huayhua[2]**

[1]Pontificia Universidad Catolica del Peru, Peru
[2]Universidad Nacional de Juliaca, Peru

Triboelectric Nano-Generators (TENGs) convert mechanical energy to electricity for powering small devices such as sensors or portable electronics. They harvest energy from small frequency mechanical oscillations by taking advantage of triboelectrification and electrostatic induction that takes place when the surfaces of two different dielectric materials are in alternative contact. These two active surfaces are usually made from synthetic polymeric materials such as polyamide, polytetrafluoroethylene, polyethylene terephthalate, among others. In order for TENGs to become a feasible technology for the development of novel power sources, their ecological impact must be controlled. Previous reports have shown that biopolymers could be used for the preparation of novel active surfaces of TENGs. We have tested several films made from different biopolymers such as carrageenan, starch, collagen, among others in order to assess their feasibility as triboelectric active surfaces. A TENG prototype was used to measure the output voltage and current with each of the different biopolymeric surfaces. Synthetic polymeric surfaces were also evaluated for comparison. Different combinations of biopolymer/biopolymer and biopolymer/synthetic surfaces were used. The results allowed to classify the biopolymer-based surfaces according to their electronegativity and showed different combinations of biopolymers that could be used to fabricate TENGs with good performances. The results also showed that it is possible to develop a totally biodegradable TENG.

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Engineering of wood-based membranes with excellent permeability/selectivity properties for forward osmosis process

Masoud Rastgar[1], Longxin Jiang[1,2], Ameneh Mohammadnezhad[2], Chunrong Wang[2] and **Mohtada Sadrzadehb[1]**

[1]China University of Mining and Technology, China
[2]University of Alberta, Canada

A novel lignin-based membrane with excellent water permeability and salt rejection characteristics was developed for forward osmosis (FO) processes. The overall FO membranes had three compartments including: (i) a bottom layer of nanofibrous electrospun sulfonated kraft lignin (SKL) (70 wt%) and polyvinyl alcohol (PVA) (30 wt%), (ii) an intermediate layer of PVA-glutaraldehyde (GA) hydrogel, and (iii) a top thin film of selective polyamide (PA) layer. The thickness of the electrospun underlying SKL-PVA mat was 50 µm where its super porous structure can quickly absorb water drops within the internal pores. We coated the surface of SKL-PVA support with four different concentrations of PVA hydrogel (0.25, 0.5, 1, and 2 wt%). Increasing the concentration of the PVA hydrogel, the thickness of the deposited layer was increased accordingly. After coating of PA layer, lignin-based thin film composite (LTFC-X) membranes were obtained in which X denotes the PVA hydrogel concentration. Among all synthesized membranes, the LTFC-0.5 membrane demonstrated the lowest structural parameter (S) of 191.67±5.88 µm which can result in a minimal internal concentration polarization (ICP) in this membrane. The FO performances of the fabricated membranes were evaluated in either of two different configurations including the active PA layer facing the feed solution (ALFS) or the PA layer facing the draw solution (ALDS). The LTFC-0.5 membrane had the maximum water flux (Jw) in both ALDS (61.33±2.85 LMH) and ALFS (56.60±2.99 LMH) modes. The specific salt flux (Js/Jw) shows the potential of a membrane in salt passage versus 1 L of permeated pure water. In the ALDS mode, the LTFC-0.5 membrane represented the lowest Js/Jw of 0.087±0.004 g/L among all fabricated membranes. However, the LTFC-1 membrane had the best performance in the ALFS mode with a minimal Js/Jw value of 0.090±0.011 g/L.

Biography

Masoud Rastgar is a Postdoctoral Fellow (PDF) in the Department of Mechanical Engineering at the University of Alberta. He received his bachelor's degree in Applied Chemistry from the University of Tabriz in 2008. In 2019, he graduated with a Ph.D. in Applied Chemistry from the Faculty of Science at the University of Tehran. Since then, he has joined as a PDF in the Advanced Water Research Lab (AWRL) group, University of Alberta. His investigations are mainly about Environmental Chemistry and Clean Energy. So far, he has published over 40 research papers in prestigious journals and international congresses.

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Fracture simulation of brittle materials in tension and compression using cohesive elements

R. Durand

University of Brasilia, Brazil

Finite element models using cohesive elements have been used for decades to simulate the fracture in brittle materials. These models provided excellent results in cases where samples are mainly under tensile loadings and, to some degree, under shear states. However, they cannot adequately simulate cases under predominant shear stress, which is the case, for example, cases under unconfined compression loadings. Most constitutive models for cohesive elements are based on frictional envelopes and the plasticity theory. This work aims to extend the current approach used in the constitutive modeling for cohesive elements to predict brittle fracture under prevailing shear stress conditions. For this purpose, a plasticity-based model is proposed. In this model, the initial state of the yield function is given by a strength envelope that is tangent to the compressive and tensile Morh's circles. Also, the model considers the strength reduction due to cracking by modifying the curvature of the yield function. These features allow the accurate simulation of shear fracture under different normal stress levels. The model was successfully applied to cases usually challenging to simulate using cohesive elements, such as fracture under compression loads and indirect tensile tests. The work also presents the application to RC structures showing good agreement with experimental results.

Biography

Raul Dario Durand Farfan is a PhD in Civil Engineering and a full-time professor at the Civil and Environmental Department at the University of Brasilia, Brazil. His research is mainly concentrated on the following areas: (1) computational models for fracture in brittle materials; (2) computational models for reinforced media such as reinforced concrete (RC) and soil mass; and (3) the development of general finite element formulations to solve differential equations. He published several papers on finite elements on topics such as mesh smoothing, constitutive models for concrete, numerical simulation of reinforced concrete structures, and simulation of coupled problems. Currently he is working on constitutive models to simulate masonry using the micromodeling approach. He is also working with thermomechanical and hydromechanical simulations using finite elements.

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CuCrFeVTi high-entropy alloy studied by positron annihilation spectroscopy

R. Domínguez-Reyes, A. Rodriguez-Lopez, M. Monge and **B. Savoini**

Universidad Carlos III de Madrid, Spain

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°C were performed, and samples were characterized by Positron Annihilation Spectroscopy (PAS) (Doppler Broadening Spectroscopy (DBS) and Positron Lifetime Spectroscopy (PLS) techniques).

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

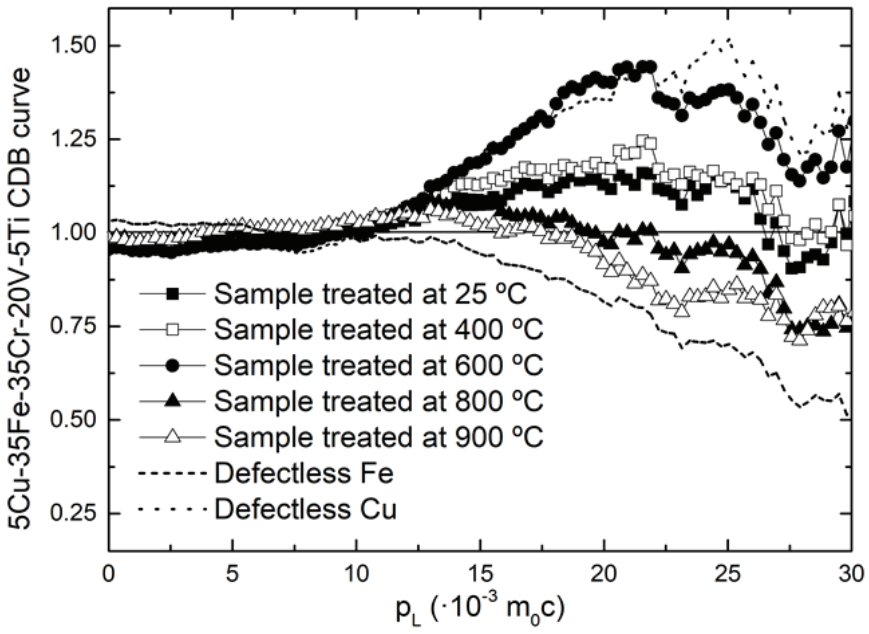

Figure: *5%Cu-35%Cr-35%Fe-20%V-5%Ti sample CDB curves for selected temperatures reference to 5.26%Cu 36.84%Cr 36.84%Fe 21.05%V sample. Pure Cu and Fe CDB curves are shown for comparison purposes.*

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°C – 400°C) its contribution is relatively low, while in the mid temperature range (500°C to 700°C) it increases significantly. In opposition, in the high temperature range (800°C – 900°C) 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.

Biography

Domínguez-Reyes received degree on Physics by *Universidad Complutense de Madrid*, and PhD on Nuclear Physics by *Instituto de Estructura de la Materia (CSIC).* He started at *Universidad Carlos III de Madrid* in a postdoctoral position, and stayed as Researcher Professor. His 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.

Reactive spark plasma sintering of advanced materials

A.S. Mukasyan

University of Notre Dame, USA

Spark plasma sintering (SPS) is an efficient method for fabricating various bulk dense materials, including ceramics. Reactive spark plasma sintering (RSPS) of the exothermic reaction systems involves an initial powder mixture that allows chemical transformation with release of an additional energy during the SPS process. Thus, a deep understanding of the chemistry is critical for controlling the microstructure and thus the properties of the obtained materials. Recent publications have revealed that the RSPS is widely used for manufacturing of variety of materials including ultrahigh-temperature ceramics, high-entropy ceramics, and thermoelectric. However, the thermodynamics and kinetics of the chemical reactions occurring during RSPS are not well understood. The goals of the present work are as follows: (i) to provide the fundamental definitions of chemistry related parameters of RSPS; (ii) to analyse the thermodynamics and kinetics of the RSPS processes; (iii) to emphases the influence of the microstructure of the consolidated media on the chemistry of RSPS; (iv) briefly overview recent publications on RSPS of ceramics. The recommendations for future work in the field of RSPS are also discussed.

Biography

Mukasyan Alexander, Professor of Chemical and Biomolecular Engineering, University of Notre Dame, Notre Dame, IN USA since 1996. Ph.D. in physics and math (1986) Institute of Chemical Physics, Russian Academy of Sciences; Sci. Dc. (1994) Institute of Structural Macrokinetics, Russian Academy of Sciences. Co-author of 5 books and 1 text-book, 33 Chapters in books and invited reviews, more than 300 research publications in archive journals and 36 patents, including 14 US patents in the fields of engineering of advanced materials. The main scientific interest relates to nanotechnology, high energy density materials, joining of refractory and dissimilar materials, as well as catalysis. The most cited publications: Combustion synthesis and nanomaterials, Current Opinion in Solid State and Materials Science 12 (3-4), 44-50, 2008; Solution combustion synthesis of nanoscale materials, Chemical Reviews 116 (23), 14493-14586, 2016; Combustion for Material Synthesis, CRS Press, Taylor and Francis, London, New York, 2015, 398pp.

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Materials for energy storage device – Na-based batteries

C. D'Urso, M. Samperi, L. Frusteri and **V. Antonucci**
CNR-ITAE, Italy

Electrochemical energy storage is a rapidly advancing field building on a continuous stream of innovative ideas. As renewable energy sources become increasingly prevalent the need for high energy-density, high- power storage devices with long cycle lives are greater than ever. The development of suitable materials for these devices begins with a complete understanding of the complex processes that govern energy storage and conversion spanning many orders of magnitude in length and time scales. Furthermore, new battery technologies have to be not only commercially and technically viable, but they should also deliver a lower environmental impact than the current state of the art. Therefore, a major challenge of modern battery technologies is to ensure that newly developed batteries are safe, efficient and follow the highest environmental and social standards at the level of production, use and disposal in a frame of a circular economy. Several emerging battery technologies are currently on endeavour to take a share of the dominant position taken by Li-ion batteries in the field of energy storage. Among them, sodium-based batteries offer a combination of attractive properties i.e., low cost, sustainable precursors and secure raw material supplies. Na-based batteries include related battery concepts, such as Na-ion, all solid-state Na batteries, Na/O_2 and Na/S, that differ in key components and in redox chemistry, and therefore result in separate challenges and metrics. This paper aims at highlighting the most promising materials in the field of Na-based batteries and challenges needed to be addressed to make this technology industrially appealing, by providing an in-depth analysis of performance metrics from recent literature. The aim of this work is to present the new materials that are used in Na-based energy storage device. In particular will be presented new material for the use like positive or negative electrode and also new electrolytes, in particular solid electrolytes.

Biography

Claudia D'Urso is a Senior Researcher at the National Council of Research (CNR), and leads a research group that mainly deals with high-temperature sodium batteries. She works at CNR from 2004, she is Senior Researcher from 2010. She received his Ph.D. degree in Materials for Enviroment and Energy (2010), M.Sc. degree in Industrial Chemistry (2002). Her current research is focused on energy conversion and storage. She is involved in research programs related to the development of energy technologies and have developed prototypes of Fuel cell and Batteries (sodium nickel chloride and Metal-air). She has published more than 70 articles ISI (HI 17) and she has more than 100 contributions in international conference, she is author of 1 patent. She is referee for several international scientific journals. She is in the Board of Delegates of the European Materials Research Society (E-MRS). She is involved in different European and National research Projects in Fuel cells, PEM Electrolysis and Batteries.

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Oxidative and antimicrobic effects of iron, titanium oxide nanoparticles and thalicarpine

Elitsa L. Pavlova[1], Radostina D. Toshkovska[1,2], Tsvetelina E. Doncheva[2] and **Iliana A. Ivanova[1]**

[1]Sofia University St. Kliment Ohridski, Bulgaria
[2]Institute of Organic Chemistry with Center of Phytochemistry, Bulgarian Academy of Sciences, Bulgaria

The aim is to evaluate the oxidant and antimicrobial effects of Fe_3O_4, TiO_2 nanoparticles and thalicarpine by luminescent and standard microbiological assays.

Their effect is studied on the kinetics of free-radical oxidation reactions (at pH 7.4 and pH 8.5) in model systems, using activated chemiluminescence:

* chemical, with Fenton`s reagent (H_2O_2-$FeSO_4$) - for the generation of hydroxyl radicals (.OH)

* chemical, with oxidant hydrogen peroxide (H_2O_2)

* chemical (NAD.H-PhMS), for the generation of superoxide radicals (O_2.-).

Fe_3O_4 nanoparticles exhibit highly pronounced antioxidant properties; TiO_2 nanoparticles exhibit mild to moderate prooxidant properties at neutral and alkaline conditions. Those properties are tested by the chemiluminescent method for the first time. Thalicarpine and its combination with TiO_2 nanoparticles exhibit pronounced antioxidant activities at pH 8.5 which are lost and transformed into well-presented prooxidant effects at pH 7.4. That is a result-supported proof on the observed typical properties of thalicarpine and TiO_2, namely antibacterial, organic-preserving and anti-pathogenic activities.

The antimicrobial effect is tested on Gram-positive and Gram-negative bacteria: two strains of Escherichia coli, Bacillus cereus *1095* and Staphylococcus aureus. All bacteria are destroyed after the application of TiO_2, but not Fe_3O_4 nanoparticles, showing their antibacterial effect. Thalicarpine, in combination with TiO_2, showed even synergetic antibacterial effect.

Biography

Elitsa Pavlova graduated as a Master in Biology at Sofia University "St. Kliment Ohridski", Bulgaria in 2001 specializing in Cellular biology and biology of development. In 2002, she completed a second M.Sc. in Biology and chemistry, same university. Her PhD thesis is in Human and animal physiology (2007), focusing on the assessment of biomarkers of oxidative stress in patients with different diseases. She has been working in the field of Biophysics with experimental and clinical laboratory data, statistical analysis and the evaluation of pathological effects ex vivo, in vitro and in vivo. She is a professional in the evaluation of nutritional supplements and antioxidants, medicinal substances and nanomaterials, their combinations and side effects. She currently teaches in the university and researches on national and international projects. She is well known for her achievements in the fields of Biochemistry and Toxicology, Biophysics and Medical Physics.

Light-controlled disorder-engineering for functional optical metasurfaces

M. Buchmüller, I. Shutsko, M. Meudt and **P. Görrn**
University of Wuppertal, Germany

Optical metasurfaces address a plethora of applications in planar optics, as they enable precise control of the phase, amplitude, and polarization of light at nanoscale interaction lengths. However, their implementation often requires surface nanostructuring based on complex design and top-down fabrication methods, such as electron beam lithography. Here, we present a novel bottom-up method for the fabrication of plasmonic metasurfaces, based on silver nanoparticles (AgNPs) using a solution-based growth method. The particle growth is controlled by light, e.g. an incident laser beam. Thereby, the specific light parameters, e.g. polarization state of the light, enable in-situ engineering of the resulting metasurface. Features of engineered disorder, in particular disordered hyperuniformity, can be observed in the reciprocal space and influenced in a facile way on large areas. In addition, the particle growth can be mediated by surface plasmon polaritons, which demonstrates the extensive versatility of the presented fabrication method.

As an application scenario, we show that the fabricated metasurfaces are directly applicable as self-optimized optical sensors. When compared to the growth conditions, their optical response is inherently sensitive to deviations from the electromagnetic environment. Since the presented approach allows for the use of common platforms (photonic and plasmonic) for the fabrication and the probing, the sensors remain well aligned with respect to the light source after fabrication. This way, we demonstrate high-performance nanoplasmonic sensing (FoM*max= 968) without the need for post-process alignments – promising for an implementation in integrated optical systems.

Biography

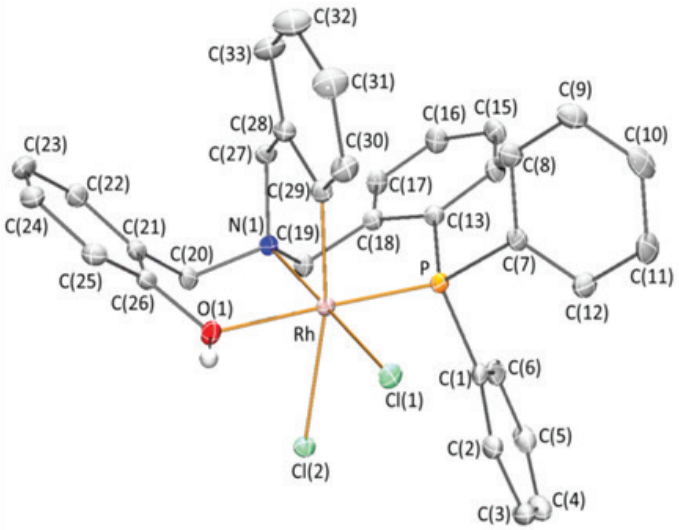
Maximilian Buchmüller received his BSc degree in Business Administration and Electrical Engineering from the University of Wuppertal, Germany, in 2017. Afterwards, he studied Electrical Engineering at the National University of Singapore, Singapore, in 2018, and received his MSc degree in Electrical Engineering from the University of Wuppertal in 2020. Since then, he is a PhD student at the Chair of Large Area Optoelectronics. His research interests include nonlinear optics and optoelectronics, in particular thin film lasers and sensors, laser displays and projectors.

Synthesis of chiral-at-metal rhodium complexes from achiral tripodal tetradentate ligands

R. Rodríguez

Instituto de Síntesis Química y Catálisis Homogénea (ISQCH), CSIC - Universidad de Zaragoza, Spain

Over some 60 years of asymmetric catalysis, the source of catalyst chirality has mainly been based on chiral organic molecules with stereogenic carbon atoms or chiral molecules exhibiting atropisomerism. However, there is a virtually unexplored option in the design of enantioselective catalysts, where the metal cation of the catalyst is a stereogenic center. In these cases, the metal center can be surrounded by any achiral ligand as long as they lead to metal complexes with the stereogenic metal, commonly called chiral-at-metal complexes. However, few examples of enantioselective catalysts with exclusive metal-centered chirality exhibit a stable configuration. This work describes the completely diastereoselective synthesis of the chiral complexes $[RhCl_2(\kappa^4\text{-L})]$ (1) and $[Rh(\kappa^4\text{-L})(NCMe)_2][SbF_6]$ (2) containing a new tripodal tetradentate ligand. The resolution of the racemic mixture of 2 has been achieved through kinetic resolution using enantiopure (S)-2-(4-isopropyl-4,5-dihydrooxazol-2-yl) phenol as a chiral auxiliary. The results of catalytic tests on the 1,3-dipolar cycloaddition reaction proving that the chirality is efficiently transferred from the metal to the substrate.



ORTEP view of complex 1

Biography

Ricardo Rodríguez studied chemistry at the University of Zaragoza (Spain) and received his Ph.D. degree in inorganic chemistry from the University of Zaragoza. After postdoctoral research at the Fundamental and Applied Heterochemistry Laboratory-LHFA (Toulouse, France), he started working as a Tenure Track in the Department of Inorganic Chemistry at Chemical Synthesis and Homogeneous Catalysis Institute-ISQCH (Zaragoza, Spain). Since 2021, he has been a Staff Scientist at the Spanish National Research Council-CSIC (Spain). His research is in the fields of metal-centered stereochemistry and transition metal frustrated lewis pairs for catalysis.

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Real-time monitoring of *Staphylococcus aureus* biofilm sensitivity towards antibiotics with isothermal microcalorimetry

Willem J. B. van Wamel[1], Andi Rofian Sultan[1,2], Mehri Tavakol[1], Nicole A. Lemmens-den Toom[1], Peter D. Croughs[1], Nelianne J. Verkaik[1] and **Annelies Verbon[1]**

[1]*Erasmus University Medical Center, Netherlands*
[2]*Hasanuddin University, Indonesia*

Biofilm-associated infections with *Staphylococcus aureus* are difficult to treat even after administration of antibiotics that according to the standard susceptibility assays are effective. Currently, the assays used in the clinical laboratories to determine the sensitivity of *S. aureus* towards antibiotics are not representing the behaviour of biofilm-associated *S. aureus*, since these assays are performed on planktonic bacteria. In research settings, microcalorimetry has been used for antibiotic susceptibility studies. Therefore, in this study we investigated if we can use isothermal microcalorimetry to monitor the response of biofilm towards antibiotic treatment in real-time. We developed a reproducible method to generate biofilm in an isothermal microcalorimeter setup. Using this system, the sensitivity of 5 methicillin-sensitive *S. aureus* (MSSA) and 5 methicillin-resistant *S. aureus* (MRSA) strains from different genetic lineages were determined towards: flucloxacillin, cefuroxime, cefotaxime, gentamicin, rifampicin, vancomycin, levofloxacin, clindamycin, erythromycin, linezolid, fusidic acid, co-trimoxazole, and doxycycline. In contrast to conventional assays, our calorimetry-based biofilm susceptibility assay showed that *S. aureus* biofilms, regardless MSSA or MRSA, can survive the exposure to the maximum serum concentration of all tested antibiotics. The only treatment with a single antibiotic showing a significant reduction in biofilm survival was rifampicin, yet in 20% of the strains, emerging antibiotic resistance was observed. Furthermore, the combination of rifampicin with flucloxacillin, vancomycin or levofloxacin was able to prevent *S. aureus* biofilm from becoming resistant to rifampicin. Isothermal microcalorimetry allows real-time monitoring of the sensitivity of *S. aureus* biofilms towards antibiotics in a fast and reliable way.

Biography

Willem van Wamel, PhD is an Associate Professor, Department of Medical Microbiology and Infectious Diseases Erasmus University Medical Centre Rotterdam, The Netherlands. He earned his doctoral degree in microbiology from the Eijkman Winkler Institute for Microbiology, Infectious Diseases, and Inflammation at the University of Utrecht in Utrecht, The Netherlands; the topic of his doctoral thesis was "Regulation of Virulence Factors in Staphylococci." In addition, he completed postdoctoral work and research there, as well as at the Laboratory of Bacterial Pathogenesis and Immunology at Rockefeller University in New York, New York, and Dartmouth Medical School in Hanover, New Hampshire.

His current areas of research include the pathogenesis of Staphylococcus aureus (S. aureus) with a focus on difficult to treat chronic infection. In his group strategies were developed to monitor in vivo/ex vivo expression of virulence factors but also ways to monitor (real-time) the metabolic status of biofilms associated bacteria.

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New space tourism industry and sustainable development

Annette Toivonen

Haaga-Helia University of Applied Sciences, Finland

The excitement of public space exploration was for decades captured only in Hollywood productions, until the 2010s saw the emergence of the New Space industry, combining the space activities of private space companies and governmental actors. As a sector of New Space, recently emerged New Space tourism industry aims to satisfy the postmodern traveller's desire for new experiences, and is forecast to develop as a multi-billion tourism sector in the future (Toivonen, 2022).

The global megatrend of sustainability was furthered by the Intergovernmental Panel Climate Change report´s (2018) concerns over the future impacts of climate change on Earth. The growth of modern tourism has indeed led to a significant increase in its environmental impact, which can no longer be ignored in the current era of climate change, and thus the need for more sustainable focused future planning in the tourism industry. Apart from being an energy- and emissions-related driver for new technological developments, sustainable development has brought responsibility and ethics to the ways of global tourism operations, and influenced the creation of global regulations. Rapidly advanced technological developments also contributed to Finland becoming a new space nation in 2017. One of the objectives of Finland´s space strategy is to provide a sustainable environment for space-related business, and the country´s recently established space legislation advocates such future points of action.

Recent academic findings (Toivonen, 2022) suggest that future sustainability in New Space tourism industry could be supported through three alternative future scenarios; through the planning of global space regulations, through improving global fairness and through the implementation of virtual and technological innovations. However, there is a strong need to expand the global academic research on the environmental impacts caused by the New Space tourism industry as it is currently still very limited.

Biography

Annette Toivonen works as a senior lecturer of tourism business at Haaga-Helia University of Applied Sciences and has pioneered in launching world´s first sustainable space tourism course for university students. She is a renowned Finnish expert on sustainable space tourism and has written a book on the topic titled "Sustainable Space Tourism: An Introduction" (2020, UK). She is also a visiting chief editor of a special space tourism issue of the journal Integrated Environmental Assessment Management (USA).

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A derivative of chalcone as green corrosion inhibitor for copper

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[1]Technologic of Higher Studies of Coacalco, Mexico
[2]Polytechnic University of Morelos State, Mexico
[3]University of Guanajuato, Mexico
[4]Autonomous University of Morelos State, Mexico

Antioxidant compounds have been important in various fields. For example, they are used in medicine and biology as they protect the human body from damage caused by reactive oxygen species or free radicals. Antioxidant agents are organic compounds that contain electronegative heteroatoms and that are compatible with health and the environment, as special characteristic required by corrosion inhibitors. There are two groups known as organic antioxidant compounds: flavonoids and their precursors, the chalcones. Several studies have shown that chalcones and their derivatives have anti-inflammatory, analgesic, antitumor, repellant, and UV-protective properties.

Antioxidant properties are attributed to the presence of heteroatoms such as Oxygen, Nitrogen, Sulfur, etc. Therefore, in this work, a synthesized derivative of chalcone called A2 which contain Oxygen and Fluor as electronegative heteroatoms, was studied as a corrosion inhibitor for copper in acid medium using electrochemical techniques, such as Electrochemical Impedance Spectroscopy (EIS), Pontentiodynamic Polarization Curves (PPC), Electrochemical Noise (EN), quantum chemical calculations (QCC) and adsorption isotherms (AI).

The best efficiency obtained by EIS experiments was in the presence of 300 ppm of A2. PPC showed the influence of A2 over the anodic curve and its slope that was shifted to more negative potential (40mV). It was attributed to the adsorption process of the inhibitor on the double layer. Also, the efficiency from PPC was 83% at the same concentration (300 ppm). Furthermore, the EN technique over a period of 24 hours corroborated the development of a A2 layer over the metal surface. It was also confirmed by the isotherm values, where the best fit for the Langmuir model was observed with and ΔG = -23 KJ/mol, and the results of chemical quantum calculations on the high value of softness can be related to the adsorption process of A2 on the metal surface.

Biography

María Yesenia Díaz Cárdenas is a chemical Engineer with Master and Doctorate in Engineering and Applied Sciences, graduated from Autonomous University of Morelos State, Mexico. About academic contributions, she is a professor at Technologic of Higher Studies of Coacalco, Mexico, where she teaches chemical engineering subjects and works as a project advisor of chemical engineering students. She has experience as a quality assurance inspector in pharmaceutical industry. She has a certification of Quality, Safety and Environment regulations. Regarding her scientific projects, her goals are based on apply her knowledge, experience, and skills about corrosion, electrochemistry, organic chemistry, quality assurance, statistical analysis, and natural products in developing research about studies of green antioxidant components, obtained from vegetable oils or by synthesis. The research team to which she belongs aims to develop alternatives to reduce reduce toxic corrosion inhibitors, replacing them with eco-friendly corrosion inhibitors, considering the applicable regulations and engineering quality standards.

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Bionate biocompatibility: *In vivo* study in rabbits

A. Vanaclocha-Saiz[1], C. Atienza[1], V. Vanaclocha[2] and **P. Jorda-Gomez[3]**

[1]Universitat Politecnica de Valencia, Spain
[2]University of Valencia, Spain
[3]Hospital General Universitario de Castellon, Spain

We are investigating the adequacy of Bionate® 80A (Bionate® II PCU 80A, a thermoplastic polycarbonate-urethane) as the material for a new nucleus disc replacement design. Bionate® human explants (neurostimulation, vascular, artificial heart, cardiac assist and diagnostic devices) show minor wear and slight local tissue reaction, but we do not know the response at the spinal cord, nerve roots, lymph nodes, or distant organs.

Objectives: Comparative *in vivo* study to evaluate the tissue reaction against Bionate® 80A when implanted at the spinal epidural space.

Methods: Twenty-four 20-week-old New Zealand white rabbits were submitted for the same surgical procedure. In the implant group (n 12) we implanted Bionate® 80A powder particle sample on the spinal epidural space. The other 12 rabbits where the control group. We studied tissues, organs, and tissue damage markers on blood biochemistry, urine tests, and necropsy.

Results: The animals' clinical parameters and weight showed no statistically significant differences. At 3 months, the basophils increased slightly in the implant group, platelets decreased in all, and at 6 months, implanted animals showed slight eosinophilia, but none of these changes was statistically significant. External, organ, and spinal tissue examination showed neither toxic reaction, inflammatory changes, nor noticeable differences between groups or survival periods. Under microscopic examination, the Bionate® 80A particles induced a chronic granulomatous response always outside the *dura mater*, with giant multinucleated cells holding phagocytized particles and no particle migration to lymph nodes or organs.

Conclusion: Bionate® particles, when implanted in the rabbit lumbar epidural space, do not generate a significant reaction, being it limited to giant multinucleated cells in the surrounding soft tissues. In addition, the particles did not cross the *dura mater* or migrate to lymph nodes or organs. This means, it could be used in the design of a nucleus disc replacement.

Biography

Amparo Vanaclocha BSc MEng is a biomedical engineer specialized in implants and prosthesis. She has been working for the medical device manufacturing industry for about ten years, with experience expanding from concept design to the launch of the final product. This includes experimental bench work, FEA analysis, verification of product specifications, quality control, regulatory coverage, etc. At this moment she is working for this industry, and at the same time also involved in a different venture that includes the design of a new nucleus lumbar disc replacement related to a PhD research. The selection of an adequate material was the first step to carry out this project.

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A review of recent developments in biomaterials used in total hip implants

Mohammed Zwawi

King Abdulaziz University, Saudi Arabia

It is unavoidable in orthopedics to replace the whole hip joint to improve the quality of life of patients with arthritis. Artificial joints are becoming increasingly popular and have become necessary in cases of damaged joints. The field of orthopedic surgery has seen much success with joint replacements but maintaining implants for a long time remains a challenge. Hip replacement arthroplasty is intended to restore the range of motion and activities of daily living to patients without pain. The current focus of artificial hip joint development is to improve its mechanical strength, biocompatibility, bioactivity, and durability. In a safe, reliable, economical, and physiologically acceptable manner, biomaterials can be used to make devices to replace bodily organs or functions. This purpose has been addressed by the development of a variety of materials. The development of biomaterials is constantly evolving, which has led to the use of a variety of materials. Metals, ceramics, and polymers are all possible materials for hip implants. The biomaterials used in hip joint arthroplasty have biocompatible properties, the ability to resist heavy stress, a low friction coefficient of sliding, and a low wear rate. This review presents a selection of metallic materials that are often used for surgical hip implants. This article focuses on how to apply the right biomaterials to hip implants. The paper provides information that supports important medical decisions regarding hip implants. All biomedical, mechanical, and materials science developments have to take into account the development of biomaterials, their treatments, properties, and surface layers and coatings. This paper attempts to provide a brief overview of the evolution of biomaterials from the early days of metals and polymers to the present day of ceramics commonly found in orthopedics for hip joint replacements.

Biography

Mohammed Zwawi received the Ph.D. degree in mechanical engineering in 2015 from University of Central Florida. Prior to his Ph.D. he served as a senior engineer in Yanbu National Petrochemical Co. (YANSAB - SABIC) Yanbu, KSA (Oct 2005 – Oct 2009). He has worked extensively in the fields of biomechanics, biomedical, fluid mechanics, and renewable energy derived from biomass. He has authored more than 40 publications. His current position is Chairman of the Department of Chemical and Materials Engineering, Faculty of Engineering, Rabigh, King Abdulaziz University.

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Oxide TFTs: Towards transparent & flexible pixel circuits for AMOLED displays

Kavindra Kandpal

Indian Institute of Information Technology, Allahabad, India

Modern ultra-HD display panels demand high-mobility thin-film transistors (TFTs) to support high frame rates. Oxide semiconductor-based TFTs support the fabrication of flexible TFT display panels mainly due to low-temperature processing. Moreover, oxide-based TFTs provide transparency in the visible spectrum due to the wide bandgap and promise higher field-effect mobility. For the channel layer of TFT, among the wide-band-gap oxides, ZnO and its composites (IGZO, AZO, ZTO) are mostly used because of their high transparency, nontoxicity, and high electron mobility. However, the nature of the deposited film: polycrystalline or nanocrystalline affects the carrier mobility significantly. Grain boundaries in polycrystalline and nanocrystalline deposited films act like charge scattering centers and reduce mobility. Moreover, Oxide-based TFTs also suffer from threshold voltage shifts due to prolonged gate bias leading to a change in the driving current. This can create a severe reliability issue in an AMOLED display. If the magnitude of the current decreases below a certain level, a pixel may turn into a dark pixel. Therefore, at the circuit level, one needs to use the voltage-programmed pixel driving scheme to make the OLED current independent of the driver TFTs. Our proposed 6 TFT-1C & 5T-2C pixel circuits can compensate wide range of V_{TH} variations. The proposed 6 TFT-1C pixel circuit ensures the maximum percentage error in OLED current is below 1.14 % for a V_T shift of 0 V- 2.1 V. Moreover, The OLED current error was found to be below 0.0018% for a ±0.3% strain in the driving TFT. The proposed low-voltage 5T-2C pixel circuit utilizes improved stacked voltage-programmed pixel circuit topology and delivers a low programming time of 8 µs making it suitable for providing a 120 Hz frame rate for HD displays. The error in organic light emitting diode (OLED) current is within 0.4% over the range of data voltage (3.8 V to 6 V) when the substrate is subjected to both compressive and tensile strains of ± 0.3% and within 10% due to threshold voltage variations under electrical stress.

Biography

Kavindra Kandpal is a senior member of IEEE and currently working in the ECE dept. of Indian Institute of Information Technology Allahabad (IIITA) as an assistant professor. He completed his Ph.D. program in the EEE department of BITS Pilani, in the area of oxide-based thin-film transistors in 2018. During his Ph.D., he worked closely with CSIR-CEERI Pilani for experimental work related to TFT fabrication. His research interest includes thin-film deposition, characterization, semiconductor devices, and display electronics. Moreover, he is also actively working in CMOS Memory, Analog and Digital VLSI Design, solid-state applications of topological insulators, Thin Film Transistors, and device-to-circuit integrated design with applications ranging from display electronics, biosensors, and photodetectors. He has more than 52 research publications in peer-reviewed journals and international conferences. He is also a recipient of the IEEE Uttar Pradesh Section Young Professional star for April, 2021.

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Ferromagnetic materials for energy efficient computing

Prasanna Kumar Misra

Indian Institute of Information Technology, Allahabad, India

In ferromagnetic (FM) materials, the electrical resistivity and mobility experienced by the spin-up and spin-down electrons are different. The asymmetry in the electron mobility for different spins is indirectly caused by the asymmetry in the electron density-of-state (DOS). When current passes from a FM metal to a nonmagnetic (NM) metal via an ohmic contact, spin-polarized current is obtained in the NM due to the mobility asymmetry (indirectly due to DOS asymmetry) in FM. Similarly, when current passes from FM to NM via an insulator (tunneling contact), spin-polarized current is obtained in the NM directly due to the DOS asymmetry in FM. Therefore, FM can be used as spin-polarizer in spintronics circuits. Although a significant amount of spin polarization arises in FM metals, this is inadequate for spin-based applications. Hence, non-equilibrium spin must be introduced in semiconductor (SC) to make advanced spin-based devices. SC based spintronics can combine the well-known advantages of SC materials.

Magnetic tunnel junction (MTJ) is a spintronic device that enables us to use the spin property of electrons along with the charge. It is composed of two ferromagnetic layers and a dielectric layer sandwiched in between them. One of the two ferromagnetic layers is strongly magnetized and is known as a pinned layer or reference layer, as its direction of magnetization cannot be changed. The other ferromagnetic layer is weakly magnetized and is known as the free layer; its direction of magnetization can be changed. MTJ has two states: the low-resistance state is termed parallel (P), whereas the high-resistance state is termed anti-parallel (AP). Many switching mechanisms have been proposed to switch the state of MTJ from P to AP or vice versa, namely, spin-transfer torque (STT), spin Hall-assisted STT (SHE-STT), and voltage-controlled magnetic anisotropy (VCMA). Among them, STT switching mechanism is the most practicable and well-founded method for constructing MTJs. MTJ have gained special attention because of its non-volatility, high speed, almost zero leakage power consumption, and, most importantly, compatibility with semiconductor devices. This device is a promising candidate for building high-performance, high-density, and low-power arithmetic functions. Magnetic full adder (MFA), multiplier, logic functions, shifters based on nonvolatile memory has been designed that defeat the communication obstruction between memory units and distinguish logic blocks. The logic in memory (LIM) architecture overcomes the bottleneck of von-neumann architecture in terms of delay and power linked with data movement. The logic in memory (LIM) architectures demonstrated better performance that can be used as energy efficient computing systems.

Biography

Prasanna Kumar Misra obtained BTech (2005) and PhD (2014) from National Institute of Science and Technology, Berhampur and IIT Kanpur respectively. Since 2014, he is working as a faculty member in the department of Electronics and Communication Engineering at IIIT Allahabad. His specific areas of interests are Semiconductor Devices, Circuits and Systems.

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Design of biocompatible energy harvesting device for low frequency operation

Surya Prakash[1], Anurekha Sharma[2] and **Sunny[1]**

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[2]Kurukshetra University, India

The aim of the present disclosure is to design a hybrid Aluminium Nitride (AlN)/polymer and AlN-polymer nanocomposites based flexible and biocompatible energy harvesting device operating at low frequencies and low 'g' (preferably <1) along with achieving biocompatible low power requirements for biomedical applications. Recent advancements in MEMS technology have led to the development of different applications in the area of biomedical implants as well. With the advent of MEMS technology, these devices have become smaller, portable, cheaper, robust, and require low power consumption. Among these developments, specifically, the pacemaker devices need more attention from a healthcare point of view where size reduction approaches have been utilized to reduce the power consumption to a few microwatts. These applications draw their power from the batteries. So, the battery of the device is to be replaced after every 5-7 years by a surgical operation which can be exacted, costly, and a risky process. Moreover, surgical replacement may not be successful every time. Therefore, there is a need to use alternate wireless energy harvesting approaches by means of tapping energy from the ambient vibrations using piezoelectric transduction that can recharge the battery of the implant and can work for more years. Piezoelectric transduction is preferred because of the higher energy density. Among the piezoelectric materials available, AlN, Zinc Oxide (ZnO), and Polyvinylidene Fluoride (PVDF) are biocompatible. Among these, AlN is the best choice because of its CMOS compatibility and due to its higher figure of merit (FoM). So, the proposed research work will focus on designing the parts of an energy harvester device for low g (< 1) and low frequency using AlN/polymer hybrid and AlN-polymer composite as an active material.

Biography

Surya Prakash is an Assistant Professor in the Department of Electronics and Communication at the Indian Institute of Information Technology Allahabad. He received his Master and Doctorate degree from the Department of Electrical Engineering, Indian Institute of Technology Bombay, India, in 2019. He has in-depth experience in MEMS device simulation and modeling and has published a good amount of publications in this area. He worked with different researchers and supervised many students in this research area. He has pioneered research on MEMS and Smart Embedded Systems and published more than 30 research articles over it.

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Simulation based reinforcement learning algorithms for material design and optimal chemical reactions

Rahul Meshram

Indian Institute of Information Technology, Allahabad, India

Recently, artificial intelligence approach like simulation based reinforcement learning (RL) algorithms, Monte Carlo Tree Search (MCTS) are used to solve complex optimization, control and planning problems. It uses combination of Monte Carlo rollout policy and Upper confidence bound algorithm in the search tree to estimate the value. More recently, the deep neural network architecture and MCTS are combined for study of Alpha Go computer game. The idea of simulation based optimization MCTS can be utilized in the material science and chemistry in order to find optimal structure of the material to optimize the target property of material and optimize the chemical reaction in drug discovery, respectively. It is very useful in industrial research and drug discovery. Further, these ideas are used to identify and the predict the AlphaFold protein structure.

In this paper we study policy gradient algorithm for reinforcement learning which is studied for optimization of parameterized policy model. We further analyze the combination of PG and MCTS approach and extend the study of DNN architecture for PG-MCTS and MCTS policy optimization. Deep exploration based Bootstrap DQN. and Ensemble DQN are analyzed. We employ simulation based RL methods to optimize the chemical reaction in drug discovery. The use of these methods leads drug discovery with efficient optimization technique and it is less time consuming compared to traditional method of optimization. We provide numerical examples to illustrate the performance of proposed approach in drug discovery and chemical reaction optimization. Next, we develop the study of these algorithms for material design problem in material science where the goal is to design material with desired properties by optimizing composition of material structures. The standard optimization tools may not be appropriate for large scale optimization with large structure and component of materials. We show that MCTS and PG-MCTS performs optimization efficiently compute optimal material design with reasonable accuracy of desired properties. We finally demonstrate the numerical simulations to illustrate the performance of proposed algorithms.

Biography

Rahul Meshram is Assistant Professor at Department of Electronics and Communication, Indian Institute of Information Technology Allahabad since April 2021. He obtained B.E. from Nagpur University in 2006, M.E. from Indian Institute of Science Bangalore in 2010, PhD from IIT Bombay 2017. He was postdoctoral fellow at University of Waterloo, Canada in 2018 He was institute postdoctoral fellow at IIT Madras from July 2019 till July 2020. His current area of interests is in Reinforcement Learning, Deep Reinforcement Learning, Stochastic Optimization, Markov Decision Processes, Multi-armed bandits and its applications to drug discovery.

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A single electron transistor nanopore as toxic gas sensor: First principles investigation

Boddepalli SanthiBhushan and **Shubham Thapliyal**

Indian Institute of Information Technology, Allahabad, India

The single electron transistor (SET) is a three terminal device similar to that of a MOS transistor, and contains a source terminal for the release of electrons, a drain terminal for the receipt of electrons, and a gate terminal to control the flow of electrons through the quantum dot (Fig.1). The unique Coulomb blockade phenomenon of SET enables the one after another tunnelling of electrons from source to drain via the quantum dot, which is highly sensitive to the surroundings making it a great choice for sensing applications. The present work utilizes a SET nanopore as a toxic gas sensor to obtain the electronic fingerprints of detection for the highly toxic hydrogen cyanide (HCN), phosgene ($COCl_2$), methyl chloride (CH_3Cl) and vinyl chloride (C_2H_3Cl) gases in the vicinity of density functional theory (DFT) based first-principles approach. The gold electrodes with a work function of 5.28 eV and gate oxide with a dielectric constant of 10ε0 are considered. The sensing mechanism is demonstrated with the help of various outputs obtained from the SET device viz. total energy plotted w.r.t gate voltages, charge stability diagrams, horizontal line scans, vertical line scans, and charging energies. The SET nanopore offers unique electronic fingerprints for these toxic gases in terms of degeneracy points, operating bias voltage ranges for single electron transfer, and charging energies. The degeneracy points, where the SET device can enter ON state are different for all the 4 toxic gases. The vertical line scans reveal distinct operating bias voltage ranges corresponding to single electron transfer for these toxic gases. The charging energies (Fig.2) are unique for each of the targeted toxic gases and their orientations. The results portray the modelled nanopore as an effective sensor for the detection of these toxic gases.

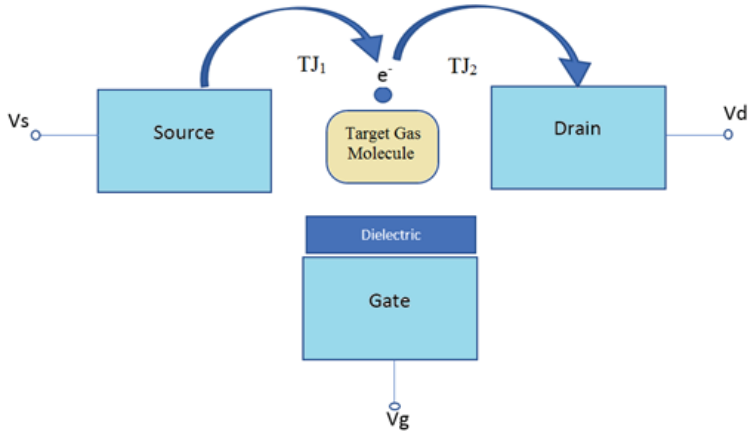

Figure1: Schematic of single electron transistor based sensor device (Here, TJ_1 and TJ_2 indicate tunnel junctions).

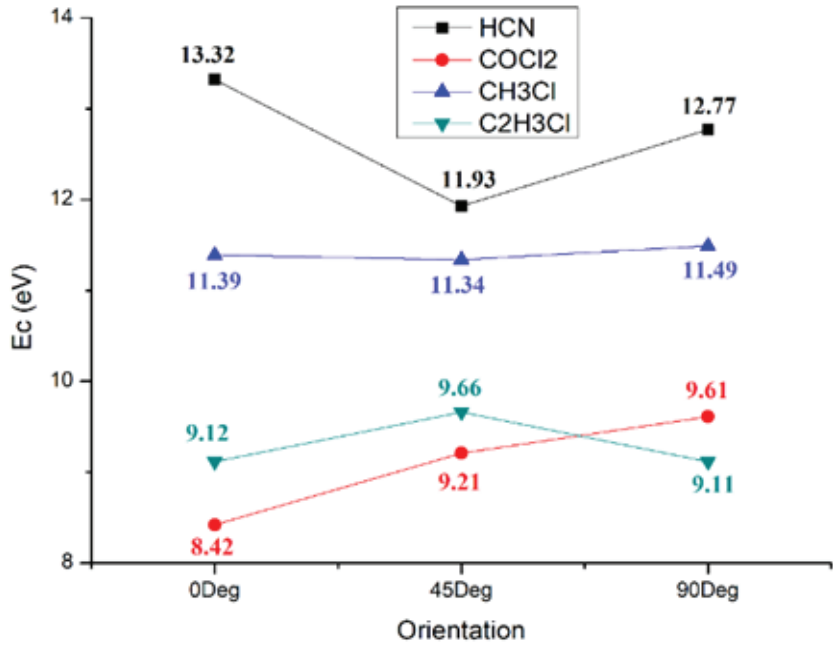

Figure2: *Charging energy (E_C) of SET nanopore in presence of various gas molecules with different orientations.*

Biography

Boddepalli SanthiBhushan (B S Bhushan) is currently an assistant professor at Indian Institute of Information Technology (IIIT), Allahabad, India. Earlier, he worked as an assistant professor at IIIT Kottayam and IIIT Bhopal, and as a Post-doctoral Fellow at IIT Bombay. He obtained the PhD degree in 2019 from IIIT Gwalior in the field of Nano-device modelling. He has published more than 30 papers including 24 SCI, 6 SCOPUS, 3 conference proceedings and 1 book chapter. He is a senior member of IEEE, and a member of IEEE electron devices society and IEEE nanotechnology council.

Climate system: A global sensitivity approach

Liban Ismail

Université Clermont-Auvergne, France

This article is a first attempt to develop a numerical approach to solving differential equations based on Galerkin projections and extensions of polynomial chaos to analyze the sensitivity of input parameters in the Lorenz-Stenflo climate model. The sensitivity analysis was undertaken to measure the influence of key parameters (chemical properties of the atmosphere, rotation, temperature gradient, convection motion). In addition, we do simulations of the climate model in the non-chaotic case and in the chaotic case and we calculate the Sobol's indices when the parameters follow the uniform law.

Biography

Liban ISMAIL is a teacher-researcher at the University of Djibouti and a PhD student at the University of Clermont-Auvergne. My research work focuses on sensitivity analysis applied to some models from infectious diseases, climate and economics.

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Microstructure, mechanical and biophysical properties of pure ultra-fine grain titanium

K. Wierzbanowski[1], D. Wojtas[1], M. Wroński[1], A. Baczmański[1], K. Sztwiertnia[2] and **R. Chulist[2]**

[1]AGH University of Science and Technology, Poland
[2]Polish Academy of Sciences, Poland

Mechanical strength, hardness and fatigue resistance of metals can be strongly increased applying plastic severe plastic deformation (SPD). In the present work the properties of hydrostatically extruded pure titanium grade 2 (HE Cp-Ti) were studied and analysed in aspect of its possible application for dental implants instead of titanium alloys alloy grade 5 (Ti-6Al-4V). Pure titanium (Cp-Ti) does not contain doping elements, which can be harmful for organism.

Mechanical testing, microstructure characterisation, and biophysical response examination of so obtained ultra-fine grain pure titanium were performed. Mechanical resistance was strongly increased, a reach of defects ultra-fine grain microstructure was obtained and anisotropic biophysical material response was confirmed. Generally, It was found that most of material characteristics are strongly anisotropic, i.e., one obtains different results for the transverse and longitudinal cross-sections of the deformed rods.

What concerns the biophysical response, the cell-material interactions were studied. It was found that they depend principally on two factors: on local defect density and the type of crystallographic planes parallel to the examined material cross-section.

Biography

Krzysztof Wierzbanowski has his expertise in the field of polycrystalline and ultra-fine grain materials, mechanical properties of metals, residual stresses and crystallographic textures. He developed crystalline models for elasto-plastic deformation and for recrystallization of metallic materials. He performed also analysis and interpretations of experimental results in the domain of X-ray diffraction, electron backscattering diffraction (EBSD) and mechanical testing of metallic materials. He gives academic lectures in the field of General Physics and Material Science. He is author of above 200 publications and of numerous presentations in conferences dedicated to material science.

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KEYNOTE PRESENTATIONS

DAY 2

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BIOGRAPHY

Ken Ri Kim is a senior lecturer in Textiles: Innovation and Design, School of Design and Creative Arts, Loughborough University. She develops innovative Jacquard weaving procedures through experiment-based research. Her research encompasses color, material, multi-layer, and new texture initiation.

KR Kim
Loughborough University, United Kingdom

Multicoloured Jacquard artworks reproduction with CMYK channels to improve colour accuracy

Multi-coloured Jacquard design reproduction has been restricted by the current setting of weaving machinery and therefore, varied weaving methods have been introduced to resolve the current restrictions. The CMYK (cyan, magenta, yellow and black) colour system applied to colour printing has been one of the important methods for the optical yarn colour mixing of Jacquard colour creation as a large scope of weave colour production is feasible with using only a small number of weft threads. In this study, the cyan, magenta, and yellow colour channels have been used to classify individual primary and secondary colours of the CMYK system to improve the colour accuracy of Jacquard artworks. The main principle is to combine a pair of the primary colour layers on defining a set of rules in order to segment cyan (C), blue (B), magenta (M), black (K), red (R), yellow (Y) and green (G) colours respectively. Shaded weave structures are aligned with the colour patterns to produce varied shades of weave colours. As a result, new six colour channels are created to improve Jacquard colour accuracy. This study explains the details of the C, M, and Y colour channel modification process to produce the six colour channels and weaving experiment results that examine the significance of the newly developed C, M, Y, R, G, B and K colour channels for the reproduction of multicoloured Jacquard designs.

BIOGRAPHY

Patrick Görrn is a professor of Large Area Optoelectronics (LGOE) at the University of Wuppertal. He holds a diploma (2004) and a PhD degree (2008) in electrical engineering from the University of Braunschweig. After his postdoc as Humboldt fellow at Princeton University (2009 - 2010), he became an assistant professor and Emmy Noether Research Group leader at the University of Wuppertal in 2011. In 2014, he then became a full professor. He received an ERC Starting Grant for his project on solar concentrators in 2015. His research interests include stretchable and flexible optoelectronics, in particular thin film lasers and sensors, laser displays and scanners, and light concentrators.

P. Görrn

University of Wuppertal, Germany

Optical sensors based on symmetric waveguide gratings

We demonstrate the fabrication and characterization of polymer based symmetric optical waveguide gratings. The experimental results are verified using rigorous coupled-wave analysis (RCWA). Typically, Waveguide gratings consist of a grating on top of a single-mode slab waveguide. Changing the waveguide's refractive index will alter the filling factor of the grating with respect to the mode intensity profile. This results in a propagation length of the mode that is slightly sensitive to refractive index changes. In this work we investigate whether this sensitivity can be increased by using symmetric waveguide gratings. We observed that both maximized propagation lengths and sensitivities with respect to refractive index changes can be achieved when the grating is placed at the position of intensity nodes of higher-order modes. For odd modes this condition is always fulfilled in symmetric optical waveguide gratings. The increased sensitivity may enable novel kinds of sensors and filters based on tunable waveguide gratings.

While node alignment leads to a minimized coupling of the mode leading to a maximized but finite radiative quality factor, symmetric waveguide gratings can even support waveguide modes of infinite radiative quality factor. Introducing a silver grating with mirror symmetry under glide operations, hybrid BICs can be formed in the waveguide grating. We present a theoretical description and experimental prove for hybrid BICs. The sensing performance (intensity change per permittivity change) of hybrid BICs is theoretically analyzed in different sensing geometries. The results are compared to classical dielectric BICs and node-aligned waveguide grating modes of finite radiative quality factor.

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BIOGRAPHY

Key Research Topics

- Bioresorbable Magnesium Implants for Orthopedic Applications
- Comprehensive Research in Orthopedics and Traumatology
- Decision Making in Orthopedic Patients with Musculoskeletal Trauma
- Critical Trauma Care
- Allograft Tissues in Sport Orthopaedic Foot and Ankle Surgery

Education

Privatdozent (venia docendi) in Orthopedics and Traumatology 2021

- Medical University of Graz, Department of Orthopedics and Trauma
- Dr.sci.med (equivalent to PhD) 2021
- Medical University of Graz, Department of Orthopedics and Trauma
- Doctoral thesis: „A lean magnesium-zinc-calcium alloy ZX00 used for bone fracture

stabilization in a large growing-animal model and in the first clinical implementation for medial malleolus fractures in adults"

Dr.med.univ. 2010

• Medical University of Graz, Department of Orthopedics and Trauma

Patrick Holweg

Medical University of Graz, Austria

Magnesium screws for fracture treatment in Trauma surgery: 3.5-Year clinical results after medial malleolus fracture fixation and Computed Tomography (CT)

Background: Over the last decade, the development of new and alternative materials in trauma care using bioresorbable metals has increased, concentrating mainly on magnesium (Mg) alloys. Our research group has dedicated itself to finding ideal indications for magnesium alloys in trauma surgery.

Aim: Magnesium (Mg)-based biodegradable screws for medial malleolar fracture reduction were investigated in this prospective cohort study. Our bioabsorbable Mg-based screws are composed of pure Mg alloyed with zinc and calcium (0.45 wt% zinc (Zn) and 0.45 wt% calcium (Ca); ZX00). Visual analog scale (VAS) and the presence of complications (adverse events) during 3.5 years of follow-up were used to evaluate the clinical outcomes. The functional outcome were analyzed through the AOFAS foot score. Furthermore, implant degradation was studied in 11 patients with computed tomography after 3.5 years.

Results: The mean follow-up was 3.5 years. The 12-weeks-results with successful fracture healing in all 20 patients had already been published (Bone Joint Res. 2020-08). No adverse events or breakage of screws were observed. All ankle fractures were reduced, and a complete consolidation of all fractures was achieved after 12 weeks. At the final follow-up examination after 3.5 years, the mean AOFAS score was 93±6.1 points. Implant remnants were assessed by the CT after 3.5 years at 22 implantation sides. At 15 (68%) screw implantation sides, the screws had been completely degraded without any visible remnants. At 7 implantation sides (32%), the range of visible remnants seen at single CT slides ranged from 2% to 21%.

Conclusion: After 3.5 year of follow-up, no adverse events and excellent clinical and functional outcomes were reported. In the CT investigation an almost complete degradation of the implants was proved. Mg-based bioresorbable screws seem to be an excellent and safe alternative compared to titanium screws while avoiding a second operation.

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SCIENTIFIC ABSTRACTS

DAY 2

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On adaptive multi-objective optimization for greener wired networks

H. Yazbek and **P. Liu**
Nova Southeastern University, USA

In this research, we develop a novel adaptive Multi-Objective Optimization (MOO) algorithm to jointly minimize the Power Consumption (PC) and Maximum Link Utilization (MLU) of wired computer networks. This novel algorithm, based on Non-dominated Sorting Genetic Algorithm II (NSGA-II), is able to discover the optimal link weights configuration for wired networks based on live network traffic data. The goal is to minimize both PC and MLU when this optimal link weights configuration is applied to the network. The impact of the Internet and wired networks' growing power consumption on costs and environment continues to be a major concern of network operators. Our adaptive MOO scheme can be applied to any wired network to reduce its power consumption with acceptable load balancing to help achieve greener energy-efficient networks. In order to validate our solution, we run experiments on two different network topologies with various network traffic data to compare the performance of three different methods of updating the link weights: random, delta-weight, and hybrid. The experiment results show that all three methods can find optimal solutions to achieve both reduced PC and MLU. Compared to the default link weights configuration, the optimal solution found by hybrid approach is the best since it can reduce the PC by 35.24%, while reducing MLU by 42.86% for specific traffic pattern on Abilene network topology.

Biography

Hatem is a Sr. director at Broadcom Communication & Switching Group (CSG) managing a multinational diverse team. He has more than 29 years of experience including extensive involvement with VLSI micro architecture, chip design, CAD, and backend physical design. Previously he worked at Intel's processors group, Cypress Semiconductor's Data Communication group, Oplus Technology startup managing the physical backend design and CAD group and lead Marvell's backend group developing EBU network switches. Additionally he co-founded Coreum and Annapurna startups that focus on SoC (System On Chip) designs. He holds several patents in the domain of chip design. He received the Ph.D. degree from the college of computing and engineering, NSU (Nova Southeastern University) in 2019. He holds a Master's degree in EE from Georgia Institute of Technology since 1991, and B.Sc.in EE from Technion from 1989. He has published several papers related to his PhD field of study of saving energy of internet networks.

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Green algae-based biopolymers for green energy storage devices

Fernando G. Torres[1], Omar P. Troncoso[1], Karen N. Gonzales[1,2] and **Edwin Huayhua[3]**

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[2]*Universitat Politècnica de València, Spain*
[3]*Universidad Nacional de Juliaca, Peru*

Portability, flexibility and low environmental impact are among the most important features that novel energy storage devices must fulfill. Electrolytes are one of the main components of such devices. Polymer electrolytes feature low weight, flexibility and safety, compared with traditional liquid electrolytes. Biopolymers have also been used as solid electrolytes with good results. In particular, sulfated polysaccharides such as carrageenan and alginate, have shown to be good candidates for the development of novel bio-based electrolytes. The anionic nature of sulfated polysaccharides allows them to form coordination sites with metal cations and increasing ion dissociation. Ulvan is a sulfated polysaccharide synthetized by green algae. In spite of the fact that green algae are potential sources of polysaccharides, only brown and red algae are utilized at a commercially. In this paper, we use green algae to extract ulvan in order to develop a novel solid flexible electrolyte that could potentially be used in an energy storage device. We have characterized the ulvan extracted from ulva sp. by means of Gel Permeation Chromatography (GPC), Fourier-transform Infrared Spectroscopy (FTIR), Differential Scanning Calorimetry (DSC) and Thermogravimetric Analysis (TGA). The ulvan extracted was used to prepare films which dielectric properties were evaluated using Broadband Dielectric Spectroscopy (BDS). Ulvan-based films doped with different salts were evaluated and showed that ulvan is a good candidate for the development of green solid electrolytes for novel energy storage devices.

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A theory of speculative bubbles and crashes

Taisei Kaizoji
International Christian University, Japan

The aim of this talk is to propose a new model of bubbles and crashes to elucidate a mechanism of bubbles and subsequent crashes. We consider an asset market in which the risky assets into two classes, the risky asset, and the risk-free asset are traded. Investors are divided into two groups of investors who have the different rationality on decision-making respectively. One is fundamentalists who maximize their expected utility of their wealth in the next period following their rational assessment of the fundamental values of risky assets. Another is speculators who maximize their random utility of binary choice: buying the bubble asset and holding the risk-free asst. The speculator's behavior is modeled in a framework of the Ising spin model of statistical mechanics, which can be considered as a model of Keynse's beauty contest metaphor. We demonstrate that (i) if speculators' conformity effect (the extent that each noise-trader is influenced by the decisions of other speculators) is weak, then the market price converges to the fundamental price, so that the efficient market hypothesis holds, but that (ii) if speculators' conformity effect is strong, then speculators' herd behavior gives cause to a bubble, and their positive-feedback trading prolongs bubble, but a bubble is necessarily ended up with a crash. Furthermore, we describe that cycles of bubbles and crashes are repeated.

Biography

Taisei Kaizoji is a Professor of Economics at International Christian University in Tokyo, Japan. He obtained his undergraduate degree in commerce in 1986 from Waseda University and received his Ph.D. in Arts and Sciences from the Tokyo Institute of Technology in 1999. He was also a visiting professor at University of Kiel in Germany in 2000 and a visiting professor at ETH Zurich in 2008. He is the Alexander von Humboldt Fellow since 2001. He is a member of the editorial board for Journal of Economic Interaction and Coordination since 2006. He has published more than 100 papers in scientific journals, and three co-edited books in econophysics, network theory, macroeconomics, and financial engineering. His recent research interests include: (1) speculative bubbles and crashes in financial markets, (2) Macroeconomic tail risks, and (3) the market efficiency of cryptocurrency markets.

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Clinical significance of 'Hepcidin inducer Laennec and Porcine' in the treatment of Hereditary Hemochromatosis, NASH, and other iron loading chronic liver diseases complicating with Type2 DM

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[1]*HAMADA Clinic for Gastroenterology and Hepatology, Japan*
[2]*Japan Bio Products Co. Ltd,, Japan*

Introduction: The disturbance of iron metabolism is one of the characteristic feature of NASH, however as for the mechanisms of the iron deposition in the liver, the precise pathophysiology is still uncertain. In many NASH cases, remarkable decline of serum ferritin as well as the improvement of T2DM were observed after treating with Laennec (Placenta derived drug) in accordance with the improvement of the liver dysfunction. We examined whether Laennec can restore the pathological background through regulating iron and glucose metabolism in NASH and Hereditary Hemochromatosis (H.H.) by the action of "hepcidin inducer".

Background and Aims: We have previously shown that hepcidin-m-RNA could be induced in dose dependent manner on applying with Laennec using primary hepatocytes and HepG2 cell. Here we show that the treatment with Laennec which contains 'hepcidin inducer' improves not only H.H. without repeated phlebotomy, but also NASH and other iron loading chronic liver diseases complicating with T2DM.

Clinical Implications and Suggestions:

NASH: We divided 68 NASH cases (all liver biopsied) into two groups retrospectively. Non-Laennec-treated 30cases were cared with ordinary liver supporting therapy. Laennec-treated 38cases were treated with the infusion of 2 ampules(224mg) of Laennec 1-2 times /W, in addition to the ordinary liver supporting. Serum ferritin, ALT and HbA1c were measured, and liver biopsy was carried out to evaluate changes of fibrosis and iron deposition.

H. Hemochromatosis: 47years-old male patient that developed type 2 diabetes mellitus had elevated serum ferritin level (10,191ng/ml) and a decreased hepcidin-25 level (0.5-1.6ng/ml). Liver biopsy revealed remarkable iron deposition and severe fibrosis. As the substitute for the repeated phlebotomy, the infusion with Laennec (672mg/d, 3times/w) has been done for 84 months. At the end of the treatment, the serum ferritin level was decreased to 506ng/ml. HbA1c also improved with the same dose of insulin (8.8→6.8%). The results suggest that Laennec may take the place of phlebotomy for H.H. and other hepcidin-deficient diseases.

Conclusion: The placenta-derived Laennec which contains "hepcidin inducer" actually improved iron overload of H.H. patient without repeated phlebotomy, and it also ameliorated glucose metabolism complicating with H.H. The decline of serum ferritin levels by infusing with Laennec observed in NASH was simultaneously accompanied by the improvement of the liver fibrosis and inflammation as well as the glucose metabolism. It is possible that Laennec containing hepcidin-inducing material can bring about the improvement of NASH, H.H and other iron loading chronic liver diseases by suppressing ROS-production of iron-origin.

Biography

Yuki Hamada Graduated from School of Medicine, Hokkaido University in 1975. From 1975-1977 he served as a Medical trainee at Osaka Medical Center for Cancer and Cardiovascular Disease, Osaka, Japan. 1977-1989 he worked as Lecturer, Gastroenterology and Hepatology Department, Hokkaido University. 1988-1989, 191 Research Fellow, Faculty of Life Science (Prof.F.L.Bygrave), Australian National University.1989-1998 Manager, Gastroenterology section, National Nishi-Sapporo hospital.1998-Present President, HAMADA Clinic for Hepatology and Gastroenterology. He has a membership of International Association for the Study of the Liver, Japan Society of Hepatology. He is a Medical Specialist at Japan Society of Hepatology, Japanese Society of Gastroenterology, Japan Gastroenterological Endoscopy Society, Japan Geriatrics Society, Japan Society of Ultrasonic and Medicine. And he is a Board Certified Physician of the Japan Society of Internal Medicine.

Dual-segment continuum robot with rotational motion along the deformed backbone

Qingxiang Zhao[1] and **Shuai Wang**[2]

[1]*Centre for Artificial Intelligence and Robotics (CAIR) Hong Kong Institute of Science & Innovation, Chinese Academy of Sciences, China*
[2]*Hong Kong Polytechnic University, China*

In continuum robotics, many researchers have designed novel actuators, new materials /mechanism, proprioception and modelling approaches to, while almost all the robots reach to a specific pose through deformation. One of the notable characteristics of continuum robot is working in narrow constrained environments, where rotation motion is generally required. As far as we know, there is no existing work presenting concurrent deformable and rotatable continuum robots. Through a novel design to decouple the actuation media and to provide line rotation, we have achieved simultaneous rotation about the deformable backbone. In detail, the deformation feature of continuum robot was well realized to direct a given tip position. Simultaneously, the entire soft robot body could also rotate along the deformed backbone with the shape unchanged. During modelling, two mapping, i.e., actuation between shape and shape between tip pose were individually established, and the control strategy for deformation and rotation contributes to accurate motion. Both simulation and experiments demonstrate the feasibility of the design. Two potential applications further show the proposed design and modelling could enhance the motion velocity and accuracy.

Biography

Qingxiang Zhao received the B.Eng. and M.S. degrees in mechanical engineering from Sichuan University, Chengdu, China, in 2016 and 2019, respectively. After that, he pushed Ph.D. degree in mechanical engineering with The Hong Kong Polytechnic University, Hong Kong, in 2022. Currently, he is an assistant professor in Centre for Artificial Intelligence and Robotics (CAIR) Hong Kong Institute of Science & Innovation, Chinese Academy of Sciences. His research focuses on continuum robot design, proprioception, and modelling.

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Development and application of a hydraulic impact test machine for simulating rockburst conditions

WANG Jie[1], PAN Yi-shan[2] and **ZHANG Jian-zhuo[1]**

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[2]Liaoning University, China

Existing testing techniques do not meet the requirements for static-dynamic composite loading tests of anti-impact supports for rockburst protection in mines. In this study, a hydraulic impact test machine was designed to simulate the rockburst conditions. The test machine was designed with the maximum impact load of 6500 kN, starting time (for static-dynamic loading conversion) of less than 50 ms, effective impact displacement of 0.8 m, maximum impact speed of 8 m/s, and a maximum energy accumulation of 8×106 J. Based on the proposed technical specifications, a symmetrical layout of four accumulator groups was opted to meet the impact energy requirements. Secondly, a novel extra-high-flow high-pressure quick-opening valve structure (with rated pressure of 31.5 MPa, an instantaneous flow rate of 120,000 L/min, and starting time <50 ms) was innovatively designed and shown to sufficiently meet the maximum impact speed requirement. Furthermore, an impact cylinder with a blowing device was developed to minimize the liquid return resistance of the hydraulic impact cylinder for achieving the required impact load and speed. An anti-rigid impact protector is also proposed to protect the test machine during high-energy impact tests. The design validation was performed through various tests. The results confirm that the test machine successfully provides a reliable method for laboratory dynamic testing of anti-impact supports. In addition, the data collected during the tests can be used for future development of novel anti-impact hydraulic supports.

Biography

Wang Jie (1981-), Doctor of Engineering, graduated from Liaoning Technical University. Her research focuses on the autonomy and intelligence of industrial and mining equipment, and mechatronics. The main research results are as follows: Based on the principle of hydraulic loading, developed an impact testing machine which solved the problem of static and dynamic composite loading in the laboratory test of rock burst mine support devices, and achieved static and dynamic loads. Developed a 50,000kN hydraulic support test bench, which can conduct relevant tests on hydraulic supports with a working resistance of 30,000kN and below. This is in accordance with national and European standards for operational performance, sealing performance, support performance, structural strength and durability.

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Photocatalytic activity of nanostructured ZnO for water and air purification: From microfluidics to smart city applications

Y. Leprince-Wang[1], N. Martin[2] and **M. Le Pivert[1]**

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[2]Eden Tech, France

Water and atmospheric pollution is a major issue affecting environment and health. Semiconductor-based photocatalysis is a well-known and efficient process for achieving water and air depollution, with very limited rejects in the environment. Zinc oxide (ZnO), as a wide-bandgap metallic oxide, is an excellent photocatalyst, able to mineralize a large scale of organic pollutants in water, under UV irradiation, that can be enlarged to visible range by doping nontoxic elements such as Ag and Fe. With high surface/volume ratio, the ZnO nanostructures have been shown to be prominent photocatalyst candidates with enhanced photocatalytic efficiency owing to the facts that they are low-cost, non-toxic, and can be produced with easy and controllable synthesis. Thus, ZnO nanostructures-based photocatalysis can be considered as an eco-friendly and sustainable process. This work presents the photocatalytic activity of ZnO nanostructures (NSs) grown on different substrates. The photocatalysis has been carried out both under classic mode and micro-fluidic mode. All tests shown the notable photocatalytic efficiency of ZnO NSs with remarkable results obtained from ZnO-NSs-integrated microfluidic reactor, which exhibited an important enhancement of photocatalytic activity by reducing drastically the photodegradation time. UV-visible spectrometry and high-performance liquid chromatography coupled with mass spectrometry (HPLC-MS) are simultaneously used to follow real-time information giving both the photodegradation efficiency and the degradation mechanism of the organic dye methylene blue. By scaling-up an innovative and low-cost hydrothermal direct growth synthesis, a few square meters paved with tiling and bitumen road were easily produced in order to evaluate their photocatalytic activity at large scale under solar lamp in a climatic chamber (Sense-City, 400m^2, 3200 m^3) to reflect real atmospheric air purification situations. Observations provide insights into their ability to simultaneously remove various pollutants from a real car exhaust (O_3, CO_X, NO_X, VOCs) and their durability.

Biography

Yamin Leprince-Wang is Full Professor at the Gustave Eiffel University (UGE), France, where she is Head of the Materials Science & Engineering Master's degree course. Her main research interest consists of synthesis and characterization of oxide nanomaterials and their applications in energy and environment fields, such as nanogenerator of electricity, solar cells, chemical sensors, and water & air purification using photocatalysis process. She received B.S. degree from Zhejiang University in China (1985), M.S. and PhD degrees from Sorbonne Université (ex. Pierre and Marie Curie University - Paris VI) in France in 1991 and 1995, respectively; then joined UGE (ex. UPEM) in 1995. Chief of the Material Science Department between 2006-2010, and leader of the Laboratoire de Physique des Matériaux Divisés & Interfaces (LPMDI, UMR CNRS) between 2008-2014, she co-authored more than 100 peer reviewed papers, 2 books, and 3 patents.

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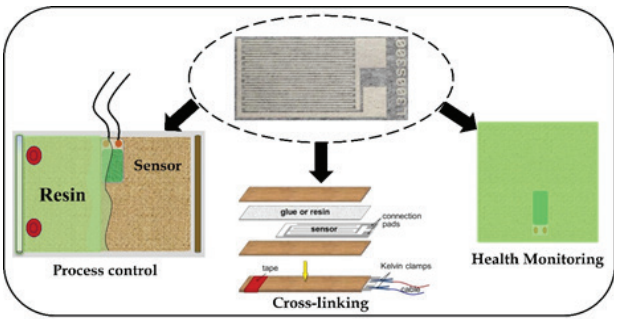
Integration of smart, ultrathin and flexible cellulose-based printed sensors for process control and health monitoring

Mohammed Khalifa, Uwe Müller, Arunjunai Raj Mahendran, Claudia Pretschuh, Florian Egger and **Herfried Lammer**

Kompetenzzentrum Holz GmbH, Austria

Integration of facile, thin, and flexible sensors is an emerging trend in production control and structural engineering. Among various sensors, highly porous cellulose-based printed sensors offer several advantages including biodegradability, versatility, flexibility, high sensitivity and chemically inert with minimal or no effect on the mechanical integrity of the structures. Printed cellulose sensors are suitable for determining the cross-linking reactions, moisture content, temperature and health monitoring of polymers, wood, composites and adhesives. However, it is vital to optimizing the paper type and printing parameters depending on the type of material and sensor functionality.

This work demonstrates the potential application of cellulose-based printed sensors for their integration in polymers, composites and adhesives for various purposes. Sensors integrated into polymer matrix such as epoxy, phenol-formaldehyde, urea-formaldehyde etc., allows real-time in-situ analysis of the cross-linking of the resin. The ability of cellulose-based sensors of tracking the real-time changes in the physical state or cross-linking of resin is an essential prerequisite for the production control of polymer composites, especially fiber-reinforced thermosets. Since, physical properties of the material hugely depend on the degree of cross-linking. On the other hand, integrated sensors are effectively used to monitor the humidity and temperature of the thermoplastic and thermoset polymer composite. For instance, the printed sensor on abaca paper is ideal for measuring the degree of cure of wood adhesives at various temperatures. Once the curing is completed, the integrated sensor was used to monitor the moisture content in wood. Cellulose-based sensors offer significant potential and are suitable for integration into structural components taking into consideration that it not only allows tracking of real-time data, but also ideal for minimal invasive integration.



Biography

Khalifa earned his bachelor's degree in Mechanical Engineering and his master's degree in Design Engineering (M. Tech) from VTU in Karnataka, India. He went on to pursue his Doctorate degree (Ph.D.) from the National Institute of Technology, Karnataka, India. His area of interest includes smart polymers, sensors and nanomaterials, with a particular interest in polymer technology, nanocomposites, and sensors for various applications. After completing his Ph.D., he served as a guest researcher at Wood-K plus, Austria. Currently, he is working as a Senior Researcher at Kompetenzzentrum Holz GmbH, Wood-K plus, Austria. In this role, he is managing several projects aimed at developing novel biomaterials and smarter lightweight constructions for aerospace and energy-related applications. He has authored numerous international journal articles, national and international conference proceedings, and book chapters. He is also a highly sought-after speaker, having delivered technical talks at several international conferences and invited as a guest lecturer in various institutions.

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Unidirectional flow of composite bright-bright solitons through asymmetric double potential barriers and wells

Amaria Javed[1,2], T. Uthayakumar[1], M.O.D. Alotaibi[3], S.M. Al-Marzoug[4], H. Bahlouli[4] and **U. Al Khawaja[1]**

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[2]*New York University Abu Dhabi, United Arab Emirates*
[3]*Kuwait University, Kuwait*
[4]*King Fahd University of Petroleum and Minerals, Saudi Arabia*

We investigate the dynamics of two component bright-bright (BB) solitons through reflectionless double barrier and double well potentials in the framework of a Manakov system governed by the coupled nonlinear Schrödinger equations. The objective is to achieve unidirectional flow and unidirectional segregation/splitting, which may be used in the design of optical data processing devices. We observe how the propagation of composite BB soliton is affected by the presence of interaction coupling between the two components passing through the asymmetric potentials. We consider Gaussian and Rosen-Morse double potential barriers to achieve the unidirectional flow. Moreover, we observe a novel phenomenon which we name *"Polarity Reversal"* in the unidirectional flow. In this situation, the polarity of the diode is reversed. To understand the physics underlying these phenomena, we perform a variational calculation where we also achieve unidirectional segregation/splitting using an asymmetric double square potential well. Our comparative study between analytical and numerical analysis lead to an excellent agreement between the two methods.

Biography

Amaria Javed received her master's degree in Physics from Quaid-i-Azam University (QAU), Islamabad, in 2012. Then she obtained her M.Phil degree in Physics from the same institute in 2015 with thesis research on Quantum entanglement between electronic spin and spatial states in graphene. She earned her Doctorate (PhD) in theoretical physics (nonlinear physics, more precisely) from United Arab Emirates University (UAEU) in 2021, and she became the first PhD graduate in the field of physics from UAEU. She has published her research in many prestigious journals. She has also presented her research at different international forums. She has been awarded the Golden visa (10-year residency) by the UAE government under the special talent category. Her PhD research focused on all-optical data communication through solitons in waveguide arrays. She tackled both fundamental and applied issues. She used different analytical and numerical techniques to solve nonlinear Schrödinger equation (NLSE) and designed waveguide arrays that allow for proper data processing and, ultimately computing. She is also looking at the prospect of soliton scattering for quantum information processing. Right after her PhD defense, she joined a research project on nonlinear dynamics at Khalifa University (KU) Abu Dhabi. Currently, she is a Postdoctoral Associate at New York University Abu Dhabi (NYU Abu Dhabi).

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Development and comparison of airplane fuselage panel assembly system alternatives using axiomatic design principles and simulation methodology

Celek. O. E.[1], Ic. Y. T.[2] and **Yurdakul. M[3]**

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[2]Baskent University, Turkey
[3]Gazi University, Turkey

This study presents combined usage of axiomatic design principles and simulation in developing and comparison of alternative assembly systems for airplane fuselage panels. In the application, four assembly system alternatives are obtained with axiomatic design methodology and their performance results are obtained using simulation. The simulation results are made available for system designers to see each alternative's capabilities and make comparison among the alternatives. The application of the proposed combined application of axiomatic design principles and simulation provides a reference guide for system designers to apply in designing other assembly systems design.

Biography

Osman Emre CELEK got B.Sc. (Mechanical Engineering) from Uludag University, first M.Sc. (Mechanical Engineering) from Hacettepe University, second M.Sc. (Aerospace Engineering) from Istanbul Technical University, Ph.D. (Mechanical Engineering) from Gazi University in Turkey.

He has been working in Turkish Aerospace for 10 years as senior mechanical engineer. Turkish Aerospace which ranks among the top hundred global players in aerospace and defense arena, is Turkey's center of technology in design, development, modernization, manufacturing, integration and life cycle support of integrated aerospace systems, from fixed and rotary wing air platforms to UAVs and satellites. At this technology center, he got involved in mostly commercial aircraft programs. He has experience in development, transition, and implementation of automated assembly, robotic and process technologies including bearing and gear manufacturing, aircraft fuselage and wing drilling, fastening, painting, sealing, measurement, tooling, and material handling for the aerospace industry. He has led company's technical development for new assembly automation technologies.

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Anti-icing and anti-fouling properties of pitcher plant inspired coatings

Esra Kasapgil

Izmir Bakircay University, Turkey

Ice or snow accumulation on surfaces, especially in cold environments, leads to failure of several systems such as wind turbines, power lines, water lines, ships, airplanes and so on. This malfunction can cause economic loss and fatalities. Despite there are some ice removal methods like mechanical scraping, thermal treatments and deicing fluid treatments, these methods are generally expensive and cannot be applied to all systems. To overcome icing problems on surfaces, some anti-icing coating methods that prevent ice accumulation have been developed. Superhydrophobic surfaces were considered as an important candidate for anti-icing coatings due to their high water-repellency properties. However, some studies showed that superhydrophobic surfaces are not always successful at preventing ice formation because they can lose their water repellency properties in high humidity conditions, or they can be damaged during ice nucleation.

On the other hand, fouling is an important problem of surfaces. Fouling can be caused by the accumulation of unwanted substances such as dirt, sand, rust, microorganisms, bacteria, proteins, etc. Fouling can cause failure and capacity loss of materials, and if the fouling occurs on the surface of biomaterials (biofouling), it can cause fatal consequences.

Recently, pitcher plant inspired slippery coatings with multi-liquid repellency, anti-fouling and anti-icing properties were developed. The main idea of this novel coating is to produce a porous surface that can hold tightly a lubricant, and then obtaining a slippery coating by lubricating this surface. In this work, pitcher plant inspired slippery coatings were developed on glass surface with different coating methods like chemical vapor deposition (CVD) and layer-by-layer assembly, and then they were lubricated with silicone oil or glycerin. These coatings showed very good water repellency, anti-fouling, and anti-icing properties with high durability against raining conditions and heating conditions. These promising slippery coatings have potential to be used in a wide range of applications.

Biography

Esra Kasapgil obtained her bachelor's degrees in Chemical Engineering and Metallurgical and Materials Engineering from Istanbul Technical University, Turkey in 2012 and her master's degree in Materials Science and Engineering from the same university in 2014. In 2020, she obtained her Ph.D. degree in Materials Science and Engineering from Gebze Technical University in Turkey where she had also worked as a research assistant in 2013-2020. During her PhD studies she focused on coating technologies, polymeric thin films, bio-inspired superhydrophobic surfaces and slippery liquid infused porous surfaces (SLIPS) for self-cleaning and antibiofouling applications. She was a visiting researcher in Biomedical Engineering at McMaster University, Canada in 2019-2020. She is currently an Assistant Professor in the Department of Biomedical Engineering at Izmir Bakircay University, Turkey. Her research interests are coating technologies, thin film technologies, superhydrophobic coatings, antifouling coatings, surface modification of biomaterials, polymer chemistry, polymer synthesis and characterization, bioinspired materials and technologies.

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Polyphenolic extracts from the xerophyte Rhamnus lycioides as a radiation biodosimeter

Sihem Guesmi[1,2], Amel Raouafi[2], Ismail Amri[3], Ahmed Hicham Hamzaoui[4], Abdennacer Boulila[5], Faouzi Hosni[2,6] and **Haitham Sghaier[2,7]**

[1]National Agronomic Institute of Tunisia, Tunisia
[2]National Center for Nuclear Sciences and Technology, Tunisia
[3]Institut National de Recherches en Genie Rural, Tunisia
[4]National Center for Research in Materials Sciences, Tunisia
[5]National Institute of Research and Physico-chemical Analyses, Biotech Pole of Sidi Thabet, Tunisia
[6]Bisha University, Saudi Arabia
[7]Sidi Thabet Technopark, Tunisia

The majority of dosimeters currently in use are synthetic and very expensive. Therefore, the study of the dosimetric characteristics of polyphenolic extracts of xerophytes is useful because drought stress causes an increase in the production of these cheap and naturalcompounds containing benzene rings. Here, the polyphenolic compounds were extracted from *Rhamnus lycioides* which was collected from Bou-Hedma National Park in Tunisia andidentified using liquid chromatography-mass spectrometry (LC-MS). We investigated the impact of cobalt-60 (60Co) irradiation (0–30 kilogray (kGy)) on the color parameters of polyphenolic extracts of R. lycioides using the Konica Minolta CR 300 portable colorimeter and UV–Visible spectroscopy. The structural and morphological characteristics of the irradiated extracts were assessed using Fourier transform infrared (FT-IR) spectroscopy, Xray diffraction (XRD) technique and scanning electron microscopy (SEM). Overall, our results suggest that exposure to ionizing radiation (IR) of the polyphenolic components of the xerophyte R. lycioides has produced significant dose-dependent changes in their optical andmorphological properties. Thus, these extracts can be valorized as biodosimeters in the dose range from 5 to 25 kGy.

Biography

Guesmi Sihem is a young Research engineer in agronomic and biological sciences. Her research areas are environmental microbiology, radiobiology, biochemistry and bioinformatics.

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Advanced nano-materials for electrochemical COVID detection

A. Brouzgou[2], G. Balkourani[1], M. Archonti[1], N. Papandrianos[2], S. Song[3] and **P. Tsiakaras[1]**

[1]Department of Mechanical Engineering, School of Engineering, University of Thessaly, Greece
[2]Department of Energy Systems, School of Technology, University of Thessaly, Larisa, Greece
[3]School of Materials Science and Engineering, School of Chemical Engineering and Technology, Sun Yat-sen University, China

Since still today the COVID variants persist, the accurate and rapid diagnosis of COVID-19 when the viral load is very low and cannot be detected by the self or rapid-tests it is imperative. Electrochemical sensors have been proved to be very promising tools for: i) accurate, ii) low cost, iii) high sensitivity, iv) quick and v) portable detection. According to our literature research, currently, two main groups of nano-materials have been thoroughly explored for COVID detection: i) the Au-based and ii) the carbon or graphene-based ones. Both present faster response time (few seconds) along with higher accuracy than the current detection methods. They display high sensitivity values, reaching even the aM scale (=10−18M), while their specificity is also comparable to the current detection methods and they can be portable and miniaturized. Au was mainly used in the form of nanoparticles onto alternative supports (polymer based or other) or supported onto reduced graphene oxide, before being deposited onto the basic platform. The inclusion of the r-GO to the Au nanoparticles significantly ameliorates SARS-CoV-2 sensor characteristics as it mainly expands the detection area, on which the virus binds. Moreover, we concluded that the carbon or graphene-based electrodes can compete the Au-based ones, as they have similar or even better operational characteristics, also offering the advantage of lower cost. Especially graphene and its derivatives, which are considered the most promising materials, do not contain chemically reactive functional groups that could help immobilizing analyte biomolecules. Thus, we observed that the surface or structure alteration by: i) doping graphene with another(bio)element, or ii) creating structure defects, or iii) being used as they are to modify screen printed carbon electrodes

Biography

Dr. Brouzgou is Asst. Prof. in the Department of Energy Systems in University of Thessaly, in Greece. Her research interests include the design and development of electrochemical systems emphasizing on electrochemical (bio)sensors as well as on the preparation of innovative nanomaterials. Dr Brouzgou has co-authored more than 25 articles in International Journals with reviewers (>1500 excluding self-citations) and has co-authored four Chapters in Books of International publishing houses. In her research activities, from 2013 to 2020, she was occupied as a postdoctoral researcher in the Low-carbon Chemistry & Energy Conservation of Guangdong Province, School of Physics and Engineering, Sun Yatsen University, Guangzhou, China, the École Nationale supérieure de chimie de Paris, Université de Paris, Paris, France and in the Istituto di Tecnologie Avanzate per l'energia "Nicola Giordano" (CNR-ITAE), Messina, Italy.

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Titanium nano-columns on graphene monolayer/Cu electrode for electrochemical dopamine detection

A. Brouzgou[1], G. Balkourani[1], C. Molochas[1], J. M. García Martín[2] and P. Tsiakaras[1]

[1]University of Thessaly, Greece
[2]Instituto de Micro y Nanotecnología, Spain

Titanium nano-columns/graphene monolayer-Cu electrode, was prepared using an advanced, glancing angle deposition by magnetron sputtering, physical vapor deposition (PVD) method and investigated for electrochemical dopamine detection. The nano-columns were grown, on a commercial single-layer graphene on copper foil substrate, almost vertical and at some points parallel to the atomic flux. The morphology and the surface were investigated by scanning electron microscopy (SEM) and atomic force microscopy (AFM) techniques. The results shown that the average height of the nanocolumns is ~170 nm; while there are some spots on the electrode of inhomogeneous growth of nanocolumns. The electrochemical detection of dopamine with the as-prepared electrode was investigated using the cyclic voltammetry (CV) and differential pulse voltammetry (DPV) methods. According to the DPV results (Figure 1) the low detection limit was 10 μM dopamine in neutral environment (PBS), at 36.6°C, while according to the calibration curve the current response-concentration presents an excellent linear relation and 200 μA/mM high sensitivity.

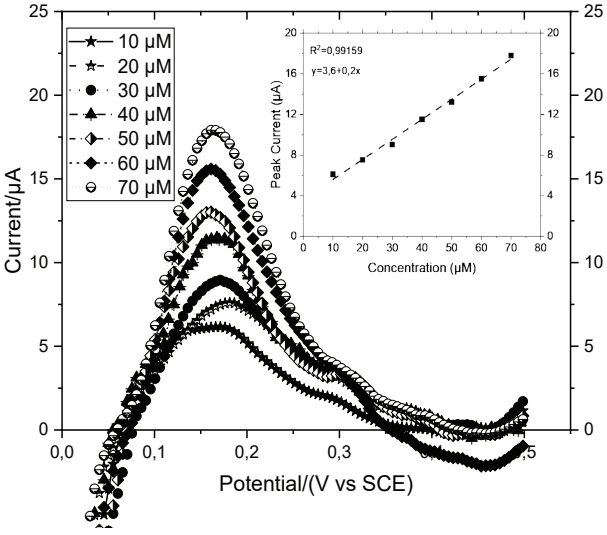

Figure: *DPV measurements of dopamine in neutral environment (PBS) at 36,6°C. Inset: Calibration curve according to the DPV measurements.*

Biography

Brouzgou is Asst. Prof. in the Department of Energy Systems in University of Thessaly, in Greece. Her research interests include the design and development of electrochemical systems for energy conversion and storage, emphasizing on electrochemical (bio)sensors as well as on the preparation of innovative nanomaterials. She has authored and co-authored more than 25 articles in peer reviewed International Journals and has co-authored four Chapters in Books of International publishing houses (received for her work more than 1500 citations)). Among her research activities, from 2013 to 2020, are included postdoctoral stages in the School of Physics and Engineering, Sun Yat-sen University, Guangzhou, in the École Nationale supérieure de chimie de Paris, Université de Paris and in the Institute CNR-ITAE, Messina, Italy.

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Numerical analysis of topological metamaterials as one dimensional photonic crystals

Akhilesh Tiwari, Ankit Singh and **Pramod Kumar**

Indian Institute of Information Technology, Allahabad, India

The concept of topology is well known in mathematical sciences. Recently, the material scientists have used it to fabricate topological metamaterials, such as topological photonic crystals. In this study one dimensional topological photonic crystal heterostructure have been designed numerically. It shows the topological protected multiple resonant modes. At the interface of two photonic crystals, the topological edge states occur, and with the addition of third photonic crystal it induces the effect of rainbow trapping. The effect of temperature tuning may also be introduced with a modification in its design, which can be used to fabricate a sensor.

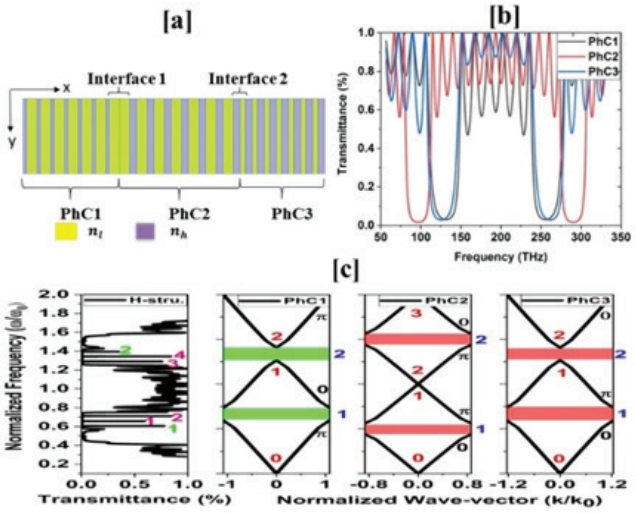

Figure: *(a) Schematic diagram of 1D Photonic Crystal (PhC). It shows the double interfaced hetero-structure of PhC1, PhC2, and PhC3. The hetero-structure consists of periodically arranged high refractive index (n_h=2.14) and low refractive index (n_l=1.45) materials. The unit cell of PhC1 is composed of two layers of thickness t_h=181.07 nm & t_l=534.48 nm, PhC2, these are t_h=362.14 nm & t_l=534.48 nm, and for PhC3 t_h=362.14 nm & t_l=367.24 nm, respectively. The proposed hetero-structure is designed in such a way that may control the surface impedance of each PhC. (b) transmittance profile of PhC1, PhC2, and PhC3, (c) Transmittance profile of hetero-structure and dispersion graphs of PhC1, PhC2, and PhC3.*

Biography

Akhilesh Tiwari is working as Associate Professor of Physics at Department of Applied Sciences, IIIT Allahabad, Prayagraj. He achieved two Ph D degrees, one in Physics from India and another one is in Process Engineering from University of Clermont-Ferrand, France. He has experience in the field of research and teaching for more than 21 years. He has published and presented more than 100 scientific papers in his credit at different National and International platforms. In his research studies, he worked on modeling and simulation of photonic crystals, quantum optics and informatics, space studies for life support system. Also, he has a broad experience in working with the French Space Agency and European space agency for data analytics and experimental modeling and simulation. He is a very active member of several International and national scientific bodies such as IEEE, IAPT, BRSI, PSI, and AIAAA etc.

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An IoT based intelligent driver assistance system *(i-DAS)*

Ashok G. Verghese and **SudalaiMuthu T**
Hindustan Institute of Technology and Science, India

The road accidents happen due to various reasons but most prominent of all are blind spot accidents which occur when the driver loses sight when their line of sight is blocked by one of the components of the vehicle. The blind spots are sometimes 'internal' wherein some specific positions such as over the right or left shoulder of the driver turns blind or sometimes 'external' due to the design and construction of roads such as hairpin bends and roundabouts. There are solutions for detecting the approaching vehicle in the deadly curve such as by implementing mirrors in the curve area to see the approaching vehicle; computer vision or automotive imaging, sensor detecting the blind spot and the use of radar sensor installed in the vehicle. The presented system is driver assisting system that is powered by Internet-of-things and is installable in the vehicle as well as at the blind-spot on the road and the fusion of both proceeds to provide enough information for the driver as he approaches the blind spot and passes it with caution. It provides an advanced overtaking assistance system comprising of short range and long range Radar Sensors that is part of the Electronic Control System that senses incoming traffic from the blind spot. The advanced overtaking assistance system is enabled with the cameras mounted on both the side mirrors in forward direction and a display device on the front console to have a clear vision of the right and left side while travelling on road with the option of switching. The assisting system can also fixed on both the sides of the road and equipped with a solar powered IOT based camera and radar sensors to sense the traffic density in the field of interest area at the risky corners or hairpin bends. The invention is designed to work both as a standalone system that even in cases of poor network cased due to extreme weather conditions as the radars continue to detect, locate and track objects and continue to feed the information to the base station which transmits the information to the vehicles.

Biography

Ashok G. Verghese is the Pro-Chancellor of Hindustan University and Executive Director of Hindustan Group of Institutions, (HGI) Chennai. He has completed his graduation in Mechanical Engineering & MBA from Madras University. To further hone his managerial skills, he pursued an Executive Management Program at Michigan University, USA. He is inducted as the Fellow of the Institution of Engineers (India). He was awarded Educational Entrepreneur of the Year by Shri Pranab Mukherjee, Hon'bl Former President of India during the ASSOCHAM National Education Summit 2019. He is having many patents and has numerous publications to his credit. He is one of the pioneers in accomplishing Work Place Management System in Higher Educational Institution. He has many international records includes Lightest Micro Satellite - Jaihind (India Book of Records); India's First Flying Bike - Project (Asia Book of Records), Institution Completed Highest no. of Online lessons completed (International Book of Records).

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Geostatistics for mineral deposit grade assessment

Bhabesh C Sarkar

IIT(ISM) Dhanbad, India

Geostatistics aims at providing quantitative descriptions of regionalized variables distributed in space or in time and space. It is one important tool where spatial correlation is the basis for mineral deposit modelling and evaluation. It quantifies geological interpretation and reinforces it when used in estimation. Over the years, the subject of geostatistics has progressed from linear, nonlinear, non-parametric, conditional simulation, multi-point to machine learning. Parallel to these advancements, a need has been felt for an appropriate link between geology and geostatistics in geostatistical modelling study. Mode of incorporating geology into geostatistics is to perform geostatistical modelling with respect to deposit geology, controls of mineralisation, and geological domains. It must be emphasized that it is geology that governs the distribution of geologically complex grades and thus should guide the estimation modelling and not the reverse. Despite wide dissemination of geostatistics and its growing acceptance in exploration and mining, there are certain issues that need careful attention, namely, (i) considerable increase in the assumptions of underlying theories; (ii) growing complexity in the mathematical treatment of these theories; and (iii) less geological considerations in the estimation procedure. From 1960 to the present, two key issues that influenced the progress of geostatistics in mineral grade assessment include (i) clarification and dissemination of geostatistical concepts and theories to the practitioners; and (ii) identification and definition of unsolved problems in evolving geo-mathematical modelling techniques. Five live Iron ore deposits located in the western limb of the Singhbhum-Keonjhar-Bonai iron ore belt, India have been studied. Spatially distributed estimation maps generated retain nonlinearity and spatial heterogeneity of the original Fe data values. Geostatistics, thus, provide an improved dimension in mineral grade assessment and should be used invariably by all exploration agencies, mining and mineral industries.

Biography

Bhabesh C. Sarkar of Department of Applied Geology at IIT(ISM) Dhanbad is recipient of a large number of awards in recognition of his outstanding contributions in the fields of Mineral Exploration and Geostatistics. He obtained his five-year Integrated M.Sc. degree in Applied Geology from IIT Kharagpur in 1980 and PhD in Mining Geostatistics and DIC in Mineral Resources Engineering from Imperial College of Science and Technology, University of London in 1988. He has conducted several industry based training programmes for capacity building on Geostatistics in Exploration and Mining. He has to his credit over 120 research publications and a book *'Essentials of Mineral Exploration and Evaluation',* published by *Elsevier USA* in 2016. He has played a momentous role in developing intimate academia-mineral and mineral industry liaison. He is Vice-President of the Indian Geological Congress and Chairman, Mining Engineers' Association of India, Dhanbad Chapter.

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Tungsten oxide–reduced graphene oxide composites for photoelectrochemical water splitting

Shahzad Munir Ansari and **M. Zubair Khan**

Federal Urdu University of Arts, Science and Technology, Pakistan

Photo Electro Chemical (PEC) water splitting is the latest technology to produce safe hydrogen and electricity by using sun light. This technology permits to split water in to its basic constituents i.e. hydrogen and oxygen. Hydrogen being highly flammable gas can be used as fuel in different sectors of life to overcome the energy needs. Oxygen gas can be utilized by the human beings for respiration. The process resembles with photosynthesis of plants to prepare food in the presence of sun light. Tungsten Oxide (WO_3) and reduced Graphene Oxide (rGO) were the materials used under different compositions to fabricate PEC cells for production of safe electricity. The low band gap of tungsten oxide (WO_3) enables it as a suitable candidate for PEC water splitting. Graphene Oxide (GO) is a material having extra thin sheets and a very large surface area with extreme electrical conductivity. GO has been synthesized by using modified Hummer's method. Later on hydrothermal reduction of GO gives rGO. WO_3–rGO composites of different ratios have been prepared hydrothermally and then coated on indium tin oxide coated glass to make electrodes for water splitting. Renewable energy technologies have their immense scope after the scarcity of fossil fuels. Various characterization techniques such as UV–visible, Diffusion Reflectance Spectroscopy, X-ray Diffraction, Scanning Electron Microscopy and Linear Sweep Voltammetry were used to study the absorbance/reflectance, structure, morphology, and optical/electrical properties

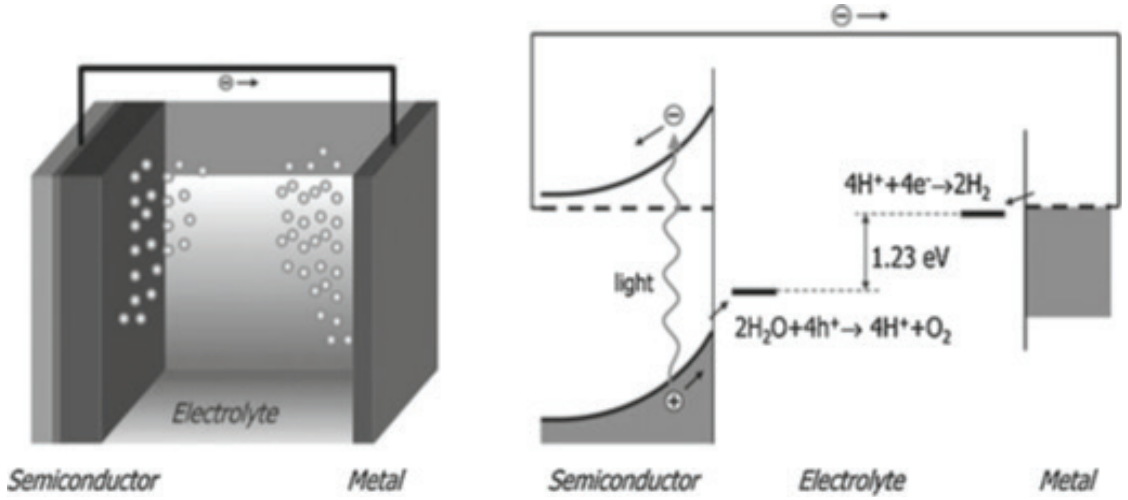
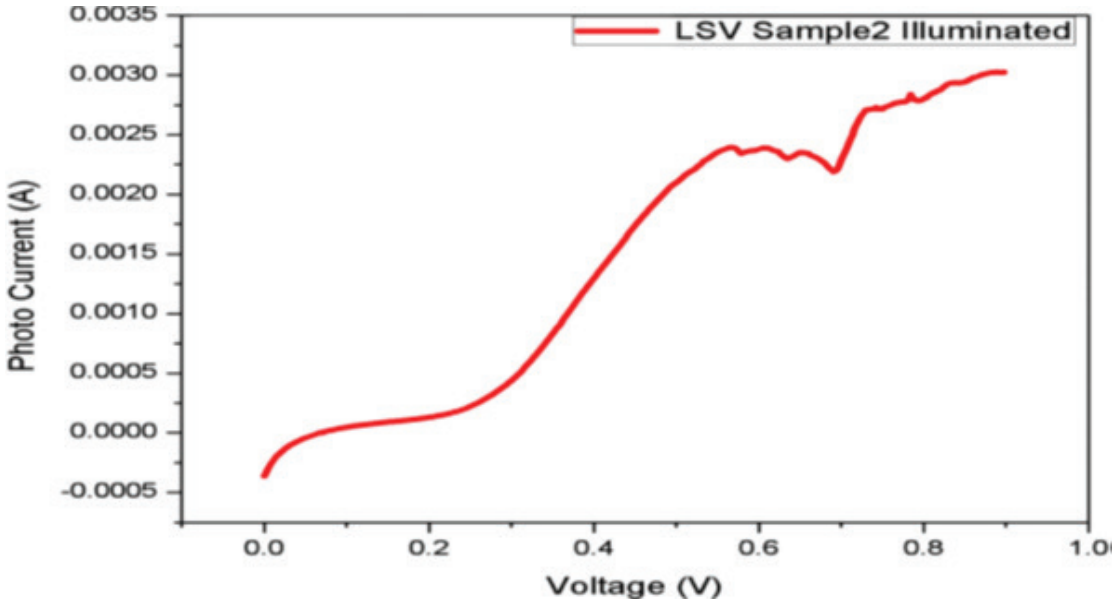


Photo Electro Chemical Water Splitting and Photo Current of 3.2 mA

of prepared nanostructures. In addition, WO3 particles were distributed on the strong sheets of rGO randomly. The IV-measurements were taken of WO_3 / rGO electrodes under dark environment (very minor current~250 nA) by using LSV. The electrodes exhibit maximum of ~ 450 µA under dark environment, while photocurrent initiates from 1.0 mA to 3.2 mA under artificial sunlight. That is convincingly an exceptional result in the field of PEC cells.



Sr. No	Sample Name	Quantity (rGO:WO3)	Ratio	Temperature
1	rGO	Starting Material	N.A	N.A
2	Sample 1	300mg:200mg	3:2	180°C
3	Sample 2	350mg:250mg	3.5:2.5	195°C
4	Sample 3	200mg:100mg	2:1	200°C
5	Sample 4	500mg:250mg	2:1	210°C

Biography

Shahzad Munir Ansari is a PhD fellow of Federal Urdu University of Arts Science and Technology, Islamabad, Pakistan in Applied Physics Department. He earned Degree of Masters of Philosophy in Applied Physics with specialization in the field of renewable energy technology mainly focused on "Novel Materials for Energy Applications" from the same university. Because of the remarkable properties of Graphene, his research is focused on it with its different compositions. He served as Researcher at National Centre for Physics Islamabad Pakistan for two years. He has hands on experience of Synthesis of Graphene / Graphene Oxide / reduced Graphene Oxide and their different compositions with metal oxides and other semiconductor materials for various energy applications. He has published two research articles in the well-known international scientific journals. Recently prepared Copper Plated-Graphene Based Ultra Capacitors and their testing is in progress. In the meanwhile research and development is going on Graphene Batteries.

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On log dagum weibull distribution: Applications on lifetime data

Aneeqa Khadim[1], Aamir Saghir[2], Tassadaq Hussain[1] and **M.Shakil[2]**

[1]Mirpur University of Science and Technology, Pakistan
[2]Miami Dade College, USA

This article proposes a new family of continuous distributions generated from a log dagum random variable (named Log-Dagum Weibull Distribution) on the basis of T-X family technique. We have explored the statistical properties such as density function, Hazard function, survival function, quantile points and order statistics of the proposed family of distribution. The Log-Dagum Weibull family has been characterized via different techniques such as characterization by order statistics characterization by truncated moments and characterization by upper record values. Parameters of the proposed model are estimated by maximum likelihood method and check their performance by using four real data sets. In comparison study by using data sets shows that the new family is better to the others named as weibull distribution (WD), Lomax distribution (LD), Gamma distribution (GD), Nadarajah exponentiated exponential distribution (NEED).

For the measures of goodness of these models, different criterions are analyzed for the comparison of these fitted models.

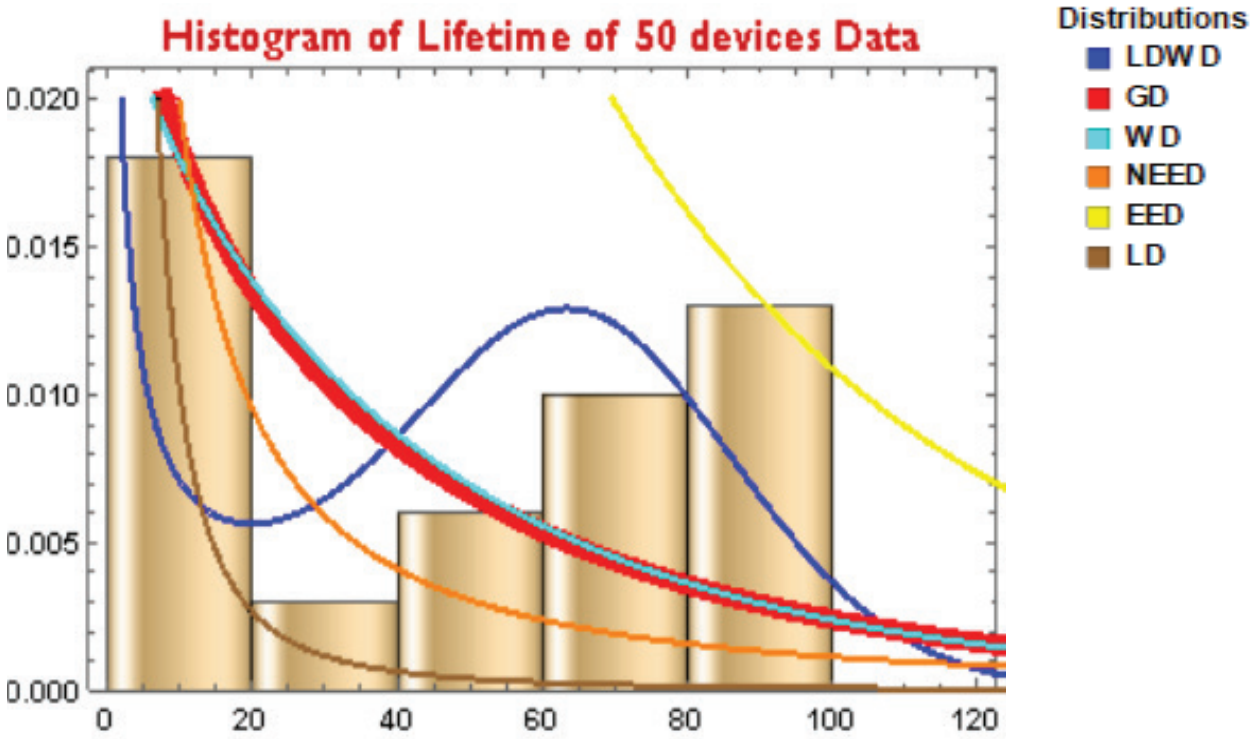
Additionally, also check the excellence of these competing models is via the Anderson Darling (A^*), Kolmogrov-Simnorov (K-S) and the Cramer-von Misses (W^*). The significance of the new model is verified empirically in modeling real data.

We demonstrate the results and graphical behavior by means of one data set are given below. Computational software MATHEMATICA is used for all calculations.

Data1. *This data set consists of 50 patient's leukemia-free survival time with autologous transplant presented.*

Table: *AD, CVM, The K-S statistics and p-values for the data set 1*

Distributions	A*	W*	K-S	p-value
LDWD	0.403996	0.0651719	0.076948	0.943568
EED	0.362828	0.0483839	0.084435	0.868171
WD	0.411538	0.0562415	0.0868536	0.845013
GD	0.369975	0.0496265	0.0847622	0.86513
LD	2.504843	0.3799524	0.19666206	0.04182
NEED	0.666096	0.0962511	0.0906376	0.805953



Biography

Aneeqa Khadim is PhD Research Scholar in the department of mathematics, Mirpur University of science and technology (MUST), Mirpur-10250 (AJK), Pakistan, under the supervision of Dr. Amir Saghir in the field of probability distribution. She has four research articles in her PHD thesis. She finalized the thesis entitled "T-X family of distributions" for examination. She has published a dozen papers in international highly reputed impact factor journals, as an author or coauthor in the field of statistics and its applications. Her research specialization is in Mathematica Statistics, Distribution Theory, Inferences, Estimation, among others. She also has 9 year experience of teaching at different levels in education department. She is also associated with the Royal Statistical Society (RSS), "U.K".

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Experimental observation of temperature variations in the bone due to certain physical parameters during bone drilling process

J.G. Tsiagadigui[1,2], M.A.N. Yamben[1], P.W.M. Huisken[2], F. Nzoning[1], F.E. Belinga[2], H. Eone[1], J. Bahebeck[1], M. Guifo[2], A. Essomba[1] and **M. Sosso[1]**

[1]University of Yaoundé 1, Cameroon
[2]University of Douala, Cameroon

During bone drilling, the cyclic use of the same drill bit causes progressive wear of the cutting edges. The resulting high frictional forces can lead to a significant temperature variation around the drilling site. Above 55°C, irreversible damage to the bone tissue occurs. An experimental study was conducted on a test rig, measuring the temperatures during bone drilling as a function of rotational speed, feed rate and cycle of use of drill bit. Bovine tibia cortices were used because of their mechanical properties similar to those of human bone. Six thermocouples were placed around the drill focus in 0.5mm increments, in order to determine the heat flow during drilling (Fig. 1). The same drill bit of 3.2mm diameter was used 3 times and temperatures were measured on each trial without any irrigation. The risk of having temperatures above the critical threshold of 55°C was greater at the 30mm/min feed rate than at the 60mm/min feed rate. The temperature increased with both the speed of rotation and the number of drillings regardless of the other cutting conditions. The best cutting conditions were found at a rotational speed of 200 rpm and a feed rate of 60 mm/min and at a rotational speed of 100 rpm and a feed rate of 30 mm/min. When the rotation speed exceeded 200 rpm, the temperature appeared to be very high. The temperature gradients were calculated for the drilling conditions where the maximum temperatures measured at the closest point to the drilling focus were less than 55°C (Fig. 2).

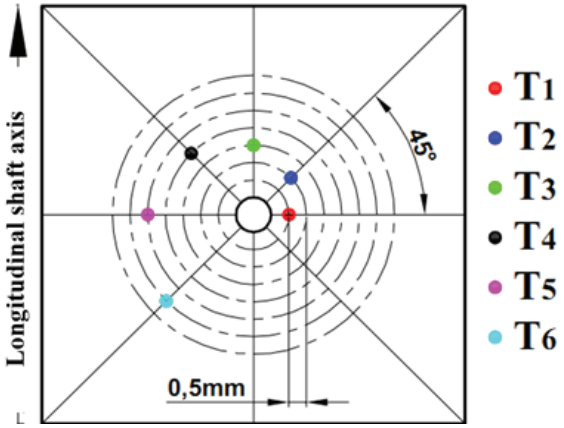

Figure: *Drilling Jig*

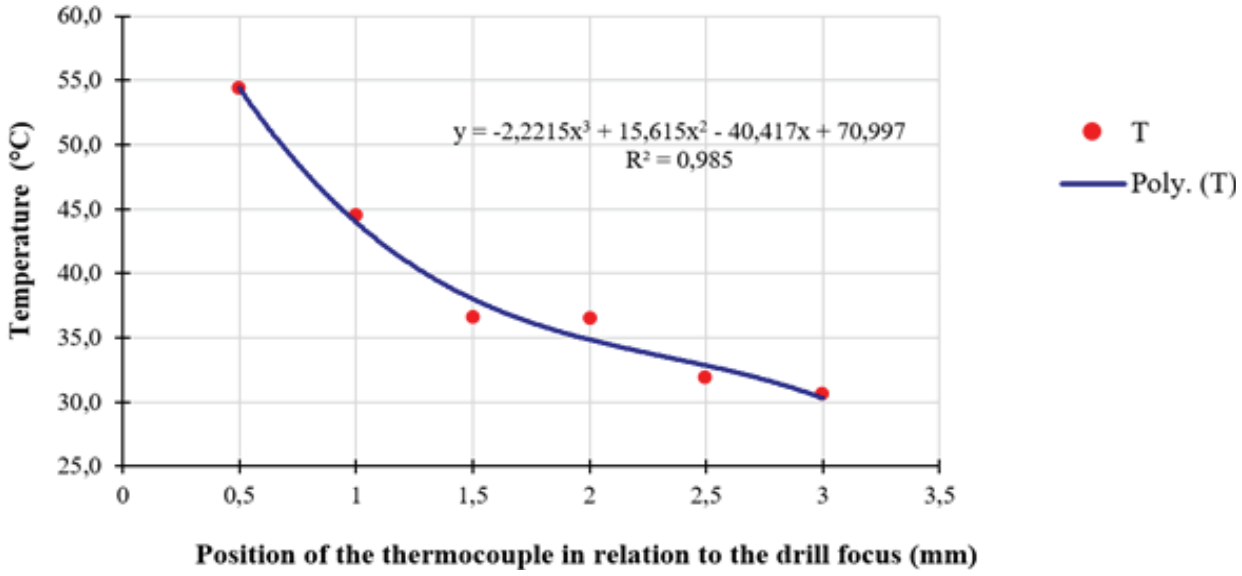

Figure 2: Temperature Gradient

The equations were used to calculate the projected temperatures at the bone-drill bit interface. It was observed that in the majority of cases the temperatures are above 55°C. It became clear that the thermal conductivity of the bone is low. The heat remains concentrated around the drilling point.

Biography

Jean Gustave Tsiagadigui trained at the Université Libre de Bruxelles with Pr BURNY Frantz, he is exposed to the teachings of Biomechanics of the Locomotor System in Brussels, Strasbourg and Davos. Fracture consolidation measurements are performed on plates and external fixators. The first mechanical tests and clinical trials of the Hofmann 2 external fixator were carried out in the orthopaedic department in Brussels. His final thesis was on the study of "Humerus fractures treated by external fixation". Back in Cameroon, he joined the mechanics laboratory of the Ecole Normale Supérieure de l'Enseignement Technique of Douala. He holds a Ph.D. in Biomechanics on the measurement of temperatures and forces during bone drilling, and the influence of the use of the same drill bit on drill bit wear. Currently, the research focuses on the study of skeletons in pygmies and the measurement of fracture consolidation by strain gauges.

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An improved multigrid solver and a novel visualization strategy for the p-version finite element method

J. Gunatilake

University of Peradeniya, Sri Lanka

Finite element methods play a vital role in computational materials science. Moreover, developing efficient high order finite element solvers, and visualizing the finite element solution effectively are crucial in modern scientific applications. In this talk, we discuss recent developments in p-hierarchical basis finite element methods.

We first present a newly developed multigrid solver that uses space decomposition as a smoother. The proposed solver combines the features of p-hierarchical bases, multigrid and space decomposition effectively. Unlike the existing p-version multigrid solvers that perform smoothing only on a subspace of the multigrid space, we adopt a global smoothing strategy at each multigrid level via space decomposition, in a multiplicative Schwarz manner. As the function spaces, space decomposition and the multigrid levels are p-hierarchical, this solver is particularly advantageous on p-nonconforming meshes. We will analyse the error operator and will establish the p-version strengthened Cauchy Buniakowskii Schwarz inequality constants yielding the first convergence estimates. Furthermore, we present numerical results to demonstrate the effectiveness of this solver. The numerical experiments show that the proposed solver outperforms the benchmark p-version space decomposition solver in terms of the convergence rates as well as the computational complexity.

We finally discuss the visualization of the p-hierarchical basis finite element solution, which is challenging with the existing software such as Paraview. Visualization on ParaView with a VTK file format is done by a linear or quadratic interpolation of the solution values at specific nodal locations. However, the p-hierarchical basis finite element solution does not support it directly. In this talk, we present a novel strategy to overcome this barrier. This new strategy comprises of two key steps: "p-hierarchical to nodal projection" and "higher order to lower order projection. We will discuss the method and will present results obtained solving Poisson problems in two and three dimensions.

Biography

Janitha Gunatilake received her BSc degree in electronic and telecommunication engineering from the University of Moratuwa, Sri Lanka in 2006, and her Ph.D. degree in mathematics from Texas Tech University, USA in 2014. Currently, she is a Senior Lecturer at the Department of Engineering Mathematics, University of Peradeniya, Sri Lanka. She has also been a Senior Lecturer at the Department of Mathematics, University of Moratuwa, Sri Lanka, before she came to the University of Peradeniya in 2016. Moreover, she is a Visiting Lecturer at the Faculty of Engineering, University of Moratuwa, Sri Lanka. Her main research interests are in p-hierarchical basis finite element methods, scientific computing, mathematical modeling, and sustainable development.

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Development of B-cell reference materials for comparable and quantitative cytometric expression analysis

Lili Wang[1], Heba Degheidy[2], Jerilyn Izac[1], Linhua Tian[1], Paul Patrone[1], Anthony Kearsley[1], Daniel Majonis[3] and **Steven Bauer[2]**

[1]National Institute of Standards and Technology (NIST), USA
[2]Food and Drug Administration (FDA), USA
[3]Fluidigm Canada

Objectives: Cell-based therapies have emerged as a novel approach to treat cancer and other conditions. Several studies highlighted the crucial role of quantifying surface CD19 using flow cytometry in providing guidance for proper selection of targeted Immunotherapy in B- cell malignancies. However, the lack of adequate reference materials and the complexity of the cytometer instrumentation have resulted in few reference standards to ensure comparable and quantitative CD19 expression analysis. This study was designed to evaluate CD19 expression in potential biological cell reference materials and provide an assessment of their suitability to support the development of CD19 reference standards.

Methods: CD19 expression measurements were made using QuantiBrite PE and CD4 based quantification schemes. Additionally, CD19 expression on a selected human peripheral blood mononuclear cells (PBMC) was evaluated using mass cytometry to verify result comparability between two orthogonal measurement techniques. Three commercial PBMC-A, PBMC-B, and PBMC-C made by three different manufacturers and one synthetic CD19 B cell material were tested. Variables potentially contributing to the differences in CD19 expression, PBMC manufacturing process, number of healthy donors used for each PBMC lot, antibody reagent, operators, and experimental days were considered in the evaluation.

Results & Conclusions: Mean of CD19 ABC (antibodies bound per cell) is 7700 with a range from 4700 to 11300 at a 95% confidence level was obtained for PBMC-A, 10900 with a range from 7400 to 14900 for PBMC-B, and 14000 with a range from 7200 to 22000 for PBMC-C.

Full understanding of the sources of uncertainty, their relative contributions and areas of improvement will lead to production of high-quality and robust reference material for quantitative expression measurement for many application fields not limited to flow cytometry.

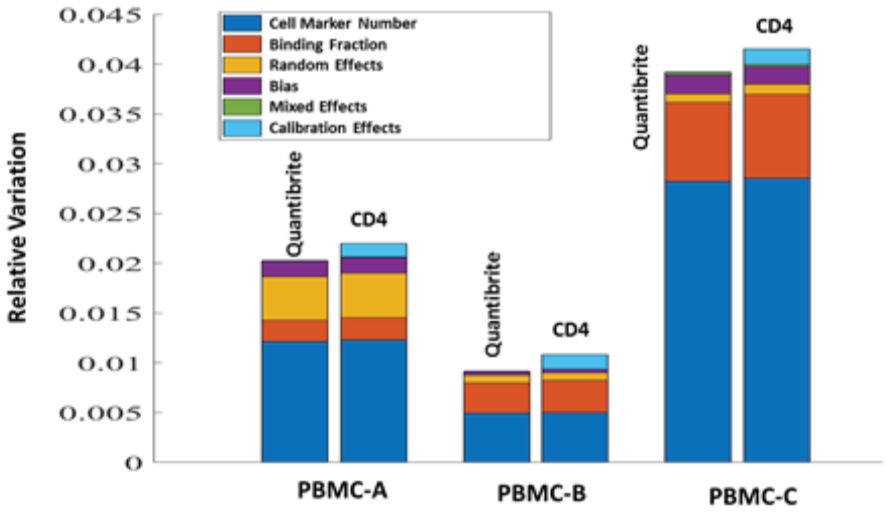

Figure: Relative variation contribution from each colored source of uncertainty for each PBMC preparation.

Biography

Lili Wang is Senior Research Scientist and Manager at the Biosystems and Biomaterials Division of NIST. She is a leading expert in quantitative flow cytometry critical for diagnostics and advanced therapeutic development. She serves as the Lead Manager for the NIST Flow Cytometry Standards Consortium, a major Public-Private Partnership with key stakeholders from other agencies, industry, and academia, where she and her team works with consortium members to address pressing measurement and standards needed for bioassays, including SARS-CoV-2 antibody testing for diagnostics, vaccine testing, surveillance. In collaboration with WHO, her team has established multiple standards and reference materials, including critical reference materials for HIV/AIDS monitoring, stem cell counting for blood transplantation, and most recently, the first international serology/antibody standard. She serves on multiple professional committees and published over 120 peer-reviewed articles. She is a recipient of the 2020 and 2021 US Department of Commerce Gold Medal.

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Analysis of the solidus temperature of multicomponent steel

Toshio Fujimura, Kunimasa Takeshita and **Ryosuke O. Suzuki**

JFE Techno Research Corp, Japan

Is the assumption of a constant solidus temperature—which has been empirically adopted in general steel solidification analysis without firm validation—valid in all solidification stages? This query has still remained owing to the difficulties in achieving the reliable measurements of the solidus temperature in real processes, while those of the liquidus temperature reasonably agree with phase diagrams.

To examine this assumption of a constant solidus temperature in all solidification stages for multicomponent steels, heat- and solute-transfer equations were simultaneously solved using the finite thickness model1), which focuses on early-to-late stage solidification except final stage solidification. In early-to-middle stage solidification, the model provides a constant solidus temperature, as predicted by the previously reported semi-infinite thickness model2),3) by the present authors wherein the solidification front was far from the strand center. In late stage solidification, however, the present model exhibited a slightly decreased solidus temperature—almost within the temperature measurement accuracy range. This suggests that the assumption of a constant solidus temperature does not exactly hold in late stage solidification, but is not unreasonable from a practical viewpoint. The obtained solutions agree well with numerical analyses and are in reasonable agreement with thermo-analytical measurements and industrial findings. Thus, the present model supports the assumption of a constant solidus temperature and estimates the solidus temperature in early-to-late stage solidification, which can play a role in search of an adequate solidus temperature as an approximate analytical solution for multicomponent steels.

Biography

Toshio Fujimura is now a technical adviser, JFE Techno Research Corp.. He got B.E. and M.E., Kyoto University and Ph.D., Hokkaido University, Japan. He got the Natl. Invention Award of Japan, for "Continuous Forging Process for Continuous Casing", 1997. He worked as the manager of Steelmaking works, Mizushima works. JFE steel, the technical manager, Middletown works, AK Steel, USA, worked as Director, JFE bars &Shapes, Board member of JFE Civil Eng. & Construction and Rinko Corp. and the chairman for the steelmaking subcommittee, Iron and Steel Inst. of Japan.

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Diagnostic performance of acoustic radiation force impulse imaging in evaluating liver fibrosis in patients withchronic hepatitis B infection: A cross-sectional study

Chuong Dinh Nguyen[1], Hoang Huu Bui[1,2], Van Huy Vo[1], Sang The Phan[1], Phong Tien Quach[1] and Dung Bich Nguyen[1]

[1]University Medical Center of HCMC, Vietnam
[2]University of Medicine and Pharmacy, Vietnam

Background: Acoustic radiation force impulse point shear wave elastography (ARFI-pSWE), measuring shear-wave velocity (SWV), has been utilized to examine the liver stiffness caused by different etiologies. However, information on its reliability in staging liver fibrosis in chronic hepatitis B (CHB) patients is scarce.

Purpose: The aim of the study is to examine the diagnostic performance of ARFI-pSWE and determine the optimal SWV cut-off values to predict significant fibrosis (F ≥2) and cirrhosis (F4) in CHB patients.

Material and Methods: All 114 adult CHB patients visiting the University Medical Center, Ho Chi Minh City, Vietnam between February 2019 and March 2021 underwent liver stiffness measurement using ARFI-pSWE and FibroScan. SWV results were tested against FibroScan for sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). The area under the receiver operating characteristic (AUROC) curve was used to identify the optimal SWV cut-off values.

Results: There was a strong agreement between ARFI-pSWE and FibroScan (r = 0.92, p <0.001). The optimal SWV cut-off value for detecting significant fibrosis was 1.37 m/s with an AUROC of 0.975, sensitivity of 83.3%, specificity of 100%, PPV of 100%, and NPV of 81%. The optimal cut-off value for predicting cirrhosis was 1.70 m/s with an AUROC of 0.986, sensitivity of 97%, specificity of 93%, PPV of 95%, and NPV of 96%.

Conclusion: ARFI-pSWE could be an effective technique for evaluating liver fibrosis in CHB patients. SWV cut-off values of 1.37 and 1.70 m/s could be used to diagnose significant fibrosis and cirrhosis, respectively.

Biography

Chuong Dinh Nguyen was born in 1992 in Vietnam. In October of 2016, he received his MD degree from the University of Medicine and Pharmacy at Ho Chi Minh City, and in December of 2019, he received his Internal Medicine resident physician diploma.

He is a young gastrointestinal physician with great passion. He is currently the Chief of the Gastrointestinal Motility Unit at University Medical Center Ho Chi Minh City, Vietnam. In addition to gastrointestinal diseases, his research also focuses on liver fibrosis assessment methods. He was selected for the "Professor Mindie H. Nguyen Award for Outstanding Clinical Research by Early Career Investigators" at the Liver Meeting 2022, organized by American Association for the Study of Liver Diseases..

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Surfaces of carbon nanotubes as revealed by thermogravimetric and solvent extraction techniques

Mark A. Banash

Neotericon LLC, USA

Perhaps the greatest challenge in the real-world application of carbon nanotubes is a lack of practical knowledge about the chemical nature of their surfaces. Compounding the problem is that many commercial nanotube manufacturers produce admixtures of tube types. While it is possible in some cases to separate and isolate the types, such processes are limited in terms of species that can be isolated and often require specialized equipment.

In this study I present demonstrate how deconvolution of thermogravimetric mass loss curves reveals the number of carbon species present, and the validity of the deconvolution is confirmed through both statistical tests and application of accepted combustion kinetic models (e. g. Fraser Suzuki). The resulting distribution functions obtained for the combustion activation energies are discussed, especially with respect to surface chemical homogeneity and carbon nanotube network morphology. Comparisons between raw samples and those that have had surface contaminants removed using a Soxhlet technique are also given. These contaminants are mainly polyaromatic hydrocarbons, identified here using GC/MS and UV-Vis spectrometry and their implications for nanotube synthesis are presented.

Biography

Mark Banash is President and Chief Scientist at Neotericon LLC, a consultancy specializing in nanoscience, nanomaterials, and nanotechnology. He was VP-Chief Scientist at Nanocomp Technologies (now Huntsman Chemicals) where he was responsible for the fundamental science of how Nanocomp made their carbon nanomaterial-based sheet and yarns as well as identifying and proving the links between their unique nanoscale features and the performance of end products. Prior to Nanocomp, he was the Director for Production and Quality for Zyvex Corporation, where he managed manufacturing operations and initiated the industry's first supply chain certification process to qualify carbon nanotubes.

He holds a Ph.D. in Physical Chemistry from Princeton University, an MBA from the University of Maryland University College, and a B.A. with honors in Chemistry from the University of Pennsylvania. He is a member of the International Standards Organization (ISO) U.S. Technical Advisory Group on the measurement of nanomaterials and has worked closely with NIOSH in their efforts to develop and deploy nanomaterial health and safety programs.

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The zygoma anatomy-guided approach (ZAGA) for rehabilitation of the atrophic maxilla

André Sakima Serrano[1], Jan Peter Ilg[1] and **Carlos Aparicio[2]**
[1]Private Practice at ZAGA Center São Paulo, Brazil
[2]ZAGA Centers S.L., Spain

A protocol to perform a prosthetically driven minimally invasive zygomatic osteotomy, named zygoma anatomyguided approach (ZAGA) is introduced. The ZAGA method aims at promoting a patientspecific therapy by adapting the osteotomy type to the patient's anatomy. In most cases, this method avoids the opening of a window or slot into the lateral wall of the maxillary sinus before implant placement. Instead, a mucoperiosteal flap, including the posterior maxillary wall and the superior zygomatic rim, is raised to allow visual control of the complete surgical field. The surgical management of the implant site is guided by the anatomy of the patient according to specific prosthetic, biomechanic, and anatomic criteria. The ZAGA Concept represents the logical evolution of the extra-sinus technique and ZAGA classification previously described. The results of using the combination of the ZAGA Concept together with the new ZAGA implant designs consistently show less traumatic osteotomy; better implant stability; improved bone to implant contact, and bone sealing around the implant neck. Additionally, the rate of late complications such as oral–sinus communication or soft tissue recession dramatically decreases when compared to the original technique.

Biography

André Sakima Serrano is a zygomatic implant expert and oral and maxillofacial surgeon. He is one of the owners and leading surgeons at ZAGA Center São Paulo. Also, he works in the leading hospitals in São Paulo city and has experience in Orthognatic Surgery, TMJ Surgery, Implantology (All-on-4 and Zygomatic implants), facial trauma and wisdom teeth. To this day he has 18 years of experience in the rehabilitation of atrophic maxilla.

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A new type of silica-induced "moundless" pitting corrosion in copper observed in Japan

M. Sakai

Muroran Institute of Technology, Japan

A new type of pitting corrosion in copper, namely "moundless" corrosion, has recently been reported in Japan. This type of pitting corrosion has some unique morphological features that differ from ordinary types of pitting corrosion, such as type I or type II. Firstly, this type of pitting corrosion has no mound of corrosion products that cover the mouth of the pit. In addition, a glassy verdigris exists around the pit. Furthermore, the pit measures <1 mm in diameter, but is extremely deep. We herein present and discuss the morphological aspects and water quality features of moundless pitting corrosion after field surveys and field tests in Noboribetsu City, Hokkaido Prefecture. In addition, a laboratory experiment is conducted using synthetic freshwater to reproduce the moundless pitting corrosion. The various corroded copper tube specimens are then examined by a range of analytical techniques, including X-ray diffraction (XRD), energy dispersive spectroscory (EDS), Fourier transform infrated (FT-IR) spectroscopy, optical microscopy. XRD and FT-IR analyses revealed that the verdigris around the pit was amorphous and a copper-containing silicate mineral chrysocolla. Upon examination of the water quality of various regions of the Noboribetsu City to determine the prerequisites for pit formation, it was found that the silica level was higher than the average Japanese level. In addition, the levels of sulfate ions in pitting detected area were also higher than the Japanese average, while those of bicarbonate ions were lower than the Japanese average. Furthermore, we succeeded in reproducing moundless pits in Noboribetsu City using a 4-year field test. Following this simulation, we found that the mouths of some pits were closed in the early stages, and that these pits were covered with thin films that contained mainly silica. It was therefore concluded that the formation of moundless pits is largely dependent on the water quality, and silica is considered indispensable for their generation.

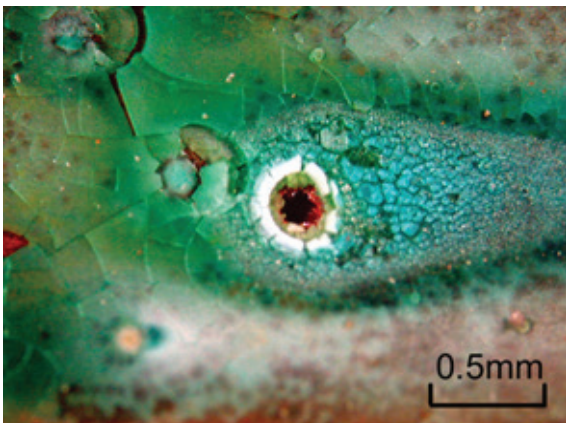

Figure: *Moundless pitting corrosion in copper*

Biography

Masahiro Sakai is an associate professor of College of Design and Manufacturing Technology at Muroran Institute of Technology. His work focuses specifically on the corrosion of non-ferrous metals, especially a copper and an aluminum.

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The advanced use of Calphad databases and methods in computational thermodynamics

Bo Sundman
OpenCalphad

Development of new materials is a challenging task which involves not only selecting the final properties but also the whole processing route. Experimental verification is very important but very expensive and to limit the cost and time for the development one regularly uses computer simulations for many steps. For equilibrium calculations the Calphad method provides facilities to calculate phase diagrams but also many other kinds of diagrams providing phase amounts, chemical potentials and heat capacities at varying temperature and compositions. But a very important feature of the assessed Calphad thermodynamic databases is that they provide information about phase amounts, chemical potentials etc also for the metastable states during phase transformations. Combined with Phase Field Methods or other kinetic models the use of validated and assessed thermodynamic databases is essential.

Biography

Bo Sundman is professor emeritus at the Computational Thermodynamics (CT) division in the Materials Science and Engineering (MSE) department of KTH, Royal Institute of Technology in Stockholm, Sweden. He graduated as a master in physics engineering at KTH in 1974, got a PhD in physical metallurgy in 1981, become lecturer at KTH in 1986, assistant professor in 1994 and professor in 2000. After 2006 he has been fully or partially on leave to work in France and other countries. From 2006 to 2009 he was at CIRIMAT at Paul Sabatier University in Toulouse and from 2009 at INSTN, CEA Saclay and together with Dr Constantin Meis arranged a annual summer school on the use of thermodynamic calculations. He retired in 2012 but continued to work part time at INSTN and at the Central South University in Changsha, China.

He published more than 180 papers and have more than 13000 citations (in 2020). He received the Calphad ”Triangle” Award 2002, the Hume-Rothery Award 2005 from IOM3 in UK, a Humboldt senior researcher award from Germany in 2012 and the NIMS Award in Japan 2017. Together with Dr Leo Lukas and Dr Suzana G Fries He written a book ”Computational Thermodynamics, the Calphad Method” published by Cambridge University press in 2007.

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Investigation on fracture behavior of cementitious composites reinforced with aligned hooked-end steel fibers

Sujjaid Khan, Longbang Qing, Iftikhar Ahmad, Ru Mu and **Mengdi Bi**

Hebei University of Technology, China

Aligning steel fibers is an effective way to improve the mechanical properties of steel fiber cementitious composites (SFRC). In this study, the magnetic field method was used to prepare the aligned hooked-end steel fiber cementitious composites (ASFRC) and the fracture behavior was investigated. In order to achieve the alignment of steel fibers, the key parameters including the rheology of the mixture and magnetic induction of electromagnetic field were theoretically analyzed. The orientation efficiency factor of ASFRC and SFRC was 0.8 and 0.58, respectively.

The results showed that, compared with SFRC, the cracking load and the ultimate load of ASFRC were increased about 24–55% and 51–86%, respectively, depending on the fiber addition content. In addition, the flexural tensile strength and residual flexural strength of ASFRC were found to increase up to 105% and 100%, respectively. The orientation of steel fibers also has a significant effect on energy consumption. The fracture energy of ASFRC was 56–70% greater than SFRC and the reinforcement effect of hooked-end steel fiber was higher than straight steel fiber. It was concluded that the fracture properties were enhanced significantly by the orientation of steel fibers. The fractural properties of ASFRC with V_f = 0.8% were found to be superior or equal to those of SFRC with V_f = 1.2%, which confirmed the advantage of ASFRC over SFRC and obtained high fracture properties, at a lesser amount of steel fibers, compared to SFRC. The fibers in the fracture surface showed that not only was the number of fibers of ASFRC higher than that of SFRC, but also the orientation efficiency factor of ASFRC was superior to SFRC, which explains the improvement of fracture behavior of ASFRC.

Biography

Sujjaid khan is a Pakistani civil engineer, did his Bachelor degree from Sarhad university of science and information technology (2013-2017) and for further master degree moved to china, Tianjin on Chinese government scholarship where he graduated from the school of civil and transportation engineering of Hebei university of technology (2018-2022) in good grades, memories and enlighten ambitions. He organized many scientific events throughout his graduate studies. During this time, he published two articles in a renowned journals, working on the alignment technique of hooked ended and straight fibers in aligned and random directions and investigating fractured properties. He is passionate about science, technology and human experiences. He is always looking for initiatives to promote research and make it more accessible.

Chitosan nanoparticles and their application in agriculture

K. Divya[1] and **M. S. Jisha**[2]

[1]*Apple International School, UAE*
[2]*Mahatma Gandhi University, India*

The demand for food is increasing day-by-day in line with the ever-increasing population. This puts extra pressure on the agricultural world to increase production within the limited land available for agriculture. Application of chemical fertilizers seems to be the only solution to double or triple the yield from the same area of land. Similarly, chemical pesticides are also extensively used to eliminate the pest and pathogen problem that can reduce the yield per area of the crop. However, these solutions have proven to have adverse long-term effects on the soil quality and biodiversity of agricultural lands. Chemical fertilizers and pesticides are also the number one agricultural pollutant. The freshwater sources have been contaminated with hazardous agricultural pollutants making it undrinkable. Overall, these chemicals have a very dis-advantageous impact on health and ecosystem. Chitosan obtained from the shell waste of crustaceans are a promising alternative for the chemical fertilizers and pesticides that are one of the main reasons of agricultural pollution. Chitosan nanoparticles (ChNP) have been reported to have very good plant growth promoting capacity in many crop plants. There are many studies demonstrating the positive effect of ChNP on promoting plant growth of various crops such as rice, wheat, tomato etc. Owing to the antimicrobial activity of ChNP, it has shown to elicit plant defence reactions against many plant pathogens in plants. The biological origin of chitosan makes it non-toxic in nature. The soil toxicity, seed toxicity and cytotoxicity studies done on ChNP supports the fact that ChNP is a non-toxic compound. In this review, we will be observing the recent works on the agricultural application of ChNP.

Biography

Divya Koilparambil is a committed research scholar with excellent research potential and an ability to actively contribute to the research projects as well as a proven publication track record. She is currently working as Science Coordinator at British Curriculum School, Apple International School, Dubai She guides and mentors Science teachers of Key stage 2 and Key stage 3 in planning and delivering high quality lessons to students. She is also a Review Editor for Frontiers in Microbe and Virus Interactions with Plants. Her key responsibilities are to ensure that experiments and studies were conducted correctly, considering appropriate ethical considerations, and that the conclusions are based on a valid, logical interpretation of the results. She was the Research Topic Coordinator for Research Topic Collection of Frontiers Journal of Drug Delivery; Section: Oral Drug Delivery "Chitosan Nanoparticles Preparation and Application for Oral Drug Delivery".

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Classification of fungal diseases in plant based on deep learning techniques

Mallikarjun Hangarge[1] and **Sukanya S. Gaikwad**[2]

[1]*Karnatak Arts, Science and Commerce College, India*
[2]*Gulbarga University, India*

India has a wide range of agricultural and ecological varieties. India is the leading producer of milk, pulses, jute, rice, wheat, sugarcane, vegetables, fruits, and cotton. The average yield of many Indian crops is inferior. Plant diseases are one of the significant causes of the low yield of crops. These diseases are caused by micro-organisms such as bacteria, viruses and fungi. This article reveals the research findings of the classification of fungi-affected diseases of popular fruit plants such as Apple, Custard Apple and Guava based on their camera-captured (14,412 images) and microscopic images (602 images). Besides, it calculates the infected area of the leaf for further processing. The experimental results are exciting and highly encouraging to justify as state-of-the-art results, i.e. 97.52%.

Sample Dataset used for experiments.

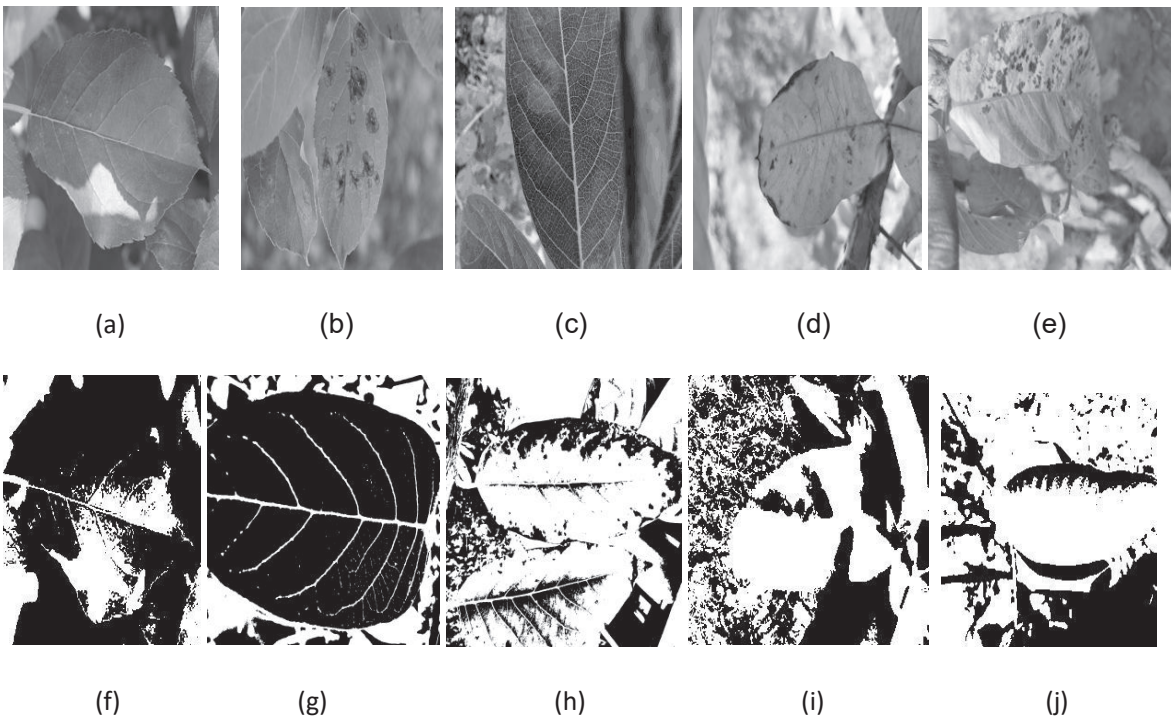

Figure: (a) Apple- healthy (b) Apple- Scab (c) Custard apple- healthy (d) Guava- leaf spot (e) Guava- rust

Deep-learning techniques for fungal diseases classification

Using Transfer Learning				
	Precision	**Recall**	**F1score**	**Accuracy**
AlexNet	0.9366	0.9386	0.9376	95.3%
SqueezeNet	0.8757	0.8905	0.8832	90%
ResNet50	0.9634	0.9278	0.9538	97.52%
Using Feature Extraction				
KNN	0.8329	0.8362	0.8346	82.6%
LDA	0.9198	0.9482	0.9338	93.4%
SVM	0.9091	0.9229	0.9159	91.7%

From the above table, it is evident that ResNet50 model gave good classification accuracy of 97.52% compared to the other models on the Microscopic image dataset.

Biography

Mallikarjun Hangarge, Associate Professor and Head Department of P. G. Studies and Research in Computer Science, Karnatak Arts, Science and Commerce College, Bidar. He received a prestigious IAPR Travel grant to attend ICPR in Hongkong in 2006. UGC Travel grants to present his research at ICDAR, 2013 at Washington DC USA, in 2013. He has received three Best Paper Awards at International conferences. He received Faculty Summer Research Fellowship in 2012 from the Indian Academy of Sciences. He has completed three major research projects of Rs. 30.0 lakhs. He has collaborated with the University of South Dakota, USA, Computer Vision and Pattern Recognition Unit, Indian Statistical Institute Kolkata and Speech Processing Laboratory, IIIT Hyderabad. His research interests are in Image Processing and Pattern Recognition and its applications such as Automatic Handwriting Analysis, Document Image Processing, etc. He is the author of more than 100 research articles and three books published in reputed International and National Journals and conferences. He serves on the Editorial Board of 6 International Journals.

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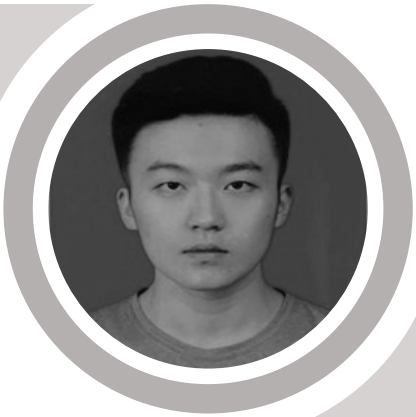

A bio-resourced and superhydrophobic dry water extinguishing agent for pool fire based on phytic acid and silicon

H.R. Jiang, Y. Jiang, R.J. Fan and **X.L. Zhu**

University of Science and Technology of China, China

A new non-toxic, clean, and effective dry water (DW) nanomaterial is synthesized, and its extinguishing performance is characterized for pool fire. The nanomaterial reaches up to 93% water content due to its special core–shell structure. Phytic acid (PA) is used to functionalize DW to obtain DW/PA because of its biocompatibility and phosphorus-rich properties. The results of the Fourier transform infrared, X-ray photoelectron spectroscopy, thermal gravity analyzer, and optical microscope successfully verify the preparation of DW/PA samples. The DW/PA samples are cylindrical particles with a length of 100 μm to 200 μm and have excellent fluidity, with a repose angle of about 29. The centrifugation and water loss rate tests indicate that the samples have appropriate mechanical stability and are suitable for storage in closed spaces. The extinguishing efficiency of DW/PA samples is characterized using a fire-extinguishing experiment designed by international standards. The average extinguishing time and consumption of DW/PA samples are reduced by 77.08% and 77.67%, respectively, comparing with commercial ABC dry powder-extinguishing agents. Moreover, fire-extinguishing efficiency is positively correlated with PA content. According to experimental results and established theories, the extinguishing mechanism of DW/PA samples is discussed and divided into three parts: chemical inhibition, the cooling effect, and the asphyxiation effect.

Biography

Haoran Jiang received the B.S. degree in Safety Engineering from Xi 'an University of Architecture and Technology, Xi 'an, China, in 2019. He is currently working toward the Ph.D. degree in Safety Science and Engineering with the State Key Laboratory of Fire Science, University of Science and Technology of China, Hefei, China. His research interests include bio-based fire extinguishing agent, flame inhibitor containing transition metal and chemical reaction mechanism in flame suppression.

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