magnus Group

5TH EDITION OF INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

25-27
SEPT, 2023

VALENCIA
SPAIN

HYBRID EVENT

PUBLISHING PARTNER:

SPONSOR:

AMERICAN ELEMENTS
THE ADVANCED MATERIALS MANUFACTURER®

Alt text: American Elements, global manufacturer of high purity metal & ceramic nanopowders, semiconductor nanocrystals, & nanotechnology materials

Venue:
Olympia Hotel, Events & Spa, Carrer Mestre Serrano, 5, 46120 Alboraia, Valencia, Spain

BOOK OF ABSTRACTS

magnus Group

25-27 SEPT

BOOK OF
ABSTRACTS

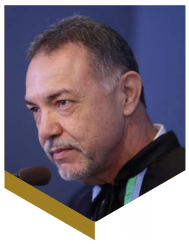
5TH EDITION OF
INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

INDEX

Contents

Keynote Speakers



Paulo Cesar De Morais
Catholic University of Brasilia, Brazil

Sergey Suchkov
Institute for Biotech & Global Health of RosBioTech and A.I. Evdokimov MGMSU, Russia

Zhongwei Guan
Advanced Materials Research Centre of Technology Innovation Institute, United Arab Emirates

Shuji Owada
Waseda University, Japan

Patil Devidas Ramrao
Rani Laxmibai Mahavidyalaya, India

Osman Adiguzel
Firat University, Turkey

Leelakrishna Reddy
University of Johannesburg, South Africa

Zakaria Boumerzoug
University of Biskra, Algeria

Yarub Al Douri
American University of Iraq, Iraq

Thank You All...

Speakers

Adam Juhasz
University of Szeged, Hungary

Aissat Sahraoui
Ibn Khaldoun University, Algeria

Alessandro Sergi
TWI Ltd, United Kingdom

Alina Vladescu (Dragomir)
National Institute of Research and Development for Optoelectronics, Romania

Anasiei Ioana
National R&D Institute for Nonferrous and Rare Metals, Romania

Andreas K Huttel
University of Regensburg, Germany

Andrey Rabin
Ben Gurion University of the Negev, Israel

Anowar Hossain
RMIT University, Australia

Bakari Chaka
Maasai mara university,Kenya

Chung Shin Jonathan Yuan
National Sun Yat-sen University, Taiwan

Delia Teresa Sponza
Dokuz Eylül University, Turkey

Dominika Beata Kwidzinska
Gdansk University of Technology, Poland

Eder Socrates Najar Lopes
University of Campinas, Brazil

Edith Johanna Diaz Canas
Universidad Industrial de Santander, Colombia

Ernst Titovets
Clinical Center of Neurology and Neurosurgery, Belarus

Erol Sancaktar
University of Akron, United States

Speakers

Evgeny Grigoryev
Merzhanov Institute of Structural Macrokinetics and Materials Science, Russia

Graziella Kassick Saft
PIEP-Innovation in Polymer Engineering, Portugal

Igor V Shevchenko
M.P. Semenenko Institute of Geochemistry, Ukraine

Ioana–Cristina Badea
National R&D Institute for Nonferrous and Rare Metals, Romania

Ioannis Dimos
University of Thessaly, Greece

Iuliia Bespalko
Federal Research Center Boreskov Institute of Catalysis, Russian Federation

Izabell Craciunescu
National Institute for Research and Development of Isotopic and Molecular Technologies, Romania

Jaume Camarasa
University of Lleida, Spain

Jyi Tsong Lin
National Sun Yat-Sen University,Taiwan

Keerthiprasad K S
Vidya Vikas Institute of Engineering & Technology, India

Lais Pellizzer Gabriel
State University of Campinas, Brazil

Mei-Yi Liu
National Chin-Yi University of Technology,Taiwan

Melnyk Igor
National Technical University of Ukraine, Ukraine

Michael Tribelsky
Lomonosov Moscow State University, Russia

Mikhail Petrovich Kashchenko
Ural State Forest Engineering University, Russia

Speakers

Milind Bhandare
Mahatma Phule Mahavidyalaya, India

Mircea Teodor Nechita
Gheorghe Asachi Technical University of Iasi, Romania

Mohammed Al Bahri
A'Sharqiyah University, Oman

Mona Mihailescu
Politehnica University Bucharest, Romania

Mothibeli Pita
University of South Africa, South Africa

N O Gopal
Vikrama Simhapuri University College, India

Norbert Varga
University of Szeged, Hungary

Olga Guskova
IPF Dresden, Germany

Petra Lacikova
Brno University of Technology, Czech Republic

Robert Buenker
Princeton University, Germany

Roger Rothon
Rothon Research Limited and the University of Chester, United Kingdom

Saman Momeni
Sharif University of Technology, Iran

Samuel Chisa Dike
Rivers State University, Nigeria

Shaoqing Wang
China university of Mining & Technology, China

Speakers

Sharda Sundaram Sanjay
An Autonomous PG College of University of Allahabad, India

Silvia Stifano
Curapath, Spain

Simona Ravaszova
Brno University of Technology, Czech Republic

Sivasubramanian Palanisamy
P. T. R College of Engineering & Technology, India

Suwen Chen
Tongji University, China

Taila Veloso de Oliveira
Federal University of Vicosa, Brazil

Toshihiko Yoshimura
Sanyo-Onoda City University, Japan

Tsisana Gavasheli
Ivane Javakhishvili Tbilisi state University, Georgia

Uroosa Ejaz
Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Pakistan

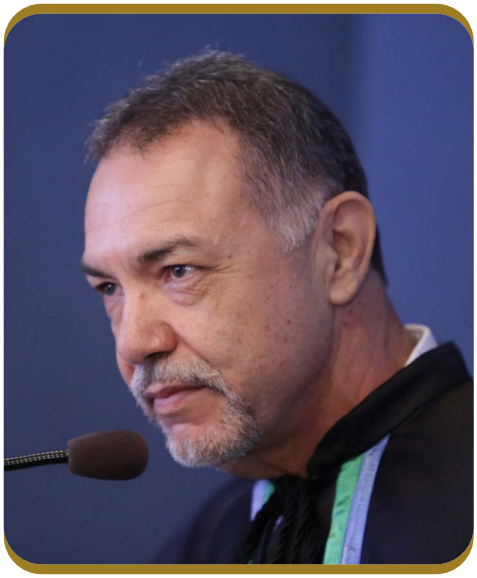
Vladimir Chigrinov
Hong Kong University of Science and Technology, Hong Kong

Wilber Ortiz Lago
University of Puerto Rico Rio Piedras, Puerto Rico

Wojciech J Nowak
Rzeszow University of Technology, Poland

Zakia Hammou
University of Science and Technology of Oran, Algeria

Welcome Message



Dear conference visitors, It is an honor and pleasure to write a few welcome notes regarding a key area included into the program. The rapid growing area of Nanobiotechnology represents the crossing point of nanotechnology and biology, while rooted in nanomaterials in both aspects; fabrication techniques and physical properties. The wide pallet of issues included into nanobiotechnology, as for instance nanotheranostics, nanobioimaging and nanotoxicity (to list a few), reveals the expected and unprecedented impact of this area in the coming decades. Cutting-edge topics of nanobiotechnology are scheduled to be included in the program and the presenters' view shared with the audience during the three-days conference agenda.

PAULO DE MORAIS

Catholic University of Brasilia, Brazil

Welcome Message

Dear Colleagues, Scientists, Drug Designers, Entrepreneurs, Bioengineers and Friends,

It gives us a genuine pleasure to extend greetings to everyone attending 7th Edition of World Nanotechnology Conference planned to be held in September 25-27, 2023, in Valencia, Spain.

Being the historical home to Romans, Visigoths and Muslims, Valencia unveils along with the Academic potential a rich artistic heritage, full of art and masterpieces, rooting from the previous civilizations and would pave a Grand Avenue for this Conference as a Monumental Event featuring lots of opportunities to network with partners from the entire World in an exciting environment.

In this context, we being representative of RosBioTech National University (Russia), A.I. Evdokimov State University of Medicine & Dentistry (Russia), Mayo Clinic (USA), and S-P State Chemical Pharmaceutical University (Russia) look forward to welcoming you to the fantastic event integrating the achievements of nanoscience, nanotechnology and nano-education as the Trinity of the next step generation.

The Conference would secure the attracted participation from many of established leaders as well to open a green light for concentrating focus on generating solutions to the field's challenges. The latter would propose ways to encourage investment in innovation and stimulate the adoption of upgraded engineering to secure the national and international stability and our daily life.

Personally we are proud to be involved into this auspicious event where a large number of world's leading scientists, researchers, biodesigners and bioengineers, clinicians, industrialists, bioentrepreneours and academicians will be exchanging new research and design-driven ideas and sharing their innovative research and experiences in their respective fields. In this context, please look for optimal solutions to promote innovation in life sciences, medicine and healthcare.

In this sense, the theme reflects our willingness and enthusiasm to offer a really innovative and imaginative Program whilst offering attractive lectures and sessions with well-balanced inputs from academia, bioindustry and regulators. The Conference will provide the ideal forum to stimulate ideas and establish collaborations as well as to initiate intense transdisciplinary and targeted international discussions to secure projects of the newest generations and to feature a highly interactive, stimulating and multidisciplinary Program including workshops, plenary sessions and panel discussions.

We do wish you the most fruitful consultations to be performed at the conference in Valencia and trust in great commitments to be achieved by this professional Forum.

We hope that you will be able to get some glimpses of the greatest Spanish Soul and hope also that your interaction with your colleagues will stimulate a creative exchange of ideas and will be personally rewarding!

Sergey Suchkov

Institute for Biotech & Global Health of RosBioTech and A.I. Evdokimov MGMSU, Russia

Welcome Message

Dear congress visitors, it is an honour and pleasure to write a few welcome notes. A common problem faced by conventional sandwich structures is debonding between the skin and the core, which can cause a fatal damage of the structure. The bonding behaviour is controlled by the tensile and shear strengths offered by an adhesive. To tackle such the problem, a 3D stitching technology using thick carbon fibre threads is developed to fully integrate the skins with foam core. After stitching, a resin infusion is applied to harden the carbon fibre struts inside the foam and stitches through the carbon fibre fabric skin. Through this process, the flatwise and edgewise compressive strength as well as flexural strength are enhanced significantly. The technology can be used in composite repair, composite joints, small aircraft wings, robotic arms, etc. Automation is the next step.

DR. ZHONGWEI GUAN

Advanced Materials Research Centre of Technology Innovation Institute, United Arab Emirates

Welcome Message

My dear friends of eminence and devotee of science and technology, it's my great honor and pleasure to welcome you through this special note offered by the organizers of this mega event.

There is a strong interest and need in the engineering of synthesis of hybrid nanomaterials having wide band gaps, for the various applications of Laymen at very low cost. Hybrid nanomaterials can be utilized extensively in the fields of sensors, power sectors, medicine, disease diagnosis, agriculture, etc. With a special reference, sensors are utilized for security, safety, food freshness, light detection and ranging, disease diagnosis, monitoring environmental pollution, detection and control of concentration of sprays in agriculture, crop yield, etc. Nowadays, available traditional type semiconducting gas sensors have some problems, viz. limitations of sensing the gases below Threshold Limit Value, high cost, difficulties in availability, etc. Most of the researchers are taking efforts in developing the sensor models. For large applicability to Laymen, features of the sensors must be improved, viz. high response at trace level of the gas (ppm, ppb or even sub-ppb level), quick response-recovery profile, longer life time, long-term stability, high selectivity to a particular gas among the mixture of gases, low cross sensitivity, very specific sensor location judgment, low cost, low power consumption, portable in size, etc. These features mainly depend on and co-related with crystallite size, thickness of sensor, nature of additives and their concentrations, microstructures and nanostructures, temperature, etc.

Also, nowadays, people have very busy schedule and they prefer the foods and junk foods in readily available packets. The packets are not stored as per the directions of food storage technology. As a result, the foods are degraded in somewhat proportions. On consumption of such degraded foods, people may suffer from diarrhoea, indigestion, stomach disorders, vomiting, acidity, headache, body ache, food poisoning, etc. So, it is today's need to detect the degree of degradation of such readily available foods in the markets.

I am sure that, if the hybrid materials can be tailored in size and shape, it can change all the properties tremendously and may fulfill the needs of society at a very low cost. Wishing you all the best and contribute for the grand success of this mega event. Thanks lot for your precious time.

Prof. Dr. D. R. Patil

Rani Laxmibai Mahavidyalaya, India

Welcome Message

Dear Distinguished Scholars, Engineers, and Colleagues!

It is my great honour and pleasure as a Committee Member to invite you to join with a contribution to the 5th Edition of International Conference on Materials Science and Engineering" (MAT 2023), which is scheduled in Hybrid Format at Valencia, during September 25-27, 2023. Spain.

The Conference will include Plenary and Keynote Speeches and Invited Talks which will be given by Distinguished Scholars and Experts from academic institutions and industry, and oral presentation by delegates and poster presentations by young junior participants.

The conference will focuse on the theme "Inquisition of Material Science for Better Perspective." Devoted to the rapid development of the Materials Science, this conference will provide excellent opportunity to meet distinguished scholars and experts and to exchange new ideas and application experiences, to establish research relations and collaborations for future research and projects. The conference has a wide variety of Materials Science from Polymer Science and Engineering, Emerging Smart Materials to Environmental and Green Materials and Structural Materials and Metallurgy.

International scientific activities are big scientific platforms for the scientists, colleagues, young academicians, and participants from all over the world, to interact and communicate with each other. I believe that 5th Edition of International Conference on Materials Science and Engineering will provide this opportunity for delegates from different cultures and countries.

Also, this conference will be performed successfully, in favour of the qualified scholars, colleagues and experts and with their valuable and informative presentations. The conference will be very beneficial for young delegates by encouraging them and improving their confidence of presenting research in an international platform.

I am pleased to invite prospective scholars, academicians, engineers, and other scientists to submit their original contributions to this important conference, where you are sure to have a meaningful experience with scholars and experts from different cultures and different countries from all around the World.

Dr. Osman Adiguzel

Retired Professor of Physics, Firat University,

Elazig, Turkey

Welcome Message

Dear scholars,

The field of materials science research remains an eternal field of scientific research because human beings need to improve the performance of certain materials and also to develop other new materials. It is in this context that the “5th edition of the International Conference on Materials Science and Engineering” (MAT 2023) will take place. During this event, all research areas related to materials science will be presented, such as the development of materials, their applications or their recycling. This event, is planned in hybrid format in Valencia, from September 25 to 27, 2023. Spain. It will be an opportunity for the different categories of researchers (PhD students, professor, ...etc.) and industrialists (engineers) to present their work and to exchange their ideas for industrial interest and a better life. Therefore, I invite all researchers and engineers to contribute to this large-scale scientific event.

Zakaria Boumerzoug
University of Biskra, Algeria

Welcome Message

Dear organizers, invitees, participants and visitors, it is a great honor to welcome all for presenting the latest industrial applications of nanotechnology that focus on the marvelous studies published by renowned names in the community of science and technology for the best of our globe and environment. This will open the horizons for modern ideas and projects to support our nation, save GDP, and work for the best of our people and coming generations via introducing the best researches of nanoscience and nanotechnology. It will be a new addition to graduates' students, scientists, researchers and academics. The engineering of industry and biomedical is attractive nowadays due to advantageous applications for humanity. It is obvious that the nanotechnology into solar cells, agricultures, cosmetics, computer science and others will revert back to all positively. I believe the topic I address will be attractive and benefited to all interests.

Dr. Yarub Al-Douri

American University of Iraq, Iraq

ABOUT
MAGNUS GROUP

Magnus Group (MG) is initiated to meet a need and to pursue collective goals of the scientific community specifically focusing in the field of Sciences, Engineering and technology to endorse exchanging of the ideas & knowledge which facilitate the collaboration between the scientists, academicians and researchers of same field or interdisciplinary research. Magnus Group is proficient in organizing conferences, meetings, seminars and workshops with the ingenious and peerless speakers throughout the world providing you and your organization with broad range of networking opportunities to globalize your research and create your own identity. Our conferences and workshops can be well titled as 'ocean of knowledge' where you can sail your boat and pick the pearls, leading the way for innovative research and strategies empowering the strength by overwhelming the complications associated with in the respective fields.

Participation from 90 different countries and 1090 different Universities have contributed to the success of our conferences. Our first International Conference was organized on Oncology and Radiology (ICOR) in Dubai, UAE. Our conferences usually run for 2-3 days completely covering Keynote & Oral sessions along with workshops and poster presentations. Our organization runs promptly with dedicated and proficient employees' managing different conferences throughout the world, without compromising service and quality.

ABOUT
MAT 2023

We solicit your gracious presence at the “5th Edition of International Conference on Materials Science and Engineering” (MAT 2023) which is held during September 25-27, 2023 which is scheduled in Hybrid Format at Valencia, Spain.

This Hybrid mode allows you to participate as in-person in Valencia, Spain or Virtual from your home or work.

The global summit will be centered on the theme “Exceeding Vision in Materials Science and Engineering through Novel Innovations.”

It will establish a platform for exchanging cutting-edge research findings and advanced research methods in material science. This congress strives to provide a valuable forum for encouraging worldwide experts including researchers, scientists, material science experts, practitioners, chemists, engineers, healthcare professionals, clinicians and industry representatives for a multidisciplinary exchange of knowledge. Over the course of three-days, internationally recognized speakers will discuss how their research has progressed in response to current challenges: inspiring lessons and innovation.

The experts and industry partners will get a terrific networking opportunity. MAT 2023 will re-unite over 200 experts from the world's finest research and professional institutes to discuss not only their expertise, but also their discoveries in the field. The colloquium also aims to foster synergistic collaboration between academics and industry, as well as to demonstrate the rapid advancement of cutting-edge technology in the field of Material science and engineering in recent years with an earnest International audience.

We encourage you to join us in addressing the topics of material science and contribute to the field alongside experts.

PUBLISHING PARTNER

Open Chemistry is a peer-reviewed, open access journal that publishes original research, reviews, and communications in the fields of chemistry in an ongoing way. Our central goal is to provide a hub for researchers working across all subjects to present their discoveries, and to be a forum for the discussion of the important issues in the field.

There are no submission charges. In order to sustain the production of our fully-refereed open access journal, each article accepted for publication in Open Chemistry is subject to Article Processing Charges (APC).

Note: We offer 30% discount on APC for the MAT 2023 conference participants.

For more details about the journal, please visit: https://www.degruyter.com/journal/key/chem/html

SPONSOR

American Elements, global manufacturer of high purity metal & ceramic nanopowders, semiconductor nanocrystals, & nanotechnology materials

American Elements' catalog of more than 35,000 products makes it the world's largest manufacturer devoted exclusively to advanced materials in both industrial bulk and laboratory/ research quantities. And the company's materials science research & development programs have been a key resource for corporate, government & academic new product development for over a quarter of a century. Our ability to cost-effectively scale lab top successes to industrial scale production has been instrumental to ushering in many of the fundamental technological breakthroughs since 1990 including LED lighting, smartphones, and electric cars.

magnus Group

25-27 SEPT

DAY 01

KEYNOTE FORUM

5TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

Mechanical behaviour of carbon fibre stitched composite joints and composite repair

Due to their high strength and stiffness, light weight and good stability and durability, fibre-reinforced polymer composites have been increasingly used in the aerospace, automotive and marine industries. Typically, in manufacturing, large scale composite structures are assembled from a number of sub-components. For this reason, joints have become indispensable in large structures. However, when designing and manufacturing joints, stress concentrations, improper design and manufacturing processes can easily result in the degradation of the mechanical properties of the whole structure. Therefore, there is a need to continually improve the strength of joints. This paper presents a novel stitching method for enhancing the mechanical properties of secondary-bonded CFRP single- and double-lap joints, as well as composite patch repair. In this approach, holes were drilled in the secondary bonded joints and carbon fibre threads were stitched through the joints and the scarf patch repaired. The vacuum resin infusion technique was then used to integrate the threads with the joints and fix the patch to the parent part. The tensile properties of the stitched joints were measured and compared with those offered by traditional bonded (unstitched) joints to investigate the potential of the stitching method. In addition, by varying the hole diameter between 2 and 4 mm, the effect of thread size on the joint load-carrying capacity of the joints was investigated. The experimental results show that by using this stitching method, the ultimate tensile strength of the stitched single- and double-lap joints are respectively 200 % and 130 % greater than the corresponding conventional bonded joints. The finite element models have been developed to predict the mechanical response of the stitched joints, in good agreement with the experimental results. The numerical analysis shows that the stiffness degradation at the end of overlap area is held back by the stitching fibres. Also, an innovative stitch-reinforced scarf patch is developed to reduce the amount of parent material that is removed during the repair. Here, the effects of varying both the hole diameter and the scarf angle on the load carrying capacity of the repaired laminates are studied. The tensile strength, strain distribution and failure mechanisms are investigated using the Digital Image Correlation (DIC) technique. It was found that by introducing a 2.5 mm diameter stitching hole, the ultimate tensile strength of repaired laminates related to three scarf angles is increased by up to 20, 27 and 45% respectively, relative to traditional laminates with an equivalent scarf ratio.

Audience Take Away Notes

- The novel 3D carbon fibre stitching technology
- This will approach enhance composite joints effectively
- This technology will be applied to composite repair
- This technology will be used to fully integrate sandwich skins and core to avoid delamination

C Sun[1], Z W Guan[1,2]*

[1]Advanced Materials Research Centre, Technology Innovation Institute, Abu Dhabi, United Arab Emirates

[2]School of Mechanical Engineering, Chengdu University, City, Chengdu, China

Biography

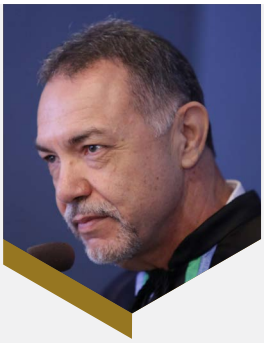
Prof Guan is an Executive Director in Advanced Materials Research Centre of Technology Innovation Institute in Abu Dhabi UAE. He is leading research groups in Lightweight Composite Materials and Structures on fibre metal laminates, PVC foam-based sandwich, 3D carbon fibre stitched reinforcement, high temperature TP prepregs. He has published more than 170 SCI papers in international leading journals, with an h-index of 41 in Google Scholar. Prof Guan has given more than 20 keynotes, thematic and plenary speeches in international conferences.

Mathematical modeling the tumor heterogeneity using a nanoemulsion biodistribution

This plenary talk is addressed to the biodistribution description of a luminescent lipid nanoemulsion and its use as a model to assess the heterogeneous architecture of an implanted solid tumor. Moreover, the talk aims to describe the tumor tissue organization and examine how the tumor heterogeneity can interfere with the passive delivery of the lipid nanoemulsion. Two breast cancer preclinical models (4T1 and Ehrlich) were used to describe how one can assess the biodistribution data. Numerical analysis of the recorded data was performed using a comprehensive mathematical model, which describes the differential nanoemulsion biodistribution and sub-tumoral localization in the two different breast cancer models. Differential equations are formulated and solved within the approach of compartment model to account for the biodistribution data.

Audience Take Away Notes

- The talk will emphasize the benefits of mathematical modeling biological data
- he audience interested in nanobiodistribution will learn the success of a case study
- The talk content will stimulate the audience toward mathematical modeling biological data
- The comprehensive data analysis presented will show how the accuracy can be improved and how the design of biological experiments can be better oriented



Paulo C De Morais

Genomic Sciences & Biotechnology, Catholic University of Brasilia, Brasilia, DF, Brazil

Institute of Physics, University of Brasilia, Brasilia, DF, Brazil

Biography

Professor De Morais, PhD, was full Professor of Physics at University of Brasilia (UnB) – Brazil up to 2013, Appointed as: UnB's Emeritus Professor (2014); Visiting Professor at HUST – China (2012-2015); Distinguished Professor at AHU – China (2016-2019); Full Professor at Catholic University of Brasília – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-years (1987-1988) post-doc position with Bell Communications Research – USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais – Brazil. He has published about 500 papers (Web of Science).

BOOK OF ABSTRACTS

magnus Group

25-27 SEPT

DAY 01

SPEAKERS

5TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

IN-PERSON

Eduardo Bertoni da Fonseca, Andre Henrique Guimaraes Gabrie[1], Diego Bastita Valim, Eder Socrates Najar Lopes*

University of Campinas, Campinas, Brazil

Processability of AISI-H13 hot work tool steel processed via additive manufacturing

Additive manufacturing offers the advantage of producing intricate parts more efficiently compared to traditional methods, resulting in cost savings and improved product quality. One promising application involves creating molds and dies with conformal cooling for injection molding, die casting, and forging. AISI H13 tool steel is commonly employed in these scenarios due to its exceptional properties such as high hardness at elevated temperature, good wear resistance, and commendable toughness. In this study, the primary focus was on examining the processability of AISI H13 tool steel using powder bed fusion with laser beam (PBF-LB), while also conducting a microstructural analysis. The experimental parameters, including laser power (ranging from 97 to 216 W) and scan speed (ranging from 300 to 700 mm/s), were intentionally varied to assess their impact on part consolidation, common defects, solidification structure, microstructure, and Vickers hardness. Throughout the explored range of processing parameters, the microstructural features were found to be largely consistent, characterized by a predominantly cellular solidification structure consisting of martensite with retained austenite content ranging from 19.8% to 25.9%. The cellular dendritic solidification structure exhibited segregation of elements such as C, Cr, and V towards the cell walls. The thermal cycle led to the formation of alternating layers of heat-affected zones, exhibiting some variations in hardness and microstructure. The presence of retained austenite was found to be associated with the solidification structure and displayed a preferential orientation aligned with the build direction. Density and porosity maps were obtained through helium gas pycnometry and light optical microscopy, respectively. These, along with the evaluation of linear crack density, were employed to identify appropriate processing parameters for H13 tool steel. Additionally, measurements of thermal diffusivity, thermal conductivity, and thermal capacity were conducted to determine dimensionless processing parameters, which were then compared to values reported in the existing literature.

Audience Take Away Notes

- Understand the process window of H13 steel under AM PBF-LB
- This research presents a workflow to study process parameters and metallurgical characterization for alloys processed via AM PBF-LB
- Comparison between dimensionless parameters and volumetric energy density

Biography

Dr. Eder Socrates Najar Lopes is a mechanical engineer (2004) and has obtained M.Sc. (2009) and Ph.D. (2013) in materials science and manufacturing at the University of Campinas, Brazil. He spent 2 years (2013–2015) as a postdoctoral researcher at Ohio State University, USA. Prof. Eder's research and interests include biomaterials, medical devices, additive manufacturing, and scaffolds for tissue engineering.

IN-PERSON

Dominika Beata Kwidzinska[1]*, Magdalena Jazdzewska[2], Dariusz Fydrych[1], Aleksandra Mielewczyk Gryn[3]

[1]Department of Technology of Structural Materials and Welding, Institute of Manufacturing and Materials Technology, Faculty of Mechanical Engineering and Ship Technology, Gdansk University of Technology, 80-233 Gdansk, Poland
[2]Department of Biomaterials Technology, Institute of Manufacturing and Materials Technology, Faculty of Mechanical Engineering and Ship Technology, Gdansk University of Technology, 80-233 Gdansk, Poland
[3]Institute of Nanotechnology and Materials Engineering, Faculty of Applied Physics and Mathematics, Gdansk University of Technology, 80-233 Gdansk, Poland

Effect of electrophoretic deposition of zirconium oxide on the Ti13Nb13Zr titanium alloy

Interest in biomedical engineering materials is still high. The number of diseases of the osteoarticular system is growing, and thus - it is necessary to fill tooth and bone defects in the face. For this reason, biomedical material for potential applications is constantly being sought.

Titanium and its alloys have been used as implant materials since the second half of the 20th century. They are characterized by a low modulus of elasticity, very good mechanical properties and high corrosion resistance. Biomaterials made of titanium and its alloys are used as elements for the reconstruction of the oral and maxillofacial cavities as well as dental root implants. Many years of research have allowed the development of various techniques for modifying the surface of titanium and its alloys. However, the optimum surface for many applications has still not been achieved.

The Ti13Nb13Zr titanium alloy has recently been used as a material for implants. It is slowly displacing the Ti6Al4V titanium alloy from the market. This is due to the presence of elements that negatively affect the human body. Research shows that aluminium and vanadium contained in the Ti6Al4V titanium alloy cause neurological disorders. On the other hand, niobium and zirconium contained in the Ti13Nb13Zr titanium alloy are elements inert to the human body. In addition - Ti13Nb13Zr has a lower modulus of elasticity than Ti6Al4V, thanks to which it is possible to come even closer to the Young's modulus of human bone.

During this lecture, the results of the study of the surface of the titanium alloy Ti13Nb13Zr modified by electrophoretic deposition of zirconia will be presented. The electrophoretic deposition process was carried out at two different times and two different voltages. The surface characteristics were assessed by Scanning Electron Microscope (SEM) and Atomic Force Microscope (AFM). The chemical composition (EDS) was also assessed, and after the nanoindentation test, the hardness and Young's modulus of the modified surfaces were determined. A comparison of the reference and modified samples were also made, thanks to which the effect of electrophoretic deposition of zirconium oxide on the surface of the Ti13Nb13Zr titanium alloy was assessed.

Audience Take Away Notes

- The results of the research on the modified surface of the Ti13Nb13Zr titanium alloy will allow for
- Further development of research on this alloy as a material intended for implantology applications
- The lecture will provide information in which direction modifications of the surface of the Ti13Nb13Zr alloy and its evaluation can be further developed
- The speech can also be a means of self-development in the field of electrophoretic deposition of zirconium oxide on the surface of the Ti13Nb13Zr titanium alloy

Biography

MSc. Dominika Beata Kwidzinska studied Nanotechnology at the Gdańsk University of Technology in Poland, and in 2020 she received her master's degree in Materials Engineering at the Gdansk University of Technology in Poland. Currently, she is a PhD student in the discipline of Mechanical Engineering at the Doctoral School operating at the Gdańsk University of Technology in Poland. She is just starting her "serious" scientific work. She participates in scientific conferences. She is the co-author of three scientific papers (including two from the JCR list) and is working on his own.

IN-PERSON

Marianela Escobar Castillo[1]*, Erik Sachse[1,2], Friedrich Waag[2], Bilal Gokce[2,3], Soma Salomon[4], Joachim Landers[4], Heiko Wende[4] Doru C Lupascu[1]

[1]Institut for Materials Science and Center for Nanointegration Duisburg-Essen (CENIDE), University of Duisburg-Essen, 45141 Essen, Germany
[2]Technical Chemistry I and Center for Nanointegration Duisburg-Essen (CENIDE), University of Duisburg-Essen, 45141 Essen, Germany
[3]Materials Science and Additive Manufacturing, University of Wuppertal, 42119 Wuppertal, Germany
[4]Faculty of Physics and Center for Nanointegration Duisburg-Essen (CENIDE), University of Duisburg-Essen, 47057 Duisburg, Germany

Laser ablation of nickel- and cobalt ferrite nanoparticles

Preparation of nanoparticles using Laser Ablation in Liquids is a well-stablished method that can provide materials with sizes less than 20 nm. We prepared nickel- and cobalt ferrite nanoparticles using this method and analysed the composition of the obtained powders. Furthermore, the magnetic and optical properties of the materials were also analysed. Our results show some breakdown products during the ablation process and that the nanoparticles have superparamagnetic behaviour. To separate the magnetic particles from the solution we used a High Gradient Magnetic Separator column and demonstrated that a small-particle cobalt ferrite fraction can be separated from larger ones using this technique.

Audience Take Away Notes

- The audience will learn that Laser Ablation in liquids is an easy and fast way to prepare nanoparticles of different materials and that the method is uncomplicated and can be used without complications
- Laser Ablation is a fast method to prepare high purity nanoparticles in a range less than 20 nm
- This research that other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- We show that High-gradient magnetic separator can be used to fractionate the nanoparticles in different sizes, this method can also be used with other magnetic materials
- List all other benefits
    - Cobalt- and Nickel ferrite nanoparticles have catalytic behavior and can be used in different fields

Biography

Dr. M. Escobar-Castillo studied Chemistry at the Martin Luther University in Germany and graduated as Diploma-Chemist in 1995. She then joined the research group of Prof. A. Buge at the Institute of Pharmaceutical Chemistry, at the same university and she received her Dr. rer. nat. degree in 1999. Currently she is working at Materials Science Institute in the University of Duisburg-Essen, Germany. She has published different articles in the field of Nanotechnology, Catalysis, etc.

IN-PERSON

Isabella Caroline Pereira Rodrigues[1], Ingrid Rossilho Casale[1], Gustavo da Silva Granjeia[2], Mateus Lu Adami Pozzibon[2], Eder Socrates Najar Lopes[1], Lais Pellizzer Gabriel[1,2]*

[1]School of Mechanical Engineering, University of Campinas, Campinas, Sao Paulo, Brazil

[2]School of Applied Sciences, University of Campinas, Limeira, São Paulo, Brazil

Additive manufacturing of customizable bioactive scaffolds for bone tissue engineering

Bone tissue engineering is a promising strategy to treat skeletal injuries by using 3D matrices, known as scaffolds, to facilitate the regeneration of damaged tissue. Given the importance of bone transplantation, the exploration of additive manufacturing techniques for bone applications has gained considerable attention. In this study, we focused on fabricating bioactive scaffolds with different compositions that can be tailored according to the specific demands of individual patients, using extrusion-based additive manufacturing technology (Allevi 2, USA). The scaffolds developed in this investigation consisted of a composite comprising poly (lactic-co-glycolic) acid (PLGA), a bioresorbable polymer, and Hydroxy Apatite (HA) nanoparticles, recognized for their osteoconductive properties. The scaffolds were engineered alternately with two bioinks containing different HA concentrations. Scanning Electron Microscopy (SEM) analysis confirmed the attainment of targeted pore sizes of 450 µm within the scaffolds. Fourier-Transform Infrared Spectroscopy (FT-IR) enabled the identification of characteristic peaks corresponding to PLGA and HA, while revealing the absence of solvent-related signals. Additionally, the Thermo Gravimetric Analysis (TGA) demonstrated the appropriate incorporation of HA at the desired concentration. Furthermore, in vitro evaluations reinforced the fabricated scaffolds' osteoconductive nature and the engineered scaffolds' biocompatibility with a pre-osteoblast cell line. The successful fabrication of the proposed scaffolds shows their potential in facilitating osseointegration for bone applications. Additive manufacturing techniques confer the notable advantage of tailoring the scaffolds to accommodate patient-specific requirements. By combining PLGA and HA nanoparticles, these scaffolds offer biocompatibility and osteoconductivity, both crucial to increase the regeneration of bone tissue. The variation in pore sizes explored presents a valuable opportunity to modulate the shape, and mechanical and biological properties of the scaffolds to match diverse bone defect scenarios. In summary, this study showcases the successful fabrication of customizable bioactive scaffolds. Through the chemical and thermal characterizations, using FT-IR and TGA, it was possible to establish the scaffolds' structural integrity and compositional fidelity. Moreover, the demonstrated osteoconductive properties of the scaffolds in vitro and their biocompatibility substantiate their efficacy as a promising platform for bone tissue engineering applications.

Audience Take Away Notes

- The audience will learn about fabricating customizable bioactive scaffolds for bone tissue engineering using additive manufacturing techniques
- This knowledge will benefit researchers, scientists, and engineers in the field by providing insights into scaffold fabrication, characterization techniques, and the use of specific materials such as polymers and nanoparticles
- The study offers a practical solution by demonstrating successful scaffold fabrication, simplifying the design process and potentially enhancing efficiency in developing bone tissue engineering solutions

IN-PERSON

- The research improves design accuracy by providing new information on scaffold composition, variation in pore sizes, and the use of bioactive materials, thus advancing the field of bone tissue engineering and personalized medicine

Biography

Dr. Gabriel studied Chemistry at the Pontifical Catholic University of Campinas, graduated as MS and PhD in Chemical Engineering in State University of Campinas (UNICAMP), Brazil. Shortly after obtaining her PhD, she obtained the position of Assistant Professor at UNICAMP. Nowadays she coordinates the Laboratory of Science and Technology of Polymers. Her research focuses on biomaterials, biofabrication, and tissue engineering of polymeric materials.

IN-PERSON

Ingrid Martorell, Jaume Camarasa*, Roger Vila, Cristian Sole, Albert Castell

Sustainable Energy, Machinery and Buildings (SEMB) Research Group, INSPIRES Research Centre, Universitat de Lleida, Pere de Cabrera s/n, 25001 Lleida, Spain

Plastic films to be used in a night-time radiative cooling technology: Optical and mechanical study for a RCE device

Current energy situation is not at all promising for the future, due to the fact that the demand for energy increases annually (according to ICAEN data, more than 40% comes from buildings). Additionally, energy main resources have non-renewable origin. Thus, one of the measures implemented by the European Union is the long-term Decarbonization Plan. Consequently, renewable energies must play a priority role to reduce fossil fuels consumption. SEMB research group of the University of Lleida, due to the fact that the cold production requires a large consumption of electricity (wide use of compression systems) and solar collectors only work during the day (partial use), have devised a unique device, based on a modified solar flat collector, to combine the production of hot water (DHW) and cold water by means of radiative cooling in a renewable way. This system is called Radiative Collector and Emitter (RCE). This innovative system makes possible to produce heat during the day and cold during the night through an adaptative cover, obtaining temperatures below ambient. However, the main problem is that solar collection materials and radiative cooling materials have different properties. In addition, the fact of being exposed to the weather causes the materials to suffer from the aging phenomenon.

It is widely spread in the literature the used of polyethylene in radiative cooling based on its great transmittance in the atmospheric window (7-14 μm). However, it is a material that degrades relatively easily in mechanical terms. Consequently, it was decided to carry out a study of the optical and mechanical properties of 5 types of plastics in order to choose the best candidate for the self-adaptive cover of the RCE. Specifically, in this paper average transmission values, aging evolution and mechanical properties are studied for five plastic films between 35 and 100 mm (two low density polyethylenes, LDPE-60 and LDPE-100, one high density polyethylene, HDPE-60, one polypropylene, PP-35 and one fluorinated ethylene propylene, FEP-50) exposed to environmental conditions during three months, using a Jasco FT-IR 6300 (for optical properties) and ZwickRoell BZ1-MMZ2.5.ZW01 (for the mechanical ones) series equipment. It should be noted that there are two types of experimental conditions for the different plastics studied: glass-covered samples and uncovered samples (design must be as close as possible to the RCE real conditions).

Results obtained confirm the aforementioned: polyethylene is the material that shows better optical behavior in terms of transmission to the atmospheric window, but it has significant loss of mechanical properties over time. On the other hand, polypropylene presents an average transmittance only 3% lower than polyethylene but shows a great resistance to the aging phenomenon. In addition, mechanical properties are an order of magnitude greater than polyethylene. Consequently, it is concluded that polypropylene is a suitable candidate for this type of technology. However, more efforts must be made in the area of smart materials that have dual functionality (heat and cold).

Audience Take Away Notes

- A unique device to produce hot water (Domestic Hot Water) and cold water below ambient temperature by means of radiative cooling, in a renewable way is presented

- Few modifications of a regular flat solar collector panel are required to introduce radiative cooling mode and therefore present a practical solution to the problem of obtaining cooling using renewable energy exclusively
- Polypropylene presents optical properties like polyethylene and outperforms polyethylene in the mechanical ones. This is why polypropylene is presented as an alternative to polypropylene when used as a wind-shield for radiative cooling
- Optical properties for materials suitable for solar collection are different than the ones required for night-time radiative cooling. Smart materials that switch properties depending on functionality have not been found yet and are required

Biography

Jaume Camarasa is a mechanical engineer, graduated in the Escola Politecnica Superior of the University of Lleida (Catalonia, Spain), who is currently combining the second year of his master's degree in industrial engineering with his first year as a predoctoral student, also in the University of Lleida. During his final degree thesis, carried out with the SEMB research group, studied different suitable materials for radiative cooling technology in order to use them in an RCE prototype. As a result of this study, he gets involved in the scientific world.

IN-PERSON

Norbert Varga[1,2]*, Alexandra Nikolett Kovacs[1,2], Arpad Turcsanyi[1,2], Edit Csapo[1,2]

[1]MTA-SZTE Lendulet "Momentum" Noble Metal Nanostructures Research Group, University of Szeged, H-6720 Rerrich B. sqr. 1, Szeged, Hungary
[2]Interdisciplinary Excellence Center, Department of Physical Chemistry and Materials Science, University of Szeged, H-6720 Rerrich B. sqr. 1, Szeged, Hungary

Synthesis optimalization and release characterization of the drug-loaded poly (lactide-co- glycolide) colloidal particles

Nowadays, the polymer-based nanostructured drug carriers play a key role in the field of nanomedicine. By using them, we can prolong and increase the efficacy of the drugs. Due to the excellent biocompatibility and good material properties, the Poly (Lactide-Co-Glycolide) (PLGA) copolymers is one of the most popularly used biopolymers in the development of new type of colloidal drug delivery systems. The degradation and hydrophilicity properties of PLGA are excellently controllable with the changing of the monomer ratios, which is advantageous in the application of these carriers. Our aim was to prepare drug-containing Nano Particles (NPs) by using Poly (Lactide) (PLA) and PLGA and to determine the effect of the synthesis parameters (e.g concentration, solvent and stabilizing agents) on the structure of the NPs. Nanoprecipitation method was used for the preparation of these systems, where the NPs have been characterized by DSC, FT-IR spectroscopy, DLS, TEM, SEM and UV-Vis measurements. During the synthesis of the PLGA NPs, it has been proved that the hydrodinamic diameter and the size distribution of the particles can be controlled with the changing of the initial parameters. The drugs having different hydrophilicity (e.g. ketoprofen (KP), D-α-tocopherol polyethylene glycol 1000 succinate (TPGS) and (±)-α-Tocopherol (TP) have been encapsulated, where the highest entrapment efficiency (%) is obtained for the most lipophilic (±)-α- tocopherol (~90%). For the characterization of the drugs release properties, we investigated the dissolution profiles of the drug-loaded PLGA NPs. Based on the results, we found that the release of the active substance can be changed by the lactide:glycolide ratio. For the determination of the kinetic parameters, the release curves were fitted by different kinetic model using nonlinear regression. We can defined that the release of the drugs meanly have diffusion controlled feature.

Audience Take Away Notes

- The presentation will be highlighted to the advantages of the polymer-based drug delivery systems and importance of these systems in the field of the nanomedicine
- The audience can get to know the effect of the initial parameters to the preparation of the PLGA-based particles
- Results of the in vitro release measurements are pointed out, how can be changed the dissolution kinetic properties of the drug-loaded PLGA at different conditions, which knowledge is essential for subsequent in vivo studies

Biography

Dr. Varga studied Chemistry at University of Szeged, Hungary and graduated as MS in 2017, then joined the research group of Edit Csapo University of Szeged, Department of Physical Chemistry and Materials Science. He received his PhD degree in 2020 at the same institution. From 2022, he obtained a Research fellow position at the MTA-SZTE Lendület "Momentum" Noble Metal Nanostructures Research Group supervised by Dr. Edit Csapo. He has published 14 research articles.

IN-PERSON

Adam Juhasz[1,2]*, Laszlo Seres[1], Egon F Varkonyi1, Edit Csapo[1,2]

[1]Interdisciplinary Excellence Center, Department of Physical Chemistry and Materials Science, University of Szeged, H-6720 Rerrich B. sqr. 1, Szeged, Hungary

[2]MTA-SZTE Lendület "Momentum" Noble Metal Nanostructures Research Group, University of Szeged, H-6720 Rerrich B. sqr. 1, Szeged, Hungary

Analysis of mixed micelle formation from binary surfactants for design of potential nanosized drug carriers

The present work describes a calorimetry-founded characterization and design of a potential surfactant based colloidal drug delivery system. However, numerous research groups have published their outcomes according to the thermodynamic characterization of mixed micelle formation but only a few articles provide deeper information on the temperature and composition dependence micellization in mixed surfactant systems combining the advantages of both aspects. For self-assembled surfactant systems, the most important parameter is the Critical Micelle Concentration (CMC) value, which quantifies the tendency to associate and gives the value of Gibbs energy of micellization. Several techniques are known for determining CMC, but the Isothermal Titration Calorimetry (ITC) deserves special attention in comparison to other procedures. The calorimetry gives an absolute basic thermodynamic characterization in a single experiment, includes cmc and binding enthalpy and this is it does not require other label material such as fluorophore, chromophore etc. as heat is a universal signal. In contrast these advantages an important shortcoming of the procedure is that, while there are several commercial software solutions for processing calorimetric data of receptor-ligand-type interactions, the modelling of self-assembled colloidal systems must be solved by self-developed computational methods. Outcomes of the calorimetric investigation of self-assembling process were evaluated using a spreadsheet-edited routine developed for handling ITC data. Thermodynamic parameters of mixed micelle formation were obtained from the nonlinear modelling of temperature- and composition dependent enthalpograms. Further the value of thermodynamic parameters the uncertainty of these data is also very important, in this way, a weighted resampling "jackknife" procedure was used for calculation of the standard deviations of the fitting parameters.

Audience Take Away Notes

- A new approach to the design of colloidal drug carriers containing surfactants
- Universal and quantitative method for the characterization of micelles formation from binary surfactants
- This research work explains the correlation of thermodynamic and functional properties of mixed surfactant systems

Biography

Dr. Juhasz studied Chemistry at University of Szeged, Hungary and graduated as MS in 2009, then joined the research group of Prof. Imre Dekany at the Hungarian Academy of Sciences. He worked simultaneously as a researcher and managing director of a technology transfer company while received his PhD degree in 2019 at the University of Szeged. After a postdoctoral fellowship he obtained a Research fellow position of at the MTA-SZTE Lendület "Momentum" Noble Metal Nanostructures Research Group supervised by Dr. Edit Csapo. He has published more than 30 research articles and belongs the inventors of four industrial patents.

IN-PERSON

Andreas K Huttel

Institute for Experimental and Applied Physics, University of Regensburg, 93053 Regensburg, Germany

High quality contacts to MoS_2 nanotube quantum dots

Planar Transition Metal Dichalcogenides (TMDCs) are at the center of manifold research efforts due to their intrinsic two dimensional nature and their outstanding electronic and optical properties. Despite detailed studies of their optical parameters, worldwide efforts to reach single level transport in lithographically designed quantum dots at low temperatures – towards spin, valley, or charge qubits - have so far been mostly unsuccessful. This is due to the requirement for very small confinement potentials as well as disorder from dangling bonds at the edges of nanoflakes. Both issues can be circumvented by using clean, as-grown MoS_2 nanotubes and nanoribbons. First Coulomb blockade measurements were recently performed on a MoS_2 nanotube grown from vapour phase, and were so far limited by disorder below the metallic scandium contacts. Here, we present low temperature measurements on MoS_2 nanotubes and nanoribbons contacted using bismuth. Bismuth is less reactive and has a vanishing density of states at the Fermi edge, suppressing metal-induced gap states. Our data clearly shows the nondestructive and transparent nature of these contacts to our quantum dots and indicates quantum confinement.

Audience Take Away Notes

- MoS_2 nanotubes are a highly promising nanomaterial for electronic quantum devices, both (at room temperature) as field effect transistors and (at cryogenic temperatures) as single electron transistors
- Bismuth-based contacts to the nanotubes are both Ohmic and nondestrucive, i.e., they preserve the lattice of the underlying MoS_2
- With this one of the fundamental problems towards using MoS_2 devices at low temperatures is solved

Biography

Dr. Andreas K. Huttel, DFG Heisenberg research fellow and research group leader at University of Regensburg, specializes in low-temperature transport experiments on quantum materials and quantum devices. Recipient of the Walter Schottky Prize of the German Physical Society 2021, he obtained his Habilitation (venia legendi) in Physics at Regensburg in 2017 and his PhD at Ludwig-Maximilians-University Munich in 2005. With multiple publications in high-level journals such as Science, Nano Letters, Nature Commun., Phys. Rev. Lett, he has reached over 2200 citations and an h-index of 21. His current research interests are transport spectroscopy and microwave optomechanics involving low-dimensional materials.

IN-PERSON

Milind Bhandarea*, Madhav Sarodeb

Department of Physics, Rayat Shikshan Sanstha's Mahatma Phule Mahavidyalaya Pimpri, Pune 411 017, MS, India

Interdependence of morphological electrical and magnetic properties of Cu-substituted Ni-Zn-Mg nano-crystalline ferrite

Ferrites having chemical formula, Ni0.5-xCuxZn0.3Mg0.2Fe2O4 with x = 0, 0.1, 0.2, 0.3, 0.4 and 0.5 have been prepared by auto-combustion route. Field Emission Scanning Electron Microscopy (FE-SEM) micrographs show that samples have nano-crystalline behavior and show spherical shape. Selected Area Electron Diffraction (SAD) patterns confirm the spinel structure of the ferrite. Transmission Electron Microscopy (TEM) images show a well defined nano-crystallite state with an average particle size of around 28 to 39 nm. The electric properties have been studied by means of DC electrical resistivity. The increase in AC conductivity is observed with increase in Cu-content, indicates dispersion with frequency at room temperature. The magnetic hysteresis were done using Vibrating Sample Magnetometer (VSM) which show that saturation Magnetization (Ms), Remanent Magnetization (Mr) and Coercivity (Hc) decrease with increasing Cu-content exhibiting super paramagnetism characteristic at room temperature. The frequency dependence initial permeability was studied in the range of 100Hz to 5MHz. This shows high frequency stability after dispersion occurred. The graph of magnetic loss tan (δμ/μi) supports dispersion. Variation of loss tan (δμ/μi) against frequency exhibit resonating behavior.

Keywords: Spinel ferrites, DC resistivity, AC conductivity, M-H loop, Initial Permeability.

Audience Take Away Notes

- There are several commonly used methods; each offers its own insights into your target audience. You should eliminate any information that has already been found by other researchers as part of your primary research phase, since this will allow you to start from scratch. You might choose to use qualitative or quantitative research methods during this process, but all information should come from your own work and findings
- Ferrite Nano-Particles (FNPs) belong to a broad group of Magnetic Nano-Particles (MNPs) and have received a considerable amount of attention due to their wide applications in various fields, which ranges from biomedical to industrial
- This research that other faculty could be used to expand their research or teaching. Probably the most conventional argument for how research supports teaching is that faculty with active research programs bring their research into the classroom and use it to inform their teaching

Biography

Dr. Milind bhandare Associate Professor in Physics at the Mahatma Phule Mahavidyalaya Pimpri, Pune (MS) India affiliated to Savitribai phule Pune University.Completed M.Sc in physics in 1986 and joined the research group of Prof. SHAIKH AKHTAR MAHAMAD-HUSEN Department of Electronics Shivaji University Kolhapur, Maharashtra (India). I have received Ph. D degree in 2012 at Shivaji university Kolhapur, Maharashtra (India). My citation index is 84. Have published more than 8 research papers in reputed journals and completed two research projects.Participated International Conference on Metals and Alloys, 19-22 August 2019, Beijing, China. My research area: Nano-crystalline ferrite ferrites, thin film.

IN-PERSON

Alessandro Sergi[1]*, Raja Khan[1], Amanda Allison[1], Sam Ward[1], Ehsan Rahimi[2]

[1]TWI Ltd., Cambridge, CB21 6AL, United Kingdom
[2]Materials Processing Institute, Middlesbrough, TS6 6US, United Kingdom

Microstructure and properties evolution of additively manufactured alloy 718

In this study, the Laser Powder Bed Fusion (L-PBF) and heat treatment response of a plasma atomised Alloy 718 powder is investigated using advanced characterisation techniques and mechanical testing. In particular, the study focused on the impact of different heat treatment regimes on the microstructure and mechanical properties. Initially, the investigation focuses on a detailed powder characterisation to have a comprehensive understanding on how physical (apparent and tap density, flowability, particle size distribution and morphology) and chemical properties of the powder can affect the L-PBF built quality. Following L-PBF process, samples were subjected to two different heat treatment regimes. The first heat treatment was based on the AMS5663N standard, while in the second one, an higher solution temperature assisted via the use HIP was employed. The microstructure as-built and heat treatment samples were characterised using Scanning Electron Microscopy (SEM), energy dispersive X-ray (EDX), Electron Backscatter Diffraction (EBSD) to evaluate the presence of secondary phases, grain size and structure, recrystallization mechanisms and grain boundary characteristics. Following a detailed microstructure analysis, samples were subjected to SEM in-situ tensile, room and elevated temperature tensile testing, Charpy impact and fatigue testing. The results reveal that Alloy 718 processed using L-PBF exceed the AMS 5383F aerospace standard minimum specifications for both heat treatment regimes. However, the use of HIP in combination with higher solution treatment was proved beneficial in achieving a fully recrystallized microstructure with a better balance of mechanical properties due to a reduction of detrimental Laves and delta (δ) phases in the microstructure.

Audience Take Away Notes

- The audience will get an understanding on how to characterize powder, L-PBF microstructure in as-built and heat treated condition
- Mechanical properties including Tensile, Charpy and Fatigue of Alloy 718
- Failure mechanisms in Alloy 718 through in-situ SEM tensile testing
- The audience can apply the presented characterization techniques to assess the microstructure and properties of L-PBF materials
- Understand the potential of additive manufacturing and propose new solutions for complex-shaped parts
- General link between microstructure and materials' properties that can be extended to a wide range of materials
- This research utilize state-of-the-art characterization facilities and technique to understand the microstructural evolution, tensile properties and failure mode, thus it would be highly valuable in research and/or teaching
- Understanding how materials' properties can be improved through heat treatment can lead to a sharp increase in the industrialization of additive manufacturing, with consequent reduction in material waste

- Manufacturing parts through L-PBF processes would allow to manufacture much more complex geometries which would increase the design flexibility
- List all other benefits
    - Extend the audience knowledge on HIP technique
    - Awareness on the importance of powder characterization for L-PBF process

Biography

Dr. Alessandro Sergi is a Project Leader in the Thermal Processing Technologies section at TWI Ltd since September 2021. During his PhD on Hot Isostatic Pressing of high temperature materials, he has developed expertise in powder metallurgy, hot isostatic pressing, metallurgy of Ni-based superalloys and refractory metals, with particular focus on how powder characteristics affect the final properties in powder-related manufacturing processes. Over the years, he has developed expertise in powder metallurgy, materials characterisation and additive manufacturing through large research projects including UKRI funded 'SAMRCD' project, the EU funded 'SUPREME' and the EPSRC funded 'AHEAD' project on novel brazing fillers.

IN-PERSON

Alina Vladescu (Dragomir)*, Catalin Vitelaru, Anca C Parau, Mihaela Dinu

National Institute of Research and Development for Optoelectronics-INOE 2000, 409 Atomistilor St., 077125 Magurele, Romania

Effect of the N_2 and C_2H_2 mass flow rates on the corrosion properties of TiSiCN coatings

The objective of the present study was to enhance the quality of cutting tools used in wood industry, where working parts and tools are subjected to severe conditions. TiSi-based carbo-nitrides were deposited by cathodic arc evaporation using TiSi cathodes with 99.9% purity. The coatings were deposited simultaneously on 2-inch Si (100) wafer (0.8 mm thickness, 50.8 mm diameter) and three types of steel (ϕ= 20 mm), depending on the analysis carried out. The metallic substrates were X155CrVMo12 alloy (elemental composition, at. %: 1.53 C, 0.35 Si, 0.40 Mn, 12 Cr, 1 Mo, 0.85 V), 16MnCr5 alloy (elemental composition, at. %: 0.14-0.19 C, 0.4 Si, 1-1.3 Mn, 0.025 P, 0.035 S, 0.8-1.1 Cr) and C45 alloy (elemental composition, at. %: 0.43-0.50 C, 0.60-0.90 Mn, 0.04 P, 0.050 S).

The deposition conditions were fixed: 2 x 10-3 Pa residual pressure, 6 x 10-2 Pa working pressure, -200 V substrate bias and 90 A arc current. To obtain coatings with different composition, the N_2 and C_2H_2 mass flow rates were varied such as four sets of samples were fabricated: series-1 (20 sccm Ar, 110 sccm C_2H_2), series-2 (40 sccm Ar, 90 sccm C_2H_2), series-3 (80 sccm Ar, 50 sccm C_2H_2), and series-4 (110 sccm Ar, 20 sccm C_2H_2).

Surface morphology, elemental/phase composition and roughness were investigated before and after corrosion process evaluation. There is an increasing tendency of nitrogen concentration (ranging from ~2 to ~26 at. %) detrimental to carbon content (ranging from ~53 to ~21 at. %), in correlation with the reactive atmosphere of the deposition process. For the coatings, a gradual increase is visible for the (200) oriented peak located at ~59°. Above 26 at. % nitrogen the preferred orientation of the TiC/TiN phase was changed to (111) plane, inducing modification in crystalline growth, most probably due to the competition between surface and strain energy. The results showed that TiSiCN coatings improved the corrosion resistance of the uncoated alloys. Moreover, an increase in the nitrogen flow rate during the deposition had a positive influence on their electrochemical behaviour, regardless of the type of substrate.

This research was supported by a grant of the Ministry of Research, Innovation and Digitization, project number COFUND-M-ERANET-3-HardCoat-1 (no.311/2022), within PNCDI III and Romanian National Core Program no.PN11N-03-01-2023.

Audience Take Away Notes

- The service life of cutting tools used in wood industry will be improved by these coatings
- The knowledge related to correlation between properties and functional performance
- The proposed coatings can also be used for other applications

Biography

Dr. Eng. Alina Vladescu (Dragomir) has PhD in Materials Science from University Politehnica of Bucharest (UPB) (2011). She works at National Institute for Optoelectronics INOE2000, Department for Advanced Surface Processing and Analysis by Vacuum Technologies (since 2002). She is also associate professor in Surface Engineering at UPB. Expertise: Functional coatings (metals, nitrides, carbides, oxides and oxynitrides) deposited by magnetron sputtering and cathodic arc techniques, especially for optics, optoelectronics, mechanical/tribological applications, but also with special properties, such as corrosion resistant and biomaterials. She has 140 ISI papers, and over 250 presentations, 17 patents, 7 books, 16 awards at Invention Exhibitions. Hirsh score is 25.

IN-PERSON

Bespalko Yu[1]*, Kharina S[1], Eremeev N[1], Mikhailenko M[2], Korobeynikov M[3], Sadykov V[1]

[1]Federal Research Center, Boreskov Institute of Catalysis, Novosibirsk, Russia
[2]Institute of Solid State Chemistry and Mechanochemistry, Novosibirsk, Russia
[3]Budker Institute of Nuclear Physics, Novosibirsk, Russia

E-beam sintered materials for catalytic membranes with selective hydrogen permeability

Last decade proton conducting mixed oxides have been extensively studied as application in the different electrochemical devices (fuel cells, separators, etc.). Membranes with selective hydrogen permeability based on them can also be used to remove H_2 from products of catalytic reactions (synthesis gas), for example, ethanol steam reforming, which increases efficiency of reactors. Ceramic-metal composites with high mixed proton-electron conductivity have a great potential for use in catalytic membrane reactors, since they meet requirements of high thermal and mechanical strength along with chemical stability in the working media. The metal phase increases the electronic conductivity and reactivity in the surface processes of hydrogen exchange, while ceramic phase, in addition to ionic conductivity, contributes to the mechanical strength of the composite. Lanthanide orthoniobates, tungstates and scandates are promising materials for hydrogen separation membranes due to their high protonic conductivity. Nanocomposites were prepared by treating in the high-power planetary ball mill a mixture of mixed oxides ($Nd_{5.5}(Mo,W)O_{11.25-\delta}$, $La_{0,96}Sr_{0,04}ScO_3$ и $LaNb_{0,8}Mo_{0,2}O_4$) calcined at 700°C and NiCu alloy with addition of isopropanol. The powders were pressed into pellets and then sintered using conventional thermal sintering as well as radiation -thermal sintering using e-beams at 1100°C. The influence of the structure of nanocomposites and sintering conditions on the transport properties of obtained materials was investigated. According to XRD, in nanocomposites the main phases of scheelite $LaNb_{0.8}Mo_{0.2}O_4$, perovskite $La_{0.96}Sr_{0.04}ScO_3$ and fluorite $Nd5.5(Mo,W)O_{11.25}$ were observed. No chemical interaction between alloy and mixed oxide nanoparticles was observed. The oxygen mobility studies by temperature-programmed heteroexchange with $C^{18}O_2$ revealed two types of bulk oxygen migration channels related to two phases in samples.

Biography

Dr. Bespalko graduated as MS in 2002 Chemical Faculty of Tomsk State University. Then she joined the research group o Prof. Sadykov at the Laboratory of Catalysts of Deep Oxidation, Boreskov Institute of Catalysis, Novosibirsk, Russia. She received her PhD degree in chemistry (kinetics and catalysis) in 2008 at the same institution. Now she continues to work in Boreskov Institute of Catalysis and since 2021 teaching at the Faculty of Physics at Novosibirsk State University. She has published more than 60 research articles in SCI(E) journals, 5 patents. She is the member of American Ceramic Society.

IN-PERSON

Jyi Tsong Lin*, Kuan Pin Lin, Chun Ju Chu, Shao Cheng Weng, Yen Chen Chang

Department of Electrical Engineering, National Sun Yat-Sen University, Kaohsiung 80424, Taiwan

Can a simple iTFET become a mainstream of future technology generation

In this presentation, we embark on a journey to explore the transformative potential of a simple yet innovative inductive Tunnel Field-Effect Transistor (iTFET), contemplating its possible ascent to a leading role in shaping future technology landscapes. The narrative traverses the realms of simplicity, cost-efficiency, power frugality, multifunctionality, streamlined fabrication, production scalability, and its distinctive attributes.

As we set the stage, it is imperative to address the inherent limitations of conventional Gated PIN TFETs. These devices grapple with the vexing issues of gate-bias dependent Subthreshold Swing (SS) degradation, anemic current drive, substantial leakage current, ambipolar complexities, and the formidable challenge of Trap Assisted Tunneling (TAT). The iTFET, poised as a novel protagonist in this tale, emerges as a harbinger of novel solutions to circumvent these prevailing obstacles.

The iTFET's relevance assumes paramount importance when viewed against the backdrop of mainstream CMOS technology's limitations. The industry's pursuit of achieving a subthreshold swing below thermal constraints faces substantial impediments, particularly in applications necessitating ultra-low-power paradigms, such as high-performance yet power-savvy IoT and AI systems. While Tunnel Field-Effect Transistors (TFETs) have tantalized with their promise, their adoption trajectory encounters formidable challenges rooted in manufacturing intricacies, the quest for performance augmentation, and the unwavering quest for reliability.

At the heart of our exploration lies the conundrum of Trap Assisted Tunneling (TAT), a thorn in the side of TFET feasibility. TAT's adverse impact compounds the already challenging endeavor of achieving subthreshold swings smaller than the elusive 60mV threshold. This pivotal challenge reverberates across the industry, influencing transistor switching efficiency and practical real-world implementation. It is precisely this challenge that we aim to dissect and potentially overcome during our discourse.

The iTFET, our central protagonist, shines as a beacon of hope and ingenuity. It heralds a paradigm shift in semiconductor device architecture. Unlike conventional MOSFETs, which operate predominantly as majority carrier Gated NPN or PNP devices, TFETs, including iTFET, function as minority carrier tunneling Gated PIN diodes but in a reverse-biased configuration. This departure from convention opens vistas of opportunity for enhanced performance and resilience. Remarkably, the fabrication processes for the iTFET are fully compatible with those of recent CMOS technologies, ensuring seamless integration into contemporary semiconductor manufacturing landscapes.

Adding to its allure, the iTFET flaunts an impressively facile fabrication process. Its manufacturing journey is marked by simplicity, efficiency, and a significantly reduced wafer footprint. Notably, its current drive is not tethered to the conventional W/L ratio but is instead directly proportional to the product of channel Length (L) and Width (W), a distinctive attribute that sets it apart from its predecessors.

In summary, this presentation endeavors to illuminate the transformative potential of iTFET technology. It does not merely rest on the promise of overcoming current semiconductor device shortcomings but holds the potential to redefine the very foundations of mainstream technology generation. The iTFET's attributes of simplicity, cost-effectiveness, power efficiency, multifunctionality, ease of fabrication, and scalability, combined with its unique current drive characteristics, make it a compelling candidate for shaping the future of semiconductor technology.

Audience Take Away Notes

- Understanding iTFET Technology: The presentation provides a comprehensive understanding of iTFET technology, including its unique operational principles, characteristics, and advantages
- Use: Attendees will be equipped with knowledge about an emerging semiconductor technology, enabling exploration of its potential applications in their work
- Benefit: This knowledge can help researchers, engineers, and designers stay at the forefront of semiconductor advancements and consider iTFETs as a viable option in their projects
- Overcoming Conventional Limitations: The presentation highlights how iTFETs address the limitations of conventional TFETs, such as subthreshold swing, current drive, and manufacturing complexity
- Use: Attendees can apply these insights to their own research or design projects to potentially overcome similar limitations and enhance device performance
- Benefit: This research provides a practical solution to challenges in semiconductor device design, simplifying the job of device designers and improving the efficiency of their work
- Integration into CMOS Technologies: The presentation emphasizes the compatibility of iTFET fabrication processes with recent CMOS technologies
- Use: This information is valuable for semiconductor manufacturers and researchers aiming to integrate iTFETs into existing CMOS processes
- Benefit: It simplifies the integration process, reducing the effort and cost required for incorporating iTFETs into mainstream semiconductor production, which can ultimately lead to cost-effective and efficient designs
- Performance Enhancement: The presentation discusses how iTFETs offer unique performance characteristics, including simplified current drive calculations
- Use: Designers can utilize this knowledge to optimize designs for improved efficiency and performance
- Benefit: It can lead to more accurate designs, enhanced device performance, and energy- efficient solutions, benefiting a wide range of applications from IoT devices to high- performance computing
- Future Technology Landscape: The presentation explores the potential of iTFETs in shaping the future technology landscape
- Use: Researchers and educators can incorporate this information into work, guiding students and colleagues in exploring emerging semiconductor technologies
- Benefit: It expands the body of knowledge in semiconductor research and opens new avenues for innovation, potentially impacting various industries and applications
- In summary, the presentation not only educates attendees about iTFET technology but also equips them with valuable insights that can be applied to their work, whether it's research, design, or teaching. It offers practical solutions to existing challenges in semiconductor design, simplifies integration into mainstream processes, and has the potential to improve the efficiency, accuracy, and performance of future semiconductor devices

Biography

Dr. Jyi-Tsong Lin, a senior member of IEEE. He earned his B.S. degree in physics from National Taiwan Normal University in 1982, his M.S. degree in electronics from National Chiao Tung University in 1984, and his Ph.D. degree in electronics and computer science from the University of Southampton, England in 1993. Since 1984, he has been associated with National Sun Yat-Sen University in Taiwan, where he currently serves as a Professor in the Department of Electrical Engineering. His research focuses on the design and modeling of small-geometry SOI devices, high-speed and low-power circuits of bulk SOI MOSFETs and TFETs, and cutting-edge developments in various semiconductor applications, including solar cells, 1T DRAMs, TFETs and TFT nano devices.

BOOK OF ABSTRACTS

magnus Group

25-27 SEPT

DAY 01

POSTERS

5TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

IN-PERSON

Graziella Kassick Saft

PIEP-Innovation in Polymer Engineering, University of Minho, 4800-058 Guimaraes, Braga, Portugal

Advancing non-woven PPE materials: Heat-resistant stereocomplex PLA-rPET blend

Poly(Lactide) (PLA) is a biodegradable polymer that finds widespread applications in various industries. However, its low heat resistance has been a limiting factor, hindering its use in high-temperature applications. This study endeavors to overcome this drawback by creating a stereocomplex PLA, a promising approach to enhance PLA's heat resistance significantly. To achieve this, it is expected to blend poly(L- lactide) and poly(D-lactide) using a co-rotating twin-screw extruder. The combination of these two enantiomers will result in the formation of a stereocomplex, a crystalline structure known for its improved thermal properties. The team will employ Differential Scanning Calorimetry (DSC) and Thermal Deflection Temperature (HDT) analysis to thoroughly characterize the stereocomplex PLA and confirm its enhanced heat resistance. The ultimate goal of this study is to develop a blend of stereocomplex PLA and Recyclable Polyethylene Terephthalate (rPET) for use in non-woven applications, particularly in the manufacturing of Personal Protective Equipment (PPE). By incorporating the high-temperature resistant stereocomplex PLA into the rPET matrix, it is expected to create a composite material that is both mechanically robust and thermally stable, making it well-suited for non-woven fiber production. To ensure the composite's stability and longevity, appropriate antioxidants will be incorporated into the blend. Primary antioxidants, such as phenolic-based additives, and secondary antioxidants, including phosphite and HALS-based compounds, will be utilized to prevent degradation caused by heat, light, and oxygen exposure. Additionally, an epoxy-based chain extender will be introduced, which will react with hydroxyl groups formed during PLA degradation or present as moisture, further enhancing the blend's overall performance and durability. It will be determined the optimum ratio of stereocomplex PLA that can be blended with rPET while considering their distinct processing characteristics. This critical aspect will be evaluated through characterization, including extensional rheometry, DSC, and tensile strength analysis. The significance of this study lies in the potential to produce a novel material that satisfies the stringent requirements of non-woven fiber production, particularly in the context of PPE. If successful, the newly developed composite material could find applications beyond the realm of protective gear and offer a sustainable solution to various industries in need of thermally stable and environmentally friendly materials. In conclusion, the study aims to advance the application of PLA in high-temperature scenarios by creating a stereocomplex PLA and blending it with rPET. By enhancing heat resistance and incorporating essential additives, the study aims to create high- performance materials that can meet the demands of diverse industries while also contributing to a greener and more sustainable future.

Audience Take Away Notes

- The audience will gain valuable insights into enhancing the heat resistance of Poly(lactide) (PLA) through stereocomplex formation. They will learn about the process of blending poly(L- lactide) and poly(D-lactide) to create a stereocomplex PLA and the various techniques used for characterization, such as Differential Scanning Calorimetry (DSC) and Thermal Deflection Temperature (HDT) analysis. This knowledge will enable them to develop advanced materials with improved heat resistance, opening up new possibilities for PLA in high-temperature applications

- The research findings will benefit the audience by providing them with a practical solution to the heat resistance limitations of PLA. By incorporating stereocomplex PLA into recyclable polyethylene terephthalate (rPET), they can create a high-performance composite material suitable for non-woven fiber production, particularly in the context of personal protective equipment (PPE) manufacturing. This will enable professionals to design and develop PPE with enhanced thermal stability, improving the overall performance and safety of such products
- The study's methodology, involving the creation and characterization of stereocomplex PLA, as well as the incorporation of necessary additives for improved performance, can inspire further investigations and experiments in the domain of polymer blends and composites
- Moreover, this research can be used to enrich teaching materials for students interested in polymer science and sustainable materials development
- The research aims to provide a practical solution to the low heat resistance of PLA, which has been a limiting factor in designing products for high-temperature applications. By creating a stereocomplex PLA and blending it with rPET, designers can access a novel composite material that combines the benefits of both components, resulting in improved thermal stability and mechanical performance. This can simplify the design process and make it more efficient for developing heat-resistant products, saving time and resources.
- The research will likely lead to improved accuracy in designing products requiring heat resistance. By understanding the properties of stereocomplex PLA and its blending characteristics with rPET, designers can make informed decisions when developing non- woven fiber materials for PPE and other applications. The new information obtained from the study's characterization techniques will assist in optimizing the blend composition and processing conditions to achieve the desired performance and reliability
- The other benefits of this research include:
    - Contribution to sustainability: By utilizing PLA, a biodegradable polymer, and recyclable rPET, the study promotes environmentally friendly materials and reduces the reliance on conventional, non-biodegradable plastics
    - Diversification of applications: The development of heat-resistant PLA opens up new possibilities for its use in industries that require materials with enhanced thermal properties, beyond traditional applications
    - Industry advancement: The research can drive innovation in the field of polymer processing and composite materials, contributing to advancements in manufacturing techniques and product development
    - Economic impact: With the potential for a more efficient and sustainable material, industries can benefit from cost savings and reduced environmental impact, leading to a positive economic outcome

Biography

Graziella Saft is a Brazilian professional with a Master's degree in Materials Engineering and Technology. With over 12 years of experience in Research and Development (R&D), she specializes in the synthesis, formulation, characterization, and processing of thermoplastic polyurethanes. Her expertise also extends to polyureas and epoxy resins. Graziella possesses valuable knowledge in surface preparation techniques and applied rheology for coatings. Moreover, she has completed postgraduate studies in Project Management and currently works as a Researcher at PIEP – Innovation in Polymer Engineering.

IN-PERSON

Silvia Stifano[1]*, Ma Teresa Pellicer Martinez[1], Silvia Alonso de Castro[1], Aroa Duro Castano[1], Juan Jose Arroyo Crespo[1], Sergio Abad Fuentes[1], Maria Jesus Vicent[2], Marta Abellan Flos[1]

[1]Curapath, Paterna, Spain
[2]Polymer Therapeutics Laboratory, Centro de Investigacion Principe Felipe, Valencia, Spain

An alternative to krystexxa: Polysarcosine bioconjucation to uricase, biodistribution, toxicology and pharmacokinetics

PEGylation was one of the first successful technologies able to improve the pharmacokinetic of therapeutic agents and it has been applied in the clinic for more than 25 years. In early studies, PEG has been considered a biologically inert material. However, it can become immunogenic, resulting in the formation of specific Ab that cause rapid elimination upon repeated administration. This “Accelerated Blood Clearance” (ABC) phenomenon was observed in recent clinical trials as the case of Krystexxa, a recombinant mammalian Urate Oxidase (Uc) covalently conjugated to PEG (10 kDa), which was approved by the FDA in 2010 to treat refractive gout. This increasing awareness of anti-PEG antibodies generation is reflected in FDA calling for measurement of anti-PEG antibody responses in new drugs that incorporate PEG, as well as in researchers focusing on the use of alternative polymers. Here we use Polysarcosine (PSar), a non-ionic hydrophilic polypeptoid, as an alternative to PEG for protein conjugation, using Uc as a model protein. PSar has a highly hydrophilic character which results in a large hydrodynamic volume and a consequent resistance, as PEG, to protein absorption. Moreover, PSar is presented to be an excellent candidate to overcome PEG limitations, offering increased water solubility, immune evasion ability and low immunogenicity. Thus, in order to mimic Krystexxa conjugate, we synthesized a PSar 11 kDa, with a similar hydrodynamic volume as PEG 10 kDa, and then both polymers were conjugated to Uc undergoing the same bioconjugation process.

As a first approximation to validate our approach, polymer fate and toxicity of PSar(11kDa) and PEG(10kDa) were evaluated in a preclinically relevant model by Intra Venous injection (IV). The quantification of both polymers in key tissues and fluids was achieved, after extraction optimization, using GPC-RI-MALS and UPLC- MALDI-TOF systems. PSar did not produce, unlike PEG, any significant change in pro-inflammatory cytokines concentration. Moreover, its concentration in blood, after an initial decrease, remained constant until 4 hours from administration, unlike PEG that became undetectable during the same time, probably due to the ABC phenomenon. Additionally, both PEG and PSar were not detected in organs tissues with the exception of kidneys and livers for PEG.

Then, the two bioconjugates were characterized in terms of conjugation efficiency by TNBS assay, and residual Uc activity, by measuring the oxidation of uric acid to allantoin (UV-VIS). Afterwards, PEG-Uc and PSar-Uc half-lives were studied in rats' model after a single IV dose. The residual Uc activity was measured in plasma samples as previously described. Both PEG and PSar had a similar conjugation efficiency to Uc, 39 and 40 % respectively, which did not result in a significant decrease of protein activity for both conjugates. PSar-Uc showed a half-life increase (from 3 hours to 80 hours) compared to the native Uc, similar to that observed for PEG-Uc.

PSar not only had a similar behavior compared to PEG in terms of conjugation efficiency and ability to increase Uc half-life but also showed to be less immunogenic, confirming to be an excellent alternative to PEG.

Audience Take Away Notes

- Audience will become aware of the need to find PEG alternatives in clinic. It is important that academy gets aligned with market necessity in order to focus research on solving actual modern problems
- In this work, methods to extract both PEG and PSar and quantify them were developed. These results can totally be applied by other researchers for their studies in this field
- This job provides a solution to replace PEG in an approved product such as Krystexxa. The positive results obtained in terms of activity, biodistribution and toxicity show how this product is an alternative that, if further characterized, could be approved for clinical studies

Biography

Silvia Stifano is working as Quality Control (QC) Coordinator in Curapath, Spain. She graduated as MS in Chemistry from the university of Bologna (Italy) in 2019. In this same year she joined Curapath as QC technician and in 2020 she got a grant offered by the Spanish Ministry of Science Innovation and she is currently enrolled in the Chemistry PhD program in the University of Valencia focusing on the development of analytical methods for the characterization of nanoproducts.

IN-PERSON

I Anasiei[1]*, B A Serban[1], I C Badea[1], M T Olaru[2], D Mitrica1, M Burada[1], M. Ghita[1]

[1]Metal Resource Valorisation Technologies, National R&D Institute for Nonferrous and Rare Metals IMNR, 102 Biruinței, Pantelimon, Romania
[2]High PTMet Research Center, National R&D Institute for Nonferrous and Rare Metals IMNR, 102 Biruinței, Pantelimon, Romania

Development of a new material with enhanced properties for transportation industry application

Materials used in transportation industry have significantly evolved in the last decades, to face the society development challenges. Braking systems are considered an essential component of a vehicle and a wide range of materials are used in the manufacturing process, such as cast iron, aluminium based alloys, or composites. To reduce the environmental impact, materials should comply with 'safe – by – design' principles, by having a reduced content of critical metals or energetical consumption, low cost, improved recyclability, and a reduced amount of pollutant emissions generated during operation. Currently, there is a need to develop new materials with enhanced proprieties, to contribute to the implementation of climate neutrality concept, by decreasing harmful emission and stimulate circularity.

Complex Concentrated Alloys (CCAs) are a new category of materials, with a different synthesis strategy and a near – equal equimolar concentration for each element, that possess superior properties compared with the conventionally used materials.

To identify the most suitable complex concentrated alloys compositions for brake system applications, special simulation techniques are used. In this context, thermodynamic and kinetic criteria and analysed, using Metalmix program, followed by MatCalc simulations, that provide information regarding the internal structure of the new CCAs. The modelling instruments have a significant contribution in designing new materials with reduced environmental footprint and extended life cycle for the desired applications.

Keywords: Complex Concentrated Alloys, Modelling, Environmental Impact, Transportation Industry.

Acknowledgments: This work was supported by research grants from the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI–UEFISCDI, project numbers: ERANET-M-COM□TRANS-1, within PNCDI III.

Audience Take Away Notes

- The audience will learn how the complex concentrated alloys can replace the conventional alloys used in transportation industry
- The modelling process importance is an important step in the optimisation process used in wide industrial domain area
- The way we can reduce the environmental impact and the extended life cycle of final product
- This research will provide a new perspective to reduce content of critical metals and energy consumption in order to enhancing the ecological integrity

Biography

PhD Student Ioana Anasiei is working as a scientist in National R&D Institute for Non – Ferrous and Rare Metals, Romania, and the main expertise domain consists in non – ferrous metallurgy. The obtaining and recovery of non – ferrous alloys are considered the basic interest, along with applying the concepts related with reducing the environmental impact, from the design stage of the new materials. Ioana Anasiei has a valuable experience in thermodynamic and kinetic modelling of alloy systems and synthesis processes. The PhD thesis of Ms. Anasiei is focused on developing new materials with reduced environmental footprint for transport industry applications.

IN-PERSON

Wilber Ortiz Lago
University of Puerto Rico Rio Piedras, Puerto Rico

Two-dimensional hexagonal boron nitride nanosheets decorated with silver nanoparticles for high-performance, self-powered, super-broad band UV-visible photodetectors

Two-dimensional (2D) hexagonal Boron Nitride Nanosheets (BNNSs) decorated with Silver Nanoparticles (AgNPs) were the first to report on its potential application for high-performance photodetectors in a wide range of wavelengths, from the UV to the visible spectra. The present BNNS were grown in an argon gas environment by Pulsed Laser Deposition (PLD) technique on the SiO2/Si substrate, while AgNPs were obtained from liquid exfoliation via a direct dispersion and ultrasonication method. Using the spin-coating technique, AgNPs were deposited on the BNNS thin film. Scanning Electron Microscopy (SEM) and Energy-Dispersive X-ray analysis (EDX) confirmed the formation of AgNP-BNNSs with good dispersion stability, where incorporation of AgNPs on BNNSs provided a molecular platform for the development of new 2D BNNS-based hybrid nanomaterials. The obtained sample seems to be highly efficient in photoelectric conversion since the photodetector based on Au/AgNP-BNNSs/Au lateral junctions reached a responsivity of 1.69 mA/W at zero bias and 354 mA/W at 0.6 V under the Ultraviolet (UV) light illumination of 1.2 mW/cm2 at 254 nm. Instead, when exposed to visible light of 670 nm, the electrical output per optical input reached a responsivity rate of 29.1 mA/W at a bias voltage of 1.8 V, with an incident light intensity of 4.1 mW/cm2. Therefore, the present 2D nanosheets decorated with AgNPs exhibit high photon absorption in a wide range of spectra from visible to UV spectra.

Biography

Wilber Ortiz Lago is graduate of the University of San Antonio Abad del Cusco, Peru, with a Bachelor of Science degree in Physics. He then completed his master's degree at the University of Puerto Rico-Mayaguez (UPRM) in the field of high-energy physics. The Fermi National Accelerator Laboratory (Fermilab) in Illinois, USA was the place of his research. He received MS degree in 2018 at the same institution. He continued with the PhD program in Chemical Physics, where he conducted research on applications of two-dimensional materials in self-powered photodetectors and gas sensors. He was defended his doctoral dissertation on August 22, 2023.

IN-PERSON

T A Gavasheli[1]*, G I Mamniashvili[2], T O Gegechkori[2]

[1]Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia
[2]Ivane Javakhishvili Tbilisi State University Andronikashvili Institute of Physics, Tbilisi, Georgia

Influence of an additional magnetic video-pulse on the nuclear spin echo of nuclei located in the domain walls of magnets

The influence of an additional magnetic video-pulse on the nuclear spin echo in magnets is studied (on the example of cobalt micropowder and lithium-zinc ferrite) in two cases of its location relative to the second RF pulse, symmetrical and non-symmetrical. In the first case, the decrease in the echo intensity is explained by the successive excitation of nuclei that abruptly change their position in the domain wall, and in the second case, due to the anisotropy of the hyperfine field. The effect of domain wall pinning on the dependence of echo signals on the amplitude and duration of a magnetic video-pulse is studied for the first time within the entire NMR spectrum of nuclei in domain walls.

Acknowledgment: This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSFG) Grant # FR-22-7899.

Keywords: The nuclear spin echo, magnetic video-pulse, lithium ferrite, cobalt, domain wall mobility, pinning.

[1]. T.Gavasheli, G.Mamniashvili, G.Ghvedashvili, T.Gegechkori, “NMR spin-echo study of the domain wall pinning in cobalt micropowders. Proceedings of 2022 IEEE 2nd Ukrainian Microwave Week (UkrMW) 2022 Nov 14 (pp. 405-409). IEEE.

[2]. G.I.Mamniashvili, T.O.Gegechkori, “Investigation of the characteristics of domain wall fixation centers in cobalt by the nuclear magnetic resonance method”, J. Appl. Spectrosc. Vol. 89, No. 6, pp. 1076-1079 (2023).

Audience Take Away Notes

- In this work, we study the nature of the NMR line from nuclei in the domain walls of the Face-Centered Cubic (FCC) phase of cobalt
- It has been found that the width of the NMR line is mainly due to the anisotropic component of the hyperfine field at the nuclei
- The dependence of the pinning force of domain walls along the NMR spectrum of nuclei from the domain walls of fcc phase is studied in the case of symmetric and asymmetric action of a Magnetic Vileo-Pulse (MVP)
- It is shown that the pinning force does not depend on the nature of the MVP effect on the spin echo and it is maximum at the center of the NMR line, where the MVP effect is minimal
- In addition, it is shown that, along the NMR spectrum, the pinning force of the domain walls of the sample is inversely proportional to the MVP duration

Biography

Dr. T A Gavasheli1 of Physical-Mathematical Sciences, Ph.D. (1995). Chief Specialist at TSU Department of Scientific Research and Development (since 2011). Associated Professor of Faculty of Exact and Natural Sciences (since 2012). More than 30 years of teaching experience at the Faculty of Exact and Natural Sciences of TSU. 20 years' experience in research project management/execution (international and national).12 years' experience in research administration, research data processing and analysis. Author of more than 60 publications. IEEE Member (since 2014). Member of International EPR Society (since 2002). Member of AUTM (Association of University Technology Managers, since 2014).

IN-PERSON

Simona Ravaszova*, Karel Dvorak

Brno University of Technology, Faculty of Civil Engineering, Institute of Technology and Building Materials and Components, Veveri 331/95, 602 00, Brno, Czech Republic

Effect of preparation of raw material mixture on purity of tricalcium aluminate through solid state synthesis

In the cement industry, refined fuels are increasingly being replaced by alternative fuels. This replacement not only brings economic and ecological benefits but also a lot of technological problems, which consist in increasing the content of some chemical elements that cause variability in the mineralogical composition. This is subsequently reflected in the properties of Portland clinker. The synthesis of pure clinker minerals is therefore crucial both for the study of their behaviors in industrially produced cement and for the preparation of analytical standards for the identification of minerals through XRD.

The research goal is focused on preparing the pure clinker mineral tricalcium aluminate in laboratory conditions using a simple laboratory methodology using solid-state synthesis. It closely monitors the effect of the raw material mixture homogenization process on the purity of the prepared mineral. A high-speed Pulverisette 6 planetary mill and 2 types of grinding bodies were used to homogenize the tricalcium aluminate raw material mixture. A corundum grinding capsule with corundum grinding bodies to prevent contamination by foreign ions and a very efficient steel grinding capsule with steel grinding bodies were used. The raw material mixture was fired at 6 different temperatures from 1200 to 1450 °C, and the prepared mineral's purity was quantified using Rietveld analysis. The results of laser granulometry show that in both cases of grinding, there was a very similar comminution of the raw material. Iron contamination based on XRF analysis was shown to be minimal at only 0.21%. The highest purity of 97.6% C3A was achieved at a temperature of 1450 °C when grinding in a steel grinding capsule, 2.4% represents unreacted lime. When grinding in a corundum capsule, a purity of the mineral of 93.6% was achieved with a residue of the mineral mayenite of 2.2% and lime of 3.8 The reason may be the insufficient degree of comminution of the raw material in the corundum capsule. On the other hand, a slight iron contamination during the grinding of raw material mixture had a positive effect on the purity, where the iron acted as a flux and caused a better reaction of the mineral mayenite.

Audience Take Away Notes

- The audience will be introduced to a very simple methodology for the preparation of clinker mineral through solid state synthesis
- Demonstration of the importance of the preparation process within the homogenization of raw material mixture for solid state reactions
- This method is easily reproducible and can be used in the preparation of other clinker minerals in laboratory conditions

Biography

Simona Ravaszova studied Physical and Building Material Engineering and graduated in 2018 from the Brno University of Technology. She received her PhD degree at the age of 31 in 2022. She works as an Assistant Professor at the Institute of Technology and Building Materials and Components at the same university. She is the author and co-author of some impactful articles. Her research is focused on the field of laboratory preparation especially of clinker minerals as analytical standards for identification using X-ray diffraction analysis.

IN-PERSON

Andrey Rabin[1]*, Gedalya Mazor[2], Izhak Ladizhensky[2], Roni Zvi Shneck[4]

[1]The Materials Engineering Department, Ben-Gurion University of the Negev, David Ben Gurion Blvd 1, Beer-Sheva, 84105 Israel and with the Nuclear Research Center Negev (NRCN), Beer-Sheva 84190, Israel

[2]The Mechanical Engineering Department, Shamoon College of Engineering, Haim Nachman Bialik St 56, Beer-Sheva, 84100, Israel

[3]The Materials Engineering Department, Ben-Gurion University of the Negev, David Ben Gurion Blvd 1, Beer-Sheva, 84105 Israel

Mechanical properties and microstructure of AISI D2 tool steel cryogenically treated using controllable cooling

The present work describes an approach to enhance the rate of heat transfer during cryogenic quenching of steel, which is environmentally friendly and low-cost. The approach is based on creating a temporary porous layer made of magnesium sulfate. The role of the layer is to decrease the temperature at the contact between the liquid nitrogen and the hot treated workpiece due to the low conductivity of the magnesium sulfate. The porous layer generates multiple nucleation sites of nitrogen bubbles and increase the rate of bubble formation, which physically breaks the film of steams on the surface. In this way the transition and the film boiling regimes shorten or even been eliminated, thus improve the contact with the liquid.

The properties and microstructure, hardness, hardenability and dry abrasive wear of an AISI D2 steel were studied after air and water quenching (conventional treatment), direct liquid nitrogen quenching (deep cryogenic heat treatment) and rapid deep cryogenic heat treatment by creating a temporary porous layer based on magnesium sulfate.

The experiments showed an increase in the cooling rate at cryogenic temperatures by using the temporary porous layers. The enhanced cooling rate (in the austenite-martensite transformation range) gave rise to a decrease of the amount of the retained austenite and an increase of the observed hardness of the steel.

Audience Take Away Notes

- Porous coating layer is increasing the heat flux (cooling rates) at cryogenic temperatures
- The investigated cryogenic treatments (primary or supplementary) using temporary coatings increase the fraction of martensite and improves hardness (in particular surface hardness, 62HRC 68HRC)
- Investigated treatment improves the environmental safety and industrial (economical) process efficiency:
    - Low cost and environmentally safe material
    - Coating creation and removal method is very simple and cheap
    - The coating process is adjustable for different steels, shapes and dimensions of the workpiece
    - Contribute to an increase in the hardness of existing steels or allow the use of less alloyed steels with the same mechanical properties

Biography

Mr. Rabin studied Mechanical Engineering at Shamoon College of Engineering, Beer-sheba, Israel and graduated as B.Sc in 2014. He then joined the research group in heat transfer and numerical calculations at the same institute. He received his M.Sc degree in Material Engineering at Ben Gurion University of the Negev, Israel in 2023.

IN-PERSON

Petra Lacikova*, Adam Betak, Jan Vanerek[1]

Istitute of Technology of Buildings Materials and Components, Brno University of Technology, Faculty of Civil Engineering, Veveri 331/95, 602 00 Brno, Czech Republic

Durability aspects of filled wood cracks with different types of adhesives and sealants

Oversized cracks in wood reduce the strength and stability of structures. Cracks can be mechanically stabilized (e.g. by steel fasteners) or can be filled with sealants. The aim of this work was to verify the durability of selected commercial adhesives and sealants. For this experiment, two wood adhesives (epoxy resin, polyurethane /PUR/ adhesive) and two sealants (MS polymer sealant, polyurethane sealant) were selected. The glued joints for the determination of shear compression strength using all the selected adhesives and sealants were prepared from spruce wood. Before the strength determination, the specimens were soaking in cold water (for 96 hours); and in boiling water (6 hours in boiling and 2 hours in cold 20°C water), after this treatment, the acclimatization as a reference sample was provided. Reference samples were stored at 20 °C and 65% relative humidity for one week. Moreover, the shear area was visually analysed and the percentage of adhesion failure at the interface of adhesive-wood was evaluated.

Significantly higher strengths were achieved with both representatives of the adhesives for reference samples; for PUR in an amount of 1.5 MPa and for epoxy resin 1.6 MPa. For epoxy adhesive, the adhesion failure of 85% and for PUR adhesive the failure of 70% was reached. The used sealants achieved too low strengths, for the MS polymer the lowest strength of 0.1 MPa was achieved after 96 hours in cold water, for the polyurethane sealant the lowest strength of 0.2 MPa was determined for reference. Almost 100% adhesion failures in all environments were achieved for both tested sealants. After exposure in boiling water, the highest decrease in strength was recorded for epoxy adhesive of almost 50% compared to the reference. A decrease in strength of 37% was recorded for the PUR adhesive. The strength behaviour of both the sealants reached almost the same values as the reference sealants.

For the epoxy resin, due to its low viscosity, the possibility of filling was verified. The tensile properties of non-filled reference and filled epoxy by different fillers were determined on dog bone samples (type 1B, according to EN ISO 527-2). As the fillers, cotton flakes (in the amount of 10% and 20% of resin) and spruce sawdust (in the amount of 10%, 20% and 30% of resin) were chosen. The maximum fibre length for cotton flakes is 0.5 mm and width 0.025 mm, for spruce sawdust the maximum particle size is 0.5 mm. The average values of tensile strengths for epoxy adhesive with fillers slightly decrease compared to the reference in all cases. The reference achieved strengths of 27,7 MPa. For epoxy filled with cotton flakes, the highest strength was 26.7 MPa at 10% fill, and for spruce sawdust 25.7 MPa at 20% fill.

Biography

Petra Lacikova studied Civil Engineering at the Brno University of Technology in the Czech Republic, and in 2022 she received her master´s degree in Buildings Materials and Technologies. Currently, she is a PhD student in the discipline of Physical and Building Materials Engineering at the same institution. She is starting a research activity and has already published a few scientific articles as an author and co-authors too. Her research is focused on wooden structures, and structural adhesives for wood using natural fillers and fabrics to change the mechanical properties of wooden glued joints.

IN-PERSON

Hao Chuan Yang[1], Jing Shan Do[1], Wen Chieh Wu[2], Chen Hui Chang[2], Po Yen Wu[2], Man Ling Huang[2], Ci Jie Jhang[2], Mei Yi Liu[2]*

[1]Department of Chemical and Materials Engineering, National Chin-Yi University of Technology, Taichung, Taiwan
[2]Intelligence and system R&D service department, Metal Industries Research & Development Centre, Taichung, Taiwan

Electrorecovery of high purity Cu from the electrotronic waste water

Due to the simple equipment and uses of minimal chemicals of electrodeposition, the high purity copper recovered from the wastewater containing copper ions is investigated by the cathodic depostion. Using Cu plate as the working electrode, the onset potential for cathodic reduction of 5000 ppm Cu^{2+} is 0.07 V (vs. Ag/AgCl/3 M NaCl(aq)). The electrodeposition of Cu^{2+} is located in the kinetic, mixed and mass transfer control regions for the potential ranges of 0.07 ~ 0.04, 0.04 ~ -0.15 and less than -0.15 V, respectively. Increasing the current density from 0.375 to 1.0 mA cm^{-2} the current efficiency for electrorecovery of cupper in 5000 ppm Cu^{2+} stagnant aqueous solution is increased from 87.17 to 96.46 %. Based on the SEM images, a compact Cu deposit composed with 1 ~ 5 μm particles is obtained from the cathodic deposition of 5000 ppm Cu^{2+} in the 0.1 M H_2SO_4 aqueous solution with the current density of 0.5 mA cm^{-2}. The surface morphologies and the XRD spectra of Cu deposit is not affected by the presence of 20 ppm Ni^{2+} and 10 ppm Zn^{2+} in the aqueous solution. In the presence of 20 ppm Ni^{2+} and 10 ppm Zn^{2+}, the high purity cupper deposit can be electrorecovered, because Ni and Zn are undetectable in ICP analysis.

Audience Take Away Notes

- Using Cu and graphite plates as working and counter electrodes, Cu ion can be reduced for potential less than 0 V based on the results from CV and polarization curve experiments. The electrorecovery of Cu ion from 0.1 M H_2SO_4 aqueous solution is controlled by the kinetic of electrode surface, mixed kinetic and mass transfer control and mass transfer from bulk solution to electrode surface for the potentials of 0 ~ -0.1, -0.1 ~ -0.3 and less than -0.3 V, respectively
- When the electrorecovery of Cu ion is set at kinetic controlled region, increasing the current density from 0.375 to 1.0 mA cm^{-2} the current efficiency increases from 87.17 to 96.46 %
- The current efficiency is slightly decreased for the solution agitated by introducing N_2 gas into the solution
- A compact Cu deposit composed with 1 ~ 5 μm particles is found in the SEM images for recovering Cu^{2+} from the solution
- Based on the XRD, EDS and ICP-OES analysis, the co-deposited Ni and Zn is not found when the electrorecovery of Cu^{2+} from the solution in the presence of 20 ppm Ni^{2+} and 10 ppm Zn^{2+}

Biography

Mei-Yi Liu works in the Electrochemical Technology Team at the Metal Industries Research and Development Centre. During her tenure, she has been involved in the development of various technologies, including solid state electrolytic polishing, Electrochemical Machining (ECM), Electrochemical Grinding (ECG), Plasma Electrolytic Polishing (PEP), and electrolytic recovery of copper. Mei-Yi Liu has also published papers and holds patents.

IN-PERSON

I C Badea[1]*, B A Serban[1], M T Olaru[2], I Anasiei[1], D Mitrica[1], M Burada[1], A I Matei[1]

[1]Metal Resource Valorisation Technologies, National R&D Institute for Nonferrous and Rare Metals IMNR, 102 Biruintei, Pantelimon, Romania
[2]HighPTMet Research Center, National R&D Institute for Nonferrous and Rare Metals IMNR, 102 Biruintei, Pantelimon, Romania

A reflection on the recovery process of primary components from lithium-ion batteries

Lithium – ion batteries are considered a popular form of energy storage, with desirable properties, such as increased efficiency or high energy density. The demand for new generation batteries has increased in the recent years, because of the significant progress that electric vehicles have. Therefore, reducing the environmental footprint is an important strategy that should be considered in the designing stage of new materials manufacturing. The development of new components for lithium – ion batteries has as main purpose the life – cycle extension and recyclability improvement, to reduce the wastes generated by end – of – life products.

But an inconvenient that Li – ion batteries industry is currently facing is the wastes amount generated up to now. The recovery of primary components from these spent products is an important stage in reintroducing a significant amount of materials into the economic circuit and therefore, to improve circularity.

This paper is focused on the recovery of lithium from potential secondary sources and bring a contribution on reducing the amount of not recovered wastes. In this context, specific recovery methods are considered, including the combustion synthesis, whose main advantages are: the increased efficiency, rapidity of process or obtaining high purity products.

Acknowledgements: This work has received funding from the Horizon Europe program, grant agreement number 101069789: project RELiEF – Recycling of Lithium from secondary raw materials and further, and Core Program within the National Research Development and Innovation Plan 2022-2027, financed by MCID, project no. PN 23 25 01 03.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Health and Digital Executive Agency (HADEA). Neither the European Union nor the granting authority can be held responsible for them.

Funded by the European Union

Audience Take Away Notes

- The audience will better understand the environmental footprint concept and will be able to apply the information in everyday activities
- The audience will identify more easily the possibilities of designing new materials with enhanced properties and lower environmental impact

- Awareness of the anthropogenic impact and recycling processes on natural resources and climate changes
- The presented information will help the audience in their job by applying the circular economy concepts in all the industrial domains and research fields, by highlighting their benefits
- Data presented in the paper will provide a practical solution to the recovery of lithium from potential secondary sources

Biography

Drd. Ioana-Cristina Badea is involved in the investigation of multi-component alloys. She holds a BSc and an MSc degree from the Faculty of Materials Science and Engineering at the University "Politehnica" of Bucharest and is currently pursuing doctoral studies at the same institution, with a PhD thesis in the field of complex alloys. Mrs. Badea was involved in 9 national and international research projects correlated with complex alloys composition architecture, manufacturing processes, thermal treatments, characterization methods and structure optimization. Eng. Badea activities were also related to MatCalc thermodynamic and face field modelling and involves the publication of over 10 scientific papers.

IN-PERSON

Mona Mihailescu[1]*, Ionela Irimescu[2], Mihaela Deaconu[3,4], Nicolae Tarba[5], Simona Ionita[4], Roxana Popescu[6,7], Daniela Berger[4], Diana Savu[6], Eugen Scarlat[1]

[1]Centre for Research in Fundamental Sciences Applied in Engineering, Holographic Imaging and Processing Laboratory, Physics Department, Politehnica University Bucharest, Bucharest, Romania
[2]Applied Sciences Doctoral School, Politehnica University Bucharest, Bucharest, Romania
[3]CAMPUS Research Institute, "Politehnica" University of Bucharest, Bucharest, Romania
[4]Department of Inorganic Chemistry, Physical-Chemistry & Electrochemistry, "Politehnica" University of Bucharest, Bucharest, Romania
[5]Computer Science Doctoral School, Politehnica University Bucharest, Bucharest, Romania
[6]Department of Life and Environmental Physics, "Horia Hulubei" National Institute for R&D in Physics and Nuclear Engineering, Reactorului street, 30, 077125, Magurele, Romania
[7]Department of Bioengineering and Biotechnology, Department of Science and Engineering of Oxide Materials and Nanomaterials, Politehnica University of Bucharest, Bucharest, Romania

Mesoporous silica nanoparticles detection and quantification in cultured cells using hyperspectral imaging

The use of different types of Nanoparticles (NPs) in biology, medicine, or other life sciences has a special development in recent years. The main challenge consists in understanding the interaction between nanoparticles and different biological components, going down to the subcellular level. This depends on NPs parameters (like chemical structure, shape, size, area, surface charge), as well as on cell type. The final destination of the NPs in living organisms is monitored by different techniques: electronic microscopy, atomic force microscopy, confocal microscopy, fluorescence microscopy. In this way are investigated different biophysical aspects of cell's behaviour, the NPs traffic inside the cells, their final destination, changes in the cells functionality, the compartments where the NPs accumulation is significant, or other phenomena.

In this regard, we used hyperspectral imaging to investigate interaction between mesoporous silica nanoparticles functionalized with organic groups coated or no with a biopolymer and two tupes of cell lines: normal skin fibloblast BJ cell line and breast ductal carcinoma BT747 cell line. Cultured cells were prepared using standard protocols. Our goal is to observe the cytotoxic effect of these types of nanoparticles on normal and malignant cells. Their preferential accumulation inside cells was quantified by hyperspectral images processing.

We used the Cytoviva system working in the dark field configuration equipped with the hyperspectral module to record images on two categories of samples: 1) the calibration sample (consisting of mesoporous silica NPs in culture medium) which allows recording the characteristic scattering spectrum of each type of NPs, and 2) the cellular sample (consisting of cells incubated without/with mesoporous silica NPs). The specific spectral fingerprint of each type of NPs dispersed in the culture medium is saved as spectral library and subsequently used to identify the NPs in cells by running the built-in Spectral Angle Mapper (SAM) under Environment for Visualizing Images (ENVI) software.

We developed specific home-made MATLAB scripts to process images with the aim to compute relevant parameters for establishing the density of nanoparticles inside the cells. Thanks to the improved dark field system, cell details and edges appear very bright in hyperspectral images, on an almost zero background. In the first step, the images are segmented on singular cells or into groups of cells using an adapted procedure based on OUTSU method. This allows us to automatically calculate the area of the cells in the

focused cross-section and then the fraction occupied by NPs. Distances from the nucleus of different NPs aggregates is computed. Comparisions between different types of functionalized NPs internalization in the two cell sublines were realized.

In conclusion, we will present our contribution to the preparation of new types of functionalized NPs, their scattering spectral fingerprint, and the results from the scripts developed by us regarding the area occupied by nanoparticles and the distances to the nucleus of internalized NPs aggregates.

Audience Take Away Notes

- The audience will be able to use information about the enhanced darkfield microscopy, hyperspectral imaging, automated images processing
- Enhanced darkfield microscopy, hyperspectral imaging can be used to observe large fields of cells after they have been incubated with nanoparticles
- Hyperspectral images from the presentation could be used to explain darkfield technique. Scattering spectral profiles could be used to explain the usefulness of spectroscopy in chemical identification
- The work of designers of functionalized nanoparticles is made easier if cell cultures incubated with nanoparticles are observed by a fast, efficient and low-cost optical method, and hyperspectral imaging under darkfield microscopy satisfies this need
- Our scripts design ensures results that are obtained automatically in a short time by evaluating hundreds of images

Biography

Dr. Mihailescu studied Physics at the Bucharest University, Romania, graduated as MS in 199, received her PhD degree in 2007 at Politehnica University Bucharest and now she is Associate Professor at the same university. She developed the first laboratory from Romania in digital holographic microscopy, to investigate cultured cells and compute specific parameters like refractive index, dry mass, dry mass density at cellular level, NPs densities inside cells, NPs uptake efficiency. Now, she is involved in many projects aiming at the development of image processing interfaces that calculate parameters of biological interest. She has published more than 110 research articles in SCI(E) journals, has more than 540 citations (without self- citations) and h-index 15.

IN-PERSON

Mona Mihailescu[1,2], Eugen Scarlat[1], Denis Panaitescu[3], George Bostan[4], Raluca Gabor[3], Vlad Melu[4]

[1]Centre for Research in Fundamental Sciences Applied in Engineering, Politehnica University Bucharest, Bucharest, Romania
[2]Holographic Imaging and Processing Laboratory, Physics Department, Politehnica University Bucharest, Bucharest, Romania
[3]National Institute for Research in Chemistry, Bucharest, Romania
[4]OPTOELECTRONICA 2001 SA, Magurele, Romania

Nanometric structures on holographic labels imprinted via biodegradable polymers

Holographic Labels (HL) are smart elements used to secure important documents, credit cards, banknotes, passports, deluxe products. HL have several characteristics that give them the advantage of being difficult to counterfeit due to the combining of several complex scientific knowledge in their design and fabrication processes, as well as expensive equipment for manufacturing and detection. They contain many graphical structures visible by human eye by diffraction in white light (solar light, artificial illumination), but also many submicronic or hidden structures revealed only with sophisticated instruments like microscopes, lasers or ellipsometers.

To increase the security level of HL, we introduced a new security element as diffractive optical element designed with quasiperiodic structures divided in fine structures. The optical effect that forms the desired image in the far field is part of the "hidden image" category and is only visible using a laser that illuminates the structures. In the design process, we divide the quasiperiodic structures resulted from Iterative Fourier Transform Algorithm into fine structures with submicronic dimensions. In this kind, the "hidden image" effect can be formed at certain desired angles and is doubled. Thousands of millions of HL are produced annually, each series containing different security elements. Their fabrication process starts with a master produced by laser modulation in a photoresist on glass plate and ends with a polymeric plate which contains the microrelief to be finally embossed on an aluminium foil, i.e., the commercial product. It follows that many polymeric plates are used at every series of HL. For this reason, we replaced polymeric plates with biodegradable polymer plates.

The subsequent technology for imprinting HLs on the final foils is based on transparent, re-usable, eco-friendly biodegradable polymer plates, ensuring the faithful transfer of the submicrometric structures for the correct formation of the optical images and effects. To establish the optimal technological parameters (temperature, pressure, duty cycles) we have tested several variants in the laboratory using dynamic mechanical and thermal analyses. The full investigation of the submicrometric structures was achieved by introducing specific characterization procedures. We used hyperspectral imaging under enhanced darkfield microscopy for transversal characterization of nanometric details. Interference phase microscopy gives us the depth of the submicrometric structures with nanometres resolution.

In conclusion, we introduced submicrometric details designed as fine structures to increase the security level of HL, and we have greened the manufacturing technology by introducing biodegradable polymers that can be reused, ensuring the reliable transfer of submicrometric structures to accurately generate the optical images and effects.

Audience Take Away Notes

- The knowledge about holographic labels can be used to explain the visual effects formed by illuminating with white light the labels sticked on cigarette packs (for examples)
- Technological process to fabricate submicrometric structures via biodegradable polymeric plates can

help to green other production processes as well

- Iterative Fourier Transform Algorithm can be used in explanations at faculties for the design of quasi-periodic structures of diffractive optical elements
- Practical solutions are to increase the security level of holographic labels and to fabricate them using more appropriate eco-friendly technology
- Nanometric structures design and their evaluation by enhanced darkfield microscopy increases the degree of security in HL

Biography

Dr. Mihailescu studied Physics at the Bucharest University, Romania, graduated as MS in 199, received her PhD degree in 2007 at Politehnica University Bucharest and now she is Associate Professor at the same university. She developed the first laboratory from Romania in digital holographic microscopy, to investigate cultured cells and compute specific parameters like refractive index, dry mass, dry mass density at cellular level, NPs densities inside cells, NPs uptake efficiency. Now, she is involved in many projects aiming at the development of image processing interfaces that calculate parameters of biological interest. She has published more than 110 research articles in SCI(E) journals, has more than 540 citations (without self- citations) and h-index 15.

BOOK OF ABSTRACTS

magnus Group

25-27 SEPT

DAY 02

KEYNOTE FORUM

5TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

Development of next-generation process for effective utilization of low-grade aluminum dross to achieve carbon neutrality

Aluminum dross generated from scrap aluminum still involves considerable amount of metal aluminum with impurities of aluminum oxide, spinel, aluminum nitride, and so on. It is necessary to recover the metal aluminum and also to utilize the impurities. This paper introduces the total process to treat the aluminum dross, which involves the multi-stage unit operations, such asmutual separation of scrap aluminum into wrought aluminum, casting aluminum, other impurities for optimizing the following melting process in a reverberatory furnace by using LIBS, Lasor Induced Breakdown Spectroscopy, sorting, separation of aluminum dross generated in the stage(1) into high-grade metal aluminum concentrate and low-grade metal aluminum tailing by combining the methods of selective grinding, sieving, eddy current separation, recovery of pure metal aluminum from the high grade metal aluminum concentrate by metal reclaiming machine, production and purification of green hydrogen and ammonia from the low grade metal aluminum tailing by alkaline leaching, production of catalyst support from the residue of the stage by firing and compression molding, and LCA, Life Cycle Assessment, of the total process.

This paper also describes the major results in the stage of (1) and (2), which indicates the possibility of mutual separation of aluminum alloys and impurity other metal/non-metal phase by LIBS sorting and selective grinding of metal aluminum alloys and oxide/nitride impurities by combining a vibrating rod mill, sieving, and eddy current separation. This process could utilize most of the components in the aluminum dross as high-grade raw materials, such as metal aluminum, hydrogen, ammonia, and catalyst support. This process also could reduce huge amount of CO_2 emission to produce the above high quality raw materials.

Audience Take Away Notes

- Total utilization process of aluminum dross which is usually troublesome and sometimes hazardous
- They might catch a novel treatment process of utilizing aluminum dross by combining various physical treatment processes which require less energy compared with chemical processes
- We will provide a new concept on the materials recycling by using physical separation technologies.
- Physical separation technologies require much lower energy and cost in the process compared with chemical one, then, it contributes much to save energy and cost in practical plants

Shuji Owada[1]*, Michinori Sugawara[2], Takeshi Mizutani[3], Haruhiko Yasuga[4], Naohiro Shimoda[5], Motoshi Muraoka[6]

[1]Department of Resources and Environmental Engineering, Faculty of Science and Engineering, Waseda University, Professor, Tokyo, Japan

[2]ESG Office, Suzuki Shokai Co., Ltd

[3]Research & Development Laboratory for Steel, Asahi Seiren, Co., Ltd

[4]Business Department, Sumiko Air Co. Ltd

[5]Department of Applied Chemistry, Graduate School of Technology, Industrial and Social Sciences, Tokushima University

[6]NTT Data Institute of Management Consulting, Inc

Biography

Shuji Owada got the Doctor of Engineering at Waseda University in 1984, and became a full professor of the sane university in 1995 after being research associate, lecturer, associate professor. In the university he was assigned to many posts, President of Research Collaboration and Promotion Center, Vice-Dean of School of Science and Engineering twice, etc. Outside the university, he experienced many roles, such as president of several

- List all other benefits
    - Our research group is now trying to construct a commercial plant using this process and we believe this process will contribute much for establishing a practical and effective utilization of aluminum dross

academic institutes and chairman of many governmental councils. He published over 100 original papers and made over 700 presentations in domestic and overseas in the field of resources recycling and mineral processing.

Highly selective PPM level LPG sensors based on SnO_2-ZnO nanocomposites operable at low temperature

The nanoscaled SnO_2, ZnO and SnO_2-ZnO nanocomposite powders were prepared by microwave assisted ultrasonication technique by employing centrifuge for collection of dry powders of the materials. Fabrication of the thick films of the pure ZnO and SnO_2-ZnO nanocomposite powders were made by simple technique of screen printing, which involves high temperature firing (450°C) for 30 min duration. The morphologies and topographies of surfaces of various samples, the composition of elements in the synthesized materials as well as crystallographic structure of the pure and doped ZnO powders were studied by the FE-SEM, EDS and XRD techniques, respectively. It has been found that the SnO_2 doped ZnO (1 wt%) nanocomposite thick film exhibits crucial response to 100 ppm LPG at 50°C and 100°C. The electrical and gas monitoring characteristics of the pure and SnO_2 doped ZnO nanocomposites have been also studied in detail.

Audience Take Away Notes

- Awareness will be developed among the audience for the leakage of LPG at kitchens and industries
- Audience will be able to learn about the synthesis of bulk and nanomaterials, their applications in the field of LPG sensing in detail
- Audience will introduce the pollution control, if they know well about the gas sensing, they will be made aware about the hazardous effects of toxic and polluting gases. Audience will be alert in their job from getting knowledge from this presentation. Sure, other faculties or researchers will be able to use this technology in their study, teaching and research. I will help them those who want to do the further work at totally free of cost

Patil Devidas Ramrao*, Snehal D Patil

Bulk and Nanomaterials Research Laboratory, Department of Physics, Rani Laxmibai Mahavidyalaya, Parola, Dist. Jalgaon, MHS, India

Biography

Dr. D. R. Patil is the Recognized Research Guide and Director Head of the Bulk and Nanomaterials Research Laboratory, Parola, India, Life Member of Indian Science Congress Association Kolkata, Indian Association of Physics Teachers Dehradun, Society for Materials Chemistry BARC Mumbai, Crystal Research Society, Chennai, Asian Council of Scientific Editors Dubai, Full Member of American Nano Society, etc. His topics of interest are: semiconducting and ceramic gas sensors, photoconducting and photo luminescent materials, nanomaterials, thin and thick film Physics, food freshness, disease diagnosis, etc. He is working as a reviewer for the most reputed journals from Elsevier, ACS, etc. As well as for few international events. Numbers of research scholars across India are working in his laboratory under his supervision. He delivered more than 85 scientific talks in various national and international events. He is fully engaged in research activities in nanotechnology. He is working as the regional editor of the journal "Current Nanotoxicity and Prevention", USA, Senior Editor of IJRST, India, and TPC member and Reviewer of various international events at USA, Italy, South Korea, Spain, India, etc.

The role of anions in dopant activated inorganic host materials for its luminescence characteristics

This work is inspired by the comprehensive work done by my research group with respect to improving the efficiency white light emitting diodes compared to the commercially available phosphor materials. Anions of the form BO_{33}-, PO_{43}- and SO_{42}- play a crucial role in the luminescent characteristics of various host materials through the emission of light that results through electronic transitions of the various co-dopants. Individually, borate ions (BO_{33}-) which consists of centrally situated boron atoms, is surrounded by 3 oxygen atoms, which can act either as a sensitizer or an activator in various host lattices, by absorbing the excitation energy and transferring it to the luminescent center or to the dopants,thereby bringing about enhanced luminescent characteristics observed. Phosphate (PO_{43}-) ions on the other hand, with its diverse tetrahedral structure is most widely used as an anion that influences the local environment of the host material and its luminescent characteristics. The last anion, sulphate (SO_{42}-) ion also influences the crystal field environment of the host material, acting as a charge compensator that prevents structural defects and luminescence quenching effects of the phosphor material. Various host materials such as Y_2O_3, ZnO, $ABPO_4$, $ABSO_4$ (A = alkaline metal ions, B = alkaline earth metal ions) are considered for embedding of these anions. The addition of dopant ions together with these anions play a crucial role in tuning the various visible colours observed in the electromagnetic spectrum. Synthesis of these composite samples also plays a crucial role, as crystal structure changes are observed for temperature variations. In general, the incorporation of the various anions, contributes in a major way in the luminescence characteristics of the various host materials by serving either as sensitizers or ligands or activators, which ultimately influences the crystal field of the host matrix. Their presence and interactions influence the various visible colours produced, which in some cases in 100- fold bigger than the emission produced without them.Thus, these anions could be considered as triggers for the enhancing properties of various dopant activated inorganic host materials and could used by other researchers as a tool for advancing their research.

Leelakrishna Reddy

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

Biography

Prof. L Reddy, a distinguished scholar, earned his prestigious PhD in Physics from the esteemed University of Johannesburg in South Africa. With a profound expertise in condensed matter physics, he has consistently demonstrated a fervent passion for research and exploration. Initially delving into the magnetic properties of bulk materials, Prof. Reddy has since shifted his focus towards the captivating realm of luminescent properties in phosphor materials. This captivating field opens exciting avenues in diverse applications such as phototherapy, energy storage in battery cells, light-emitting devices, and cutting-edge display lighting systems. As a visionary leader, Prof. Reddy leads a dedicated research team that explores magnetic properties at the nanoscale level, pushing the boundaries of scientific understanding in this domain. His contributions to the scientific community are invaluable, with a prolific publication record in esteemed peer-reviewed journals. Recognized for his expertise, he is frequently invited to deliver keynotes and invited lectures at prestigious conferences worldwide, illuminating current topics in nanotechnology. Prof. Reddy's mentorship has played a pivotal role in nurturing future talent, as he has successfully supervised numerous MSc and PhD students, leaving an enduring impact on the scientific landscape. In South Africa, he is esteemed as an NRF-rated scientist, a testament to his remarkable contributions and dedication to advancing the field of nanotechnology. He envisions nanotechnology as the vanguard of solving contemporary challenges in medicine, health, battery technology, lighting devices, communication technology, and solar cells, making him a catalyst for innovative solutions that benefit humanity.

BOOK OF ABSTRACTS

magnus Group

25-27 SEPT

DAY 02

SPEAKERS

5TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

IN-PERSON

T Yoshimura[1]*, T Noda1, M Ijiri[2]

[1]Department of Mechanical Engineering, Sanyo-Onoda City University/Sanyo-Onoda, Yamaguchi 756-0884, Japan

[2]Department of Mechanical Systems Engineering, Tokyo Metropolitan University/Hachioji, Tokyo 192-0397, Japan

Material processing of magnesium alloy by energy-intensive multifunction cavitation in a strong magnetic field with laser light excitation

The present work demonstrates the development of a peening technique using small-diameter cavitation bubbles with a narrow nozzle, which has been considered difficult in the past. In addition, an apparatus capable of measuring sonoluminescence intensity was employed. With this technology, it has become possible to impart compressive residual stress and various mechanical functions to the surface of a sample using relatively small tabletop equipment. Applying a magnetic field to a WJ cavitation system employing a narrow nozzle activated collisions between bubbles due to the Lorentz force acting in the direction perpendicular to the flow. Collisions between bubbles were promoted as a result of multiphoton ionization inside the bubbles due to the laser irradiation. This effect, in turn, reduced the rate of motion of the bubbles, lowered the Blake threshold and facilitated MFC at high temperatures and pressures. Consequently, the application of compressive residual stress to a metal surface became possible and a peening phenomenon was achieved. Cavitation in conjunction with a narrow nozzle generated small bubbles. The concentration of various energy sources at the cavitation cloud greatly increased the number of bubbles along with the processing pressure. Furthermore, the concentration of energy raised the bubble temperature such that the surface of a rolled sheet of the AZ31B magnesium alloy could be processed while limiting the surface roughness.

Audience Take Away Notes

- A innovative process concentrates bubble energy using a strong magnetic field and laser energy while applying ultrasonication around a waterjet
- Sonoluminescence emitted from multi-bubbles at various energy concentrations was evaluated
- Precision peening cavitation with a narrow nozzle imparted compressive residual stress to metal surfaces
- Multiphoton excitation based on irradiating bubbles with laser light increased the number of ions in charged bubbles
- Laser-assisted energy-concentrated multifunction cavitation of magnesium alloys in a magnetic field improved functionality

Biography

T Yoshimura got Engineering Doctor's degree at Tokyo Institute of Technology in 1995. Specialist in materials engineering, He got the paper awards from The Vacuum Society of Japan, and The Water Jet Technology Society of Japan, and Technology Creation Award from The Japan Society of Mechanical Engineers.

IN-PERSON

Wojciech J Nowak[1]*, Małgorzata Grądzka Dahlke[2], Natalia Maciaszek[1], Jakub Jopek[1], Marcin Drajewicz[1]

[1]Department of Materials Science, Faculty of Mechanical Engineering and Aeronautics, Rzeszow University of Technology, Powstancow Warszawy 12, 35-959 Rzeszow, Poland

[2]Department of Materials and Production Engineering, Faculty of Mechanical Engineering, Bialystok University of Technology, ul. Wiejska 45 C, 15-351 Bialystok, Poland

Effect of alloying elements content on mechanical properties and oxidation behavior in dry and wet atmopshere of NiCoCrAlFe-X high entropy alloys

A constant requirement to decrease greenhouse gas emissions in combination with the desire to increase gas turbine efficiency results in a continuous trend to increase the operating temperature of gas turbines. This increase is determined mainly by the Carnot cycle, according to which the increase of the temperature in the engine results in an increase in the gas turbine efficiency. This in turn will result in lower fuel consumption, and higher combustion temperature shall result in lower pollution releasing. Moreover, there is a strong trend to use hydrogen as an alternative and clean fuel. However, using hydrogen or hydrogen-rich fuel results in a higher combustion temperature as well as an increase in the water vapor content in the exhaust gases. Modern materials used today are mainly Ni-based superalloys. However, the use of Ni-base alloys faces their limits. Moreover, studies on the effect of water vapor on oxidation kinetics showed a worsening of the oxidation behavior of Ni-based alloys in an atmosphere containing water vapor. Therefore, a new brand of materials is demanded to be used in gas turbines operated with hydrogen-rich fuel. High-Entropy Alloys (HEA) seem to be very promising materials to replace commonly used Ni-based alloys. HEA's are the group of materials consisting of at least five main equiatomic elements. These alloys can be doped by other elements in amounts less than 5 at. % in total. Thus, in the present study, NiCoCrAlFe-X alloys are studied in terms of mechanical properties and oxidation behavior during exposure to dry and wet atmospheres. NiCoCrAlFe-X alloys are doped with e.g. W or Mo in the amount varying from 1-5 at.%. The effect of alloying element concentration on mechanical properties and oxidation resistance in dry and wet atmospheres will be shown and discussed.

Audience Take Away Notes

- The presented results will surely expand the knowledge of the audience about the high entropy alloys, especially exposed to atmosphere containing water vapor
- The audience can clearly compare the results obtained on studied HEA's with state of the art Ni-base alloys and find the proper field of application of HEA's
- The audience can learn about the different oxidation mechanisms during exposure in dry and wet atmosphere

Biography

D.Sc. Eng. Wojciech Jerzy Nowak works as Associate Professor at Rzeszow University of Technology, Faculty of Mechanical Engineering and Aeronautics, Department of Materials Science since February 2016. He received his Ph.D. degree in Material Science (specialization: High-Temperature Oxidation (2014)) under supervision of Prof. Lorenz Singheiser in RWTH Aachen University. In 2022 he received his D.Sc. title at AGH University of Science and Technology in Cracow. His research is focused on materials dedicated for high-temperature application, especially Ni-base superalloys, protective coatings, and TBC systems, as well as high-entropy alloys, and their oxidation behavior during exposure at high temperature. Hehas published more than 50 research articles in SCI(E) journals.

IN-PERSON

M Pita[1]*, P Ramasobane[2]

[1]Department of Mechanical Engineering and Faculty of Engineering and Technology, University of South Africa, South Africa
[2]Department of Mechanical and Industrial Engineering, Faculty of Engineering and Technology, University of Johannesburg, South Africa

Study the microstructure, hardness and wear behavior of aluminum 1050-h4 reinforced by corn cob particles

Composite materials belong to the advanced material class, with modification in mechanical properties along its dimensions. Aluminium-corn cob particles were formed using casting method. Two different corn cob particles sizes of -0.425 mm and +0.425 mm were used to reinforce the aluminium alloy to produce the composites. Samples characterization was performed using SEM. Hardness and tribology tests were performed according to ASTM E384 and ASTM G99 standards. The results will be analysed and discussed.

Audience Take Away Notes

- This study will show how aluminum can be reinforced using organic materials, which is a cost effective method
- Audience will learn the effect corn-cob on mechanical properties, microstructure and wear behavior of aluminum reinforced by this particles
- This method can be used by other researchers to reinforce the aluminum 1050 H4

Biography

Mothibeli Pita is currently a senior lecturer, and associate chair of lab commercialization and collaboration at the University of South Africa in the Department of Mechanical Engineering (South Africa). He obtained his PHD in 2020 at the University of Johannesburg specializing in physical material processing. He hold a Bachelor of Engineering in Mechanical Engineering from Central University of Technology Bloemfontein and a Master's degree in Engineering management at University of Johannesburg. He is the solar car project coordinator at University of South Africa. He published 14 research articles and 25 conference papers.

IN-PERSON

Gabriel Dan Suditu, Andreea Ema Sava, Elena Niculina Dragoi, Mircea Teodor Nechita*

Department of Chemical Engineering, "Gheorghe Asachi" Technical University of Iasi, Bld. D Mangeron, no 73, Iasi – 700050, ROMANIA

Searching for the synergistic effect in AOPs, Case study: Sonophotocatalytic degradation of methylene blue by anatase nanopowder

The Advanced Oxidation Processes (AOPs) are currently the second most widely used wastewater treatment technology, right after adsorption. Over the past 20 years, nearly all AOPs combinations have been explored in an effort to create effective hybrid technologies with the goal of increasing the production of reactive radicals (hydroxyl, oxygen singlet, sulfate and others). The simultaneous use of two or more AOPs may exhibit: i) a cumulative (additive) effect; ii) a synergistic effect - when the aggregate effect exceeds the sum of individual AOPs and iii) an antagonistic effect - when the AOPs overlap, and the overall effect is lower than the sum of individual AOPs. The Synergy (S) or Synergy Index (□) are typically used to measure the effectiveness of various AOPs combinations.

The purpose of this study is to ascertain how the synergistic interaction of Ultraviolet (UV) and Ultrasound (US) exposure in the presence of anatase nanopowder acting as a sono-photo-catalyst is affected by various process parameters. The anatase amount, the colorant concentration, and the exposure time were taken into account as experimental factors. Methylene Blue (MB), a well-known dye representative and standard model compound in photochemical studies, was chosen as the test pollutant.

50 mL batch experiments were carried out over a mixture of MB solution and TiO2 nano-powder under UV, in sonic field, and combined UV and sonic field. The synergistic effect of ultraviolet and ultrasound was studied by comparing their separate and combined effects. It was found that the TiO2 dosage is critical in achieving synergism and that sonocatalysis is more effective than photocatalysis at lower anatase concentrations (from 0.5 up to 0.6698 g/L) owing to better catalyst particle dispersion. After this particular concentration value, the particle density is high enough to diminish the effects of cavitation. Increasing the catalyst concentration from 0.6698 to 1 g/L significantly impacts photocatalysis, while sonocatalysis is less affected. In brief, it was found that for the considered experimental system the synergistic effect is only achieved for a specific interval from 0.5 to 0.6698 g/L TiO2. Outside this range, the effect changes from synergistic to antagonistic, most likely due to intense US stirring that makes the slurry less accessible to UV light.

Audience Take Away Notes

- Insights into sonophotocatalysis as a hybrid advanced oxidation method will be provided
- Elementary explanations of the synergism and antagonism concepts will be given
- Interesting experimental results comparing sonocatalysis to photocatalysis will be presented
- Experimental proof of the synergism achievement will be supplied

Biography

Mircea Teodor Nechita is Lecturer in the Group of Transfer Phenomena – Department of Chemical Engineering of Technical University “Gheorghe Asachi” of Iasi and received his Ph.D. in chemistry in 2006. He was awarded fellowships by: World Federation of Scientists (2001, 12 months, Switzerland – Romania); Polish Academy of Science (2002 – 2003, 6 months, Poland); University of Turin, Marie Curie fellowship (2003 – 2005, 8 months, Italy); University of Turin, WWS Project (2008 – 2009, 12 months, Italy). He is currently teaching courses and applications for "Mechanical Operations" and "Chemical Reactors Design and Modelling"; applications and projects for ”Transfer Phenomena”.

IN-PERSON

Chung Shin Yuan*, Ji Ren Zheng

Institute of Environmental Engineering, National Sun Yat-sen University, No. 70, Lian-Hai Road, Kaohsiung 80424, Taiwan

Recent progress for removal of Hg0 and/or NOx with graphene-based catalysts

Graphene or Graphene Oxide (GO) is an outstanding material that has been commonly applied to modify/assist the catalysts consisting of metal oxides due to its excellent physical and chemical properties. This article reviews recent development on the application of graphene-based catalysts to remove Hg0 and/or NO, the types of graphene application, and the evolution of catalyst preparation methods. The surface characterization analysis was further presented to evaluate the physical and chemical properties and further assess the overall performance of the catalysts. The morphology (2D, 3D, and spherical), heterojunction, and heteroatom doping are expected to have better performance under complex gas conditions. The removal efficiencies of Hg0 and/or NO, the N2 selectivity, the mechanisms of Hg0 and/or NO removal, and the N2O production are thoroughly reviewed. The removal of Hg0 and/or NO can be simulated and described by Eley-Rideal (E-R) and Langmuir-Hinshelwood (L-H) mechanisms to estimate and evaluate the reaction rate and activation energy. The promoting effects on the N2 selectivity of heteroatom doping were further discussed. Furthermore, developing innovative photo- and photothermo-catalysts with high removal efficiency, strong stability, and high resistance are crucial for low-temperature (100-200oC) SCR technology to simultaneously remove Hg0 and NO emitted from coal-fired power plants. This article overviewed graphene-based catalysts including fundamental graphene species, efficient synthesis methods, characterization analysis, the capability of graphene-based materials for the removal of Hg0 and/or NO, and the reaction mechanisms of Hg0 oxidation and NO reduction.

Audience Take Away Notes

- We provide the recent progress of graphene-based catalysts for Hg0 and/or NOx removal, including the catalyst preparation method, modification for better catalysts in a Selective Catalytic Reduction (SCR), and the advantage brought by graphene, and the reaction mechanisms. This knowledge can help the audience synthesize novel catalysts
- This articlecould help the audience to conductthe surface characterization, evaluate the physical and chemical properties more efficiently, and understand the potential of using graphene as a modification material, which thus enhance the removal efficiencies of Hg0 and NOx in the flue gases emitted from coal-fired power plants
- This article reviewed and summarized the catalyst preparation methods, the physical and chemical properties of graphene-based catalysts, potential application for simultaneous removal of Hg0 and NOx, and reaction mechanisms, which can be widely applied for their research and teaching works
- This article provides practical solutions to remove target pollutants, particularly Hg0 and/or NOx, with the existence of poison gases by doping heteroatoms. This will help the engineers and designer's job more efficient
- This article provides new technical information for developing innovative low-temperature SCR technology for simultaneous removal of Hg0 and/or NOx in the flue gases

- List all other benefits
    - This article will help the environmental scientists and engineers to thoroughly understand the fundamental and practical information on catalysts application to air pollution control

Biography

Dr. Chung-shin Yuan is the Chair Professor and the Director of the Institute of Environmental Engineering at National Sun Yat-sen University in Taiwan. He received his PhD of Environmental Engineering from UIUC, USA. As a well-known scholar of air pollution control, he has served as the President of Taiwan Association for Aerosol Research (TAAR), the Chair of Taiwan Section of A&WMA, the Editors of Catalysts, JA&WMA, and AAQR. His reputation is recognized by many awards for his excellent academic achievements. He has authored 208 peer-reviewed SCI Journal papers, delivered 806 conference presentations, published 14 books/book chapters, and owned 20 patents.

IN-PERSON

Izabell Craciunescu*, George MarianIspas, Rodica Paula Turcu
National Institute for Research and Development of Isotopic and Molecular Technologies

Functionalized magnetic composites with tailored size and shape and their applications

The scientific interest in Nanoparticles (NPs) in general and Magnetic Nanoparticles (MNPs) in particular, developed these materialsas important tools in various fields such as medicine, biodetection, catalysis, agriculture and environment. These materials may have certain limitations, such as aggregation problems, low mechanical and chemical resistance, toxicity, complex and expensive preparation methods. Therefore, the development of new composite magnetic systems that overcome the limitations of classical materials and/or preparation methods, well adapted to the targeted application has become a necessity and the focus of our research.

To overcome the aggregation problems of MNP, we replaced the classical co-precipitation synthesis method of NPs with thermal decomposition method, which provides a much more rigorous control over the shape and especially the size of the nanoparticles. Using thermal decomposition method, nanoparticles with various shapes, such as spherical, polyhedral and cubic with size ranging from 10 to 100 nm with uniform size distribution were synthesized. Since the thermal decomposition method provides MNPs with hydrophobic properties, their surface being coated with a layer of oleic acid, for applications requiring hydrophilic particles, it was necessary to transfer them into hydrophilic nanoparticles. Thus, the transfer of hydrophobic into hydrophilic nanoparticles was achieved by the oxidative scission reaction of the double bond, which converts unsaturated oleic acids covering the nanoparticle surfaces to carboxylic acids. Carboxyl groups are one of the most common functionalities used in biomedical applications, but if the targeted application requires, the surface of MNPs can also been functionalized with amino groups with (3-Aminopropyl) triethoxysilane molecular layer that presents a free amino terminal group.

For more specific applications such as biodetection of some biomolecular species and/or controlled drug delivery as a specific approach in theragnostic applications, the surface of MNPs have been functionalized with different biocompatible polymeric layers with special properties (thermo and pH responsive or electroconducting) such as polyethylene glycol, polyacrylic acid, poly(N-isopropylacrylamide), polypyrrole which result in decreased surface toxicity and provide special properties for specific applications.

For applications in environmental quality control, MNPs can be used as specific tools for magnetic separation of environmental pollutants. In this context, their surface is functionalized with specific molecules for direct capture of pollutants such as nitrites and nitrates from polluted waters or even with hydrophobic layers (polystyrene, polypyrrole, methacrylic acid) for the capture of waste oils.

A highly innovative approach is represented by Magnetic Clusters (MCs), consisting of several hundred magnetic nanoparticles with superparamagnetic properties, self-assembled as MCs of up to 100 nm. The MCs have the advantage of improved magnetic response of particles, while keeping the superparamagnetic behavior. Also, their surface can be functionalized specifically for the desired application, so in our research we have coated them with hydrophilic molecular layers (sodium lauryl sulphate), with inorganic SiO2 layer for dental or security paper applications or with other hydrophilic and/or hydrophobic polymeric layers for depollution applications.

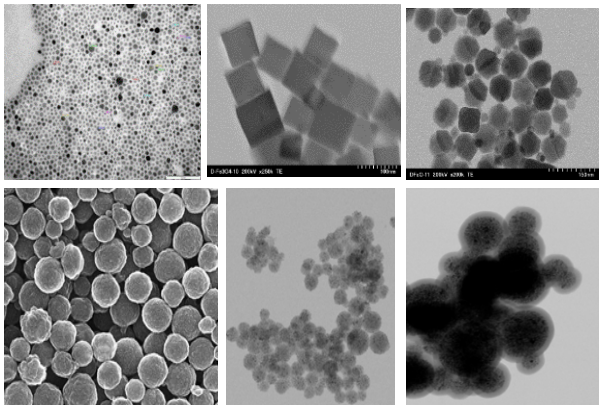


Figure 1:MNPS and MCs with different functionalites

Audience Take Away Notes

- The presentation will illustrate new, innovative, environmentally friendly synthesis methods for obtaining magnetic composite materials with improved properties
- The audience will learn new simple and efficient preparation processes of different magnetic composite materials
- Will be presented magnetic composite materials with particular properties, tailored to specific applications in various fields such as medicine, bio detection, catalysis, agriculture and environment
- The audience will be introduced to the thermal decomposition method of MNPs synthesis with different shapes and sizes and the transformation of MNPs from hydrophobic to hydrophilic phase
- Different functionalization methods of MNPs specific to the targeted applications will be presented

Biography

Dr. Izabell Craciunescu obtained PhD degree in chemistry in 2011 at Babes-Bolyai University. In parallel with the activities carried out in the PhD thesis, she built her experience in the field of magnetic polymer and polymeric composites inNational Institute for Research and Development of Isotopic and Molecular Technologies, where have a work experience of 23 years, by effective involvement in the research activity on 20 national research projects (as a participant), 3 research grants (as principal investigator), 4 international research projects. As a result of scientific research she participated as co-author of 3book chapter, two patents and 42 scientific papers, Hirsch index 11, 385 citations.

VIRTUAL

Erol Sancaktar
School of Polymer Science and Polymer Engineering, The University of Akron, Akron, OH 44325, United States of America

Design of electrically conductive adhesives and adhesive joints

Electrically Conductive Adhesives (ECA's) are used widely to replace or reinforce lead soldering or conductive metal components in electronic packaging applications such as die attachment, solderless interconnections, component repair, display interconnections, and heat dissipation. Their conductive behavior as well as the associated behaviors such as heat conduction and mechanical behavior (strength, rigidity, deformation and viscoelastic behavior, which may be affected by moisture ingression) are affected by adhesive film thickness, volume fraction, size and shape of the conductive filler, as well as uncured base adhesive viscosity, substrate and filler surface treatment and the applied pressure (during bonding and during conduction). The adhesive resistivity decreases precipitously above a characteristic filler volume fraction called the percolation threshold. In general, micron-sized metal fillers mixed in an adhesive (often an epoxy) resultingwith different filmthicknesses exhibit thickness thresholds for transition from three-dimensional conductivity to two-dimensional conductivity with considerable increases in thickness-direction (z-axis) resistivity when the film thicknesses are smaller than these threshold values. Recently, the use of conductive nanoparticles allow decreases in percolation threshold levels as well as mechanical strength and durability of ECA's. Most ECA's are supplied in liquid or paste form in varying viscosities and therefore, the method of their application also affects their performance. This work intends to provide an understanding of these effects on conduction behavior in (usually high-priced) equipment in which they are used.

Biography

Professor Emeritus (University Akron – UA, Aug. 2020) Erol Sancaktar (Ph.D.; Eng. Mechanics, Virginia Tech) is Fellow of ASME, served as ASME Technical Committee Chair for Reliability Stress Analysis, Failure Prevention (1997-2008; 2013-), Associate Editor for ASME J. Mech. Design (1995-2006) and Medical Devices (2006-2013) and organized 30 Conferences. He taught at the Mechanical Eng. Dept., Clarkson University during 1978 to 1996 before joining UA in 1996 as Professor of Polymer Engineering and Professor of Mechanical Engineering (starting 2009). He edited 25 books, authored 120 journal articles and 30 book chapters. He delivered 249 technical presentations and has 4 patents.

VIRTUAL

Roger Rothon
Rothon Research Limited and The University of Chester, United Kingdom

Utilisation of products from carbon capture processes

Carbon capture is going to be an essential part of efforts to tackle global warming. Most approaches use mineral feedstocks and result in carbonate and silica products. While these can be stored, it would be more beneficial to utilise them as replacements for products which are currently manufactured by higher emission methods. This paper focusses on the utilisation of magnesium carbonates as replacements for insulation boards such as those currently produced from gypsum. Insights will be given into the chemistry of the setting process, as well as into the control of important properties including specific gravity, compressive strength and thermal conductivity.

VIRTUAL

Taila V de Oliveira[1]*, Samiris C Teixeira[1], Clara S Marques[2], Tarsila R Arruda[1], Amanda L de Souza[1], Nilda de F F Soares[1]

[1]Department of Food Technology, Federal University of Vicosa, Vicosa, MG, Brazil
[2]Department of Food Technology, Federal Institute of Minas Gerais, Bambui, MG, Brazil

Biodegradable materials: The influence of additives added into the polymeric matrices

The plastic problem is increasing and boosting the development of new materials to replace in part the ones still used. The main material used as packaging is plastic from a petrochemical source since it has excellent physical-chemical properties, low cost of the manufacturing process, and wide application. However, sustainable materials, developed from biodegradable polymers and renewable source, has been pointed out as a short solution to the environmental problem. Regarding this issue, several additives have been studied to improve mechanical and barrier features of the biopolymer films such as reinforcement compounds such as cellulose nanocrystal, compatibilizers such as anhydride maleic, plasticizers such as glycerol, and bioactive compounds such as essential oils. Studies have been focused on the development of acetate cellulose films, polylactic acid materials, starch blends, and composites. Although the literature pointed to these materials as biodegradable, our studies indicated the opposite behavior when the acetate cellulose with an acetylation degree of around 2.5 was used to manufacture the films. Besides, the regular practice to incorporate additives in the polymeric matrices can interfere with the biodegradation process. Plasticizers addition also influences the behavior of the material degradation, but, favoring the process since the mobility favors the weight losses and breaks in the chain. Natural materials, such as starch and zein, polymer and polysaccharides respectively, has high biodegradation rates compared to cellulose materials. Knowing that the biodegradation behavior depends on several factors such as the type of microorganism of the soil, the soil composition, the climate (humidity and temperature), and the film composition, it is very difficult to understand and predict the scenario. Because of that, it is important to create an extensive data source of the materials, including the soil characterization, to understand better the material and to modulate the biodegradation properties in nature, mitigating the environmental problems.

Audience Take Away Notes

- Biodegradation is an actual theme important for materials research
- The data presented will resume some observations already done for some biopolymeric materials
- This research can help other faculty to expand their research or teaching
- This presentation will develop a critical point of view on biodegradation materials

Biography

Dr. Taila Oliveira studied Food Engineering at the Federal University of Vicosa, Brazil, and graduated as DS in 2017. She, then, joined the Federal University of Vicosa as an adjunct professor and researcher, leading the group of polymeric materials at the Packaging Laboratory, Vicosa, Brazil. She has experience in Food Science and Technology area with an emphasis on biotechnology, nanotechnology, food packaging, food analysis, cellulose materials, antimicrobial material, biodegradable polymers, natural polymers, and biosensors

VIRTUAL

Robert Buenker
Princeton University, United States

The many flaws of the Lorentz transformation

The Lorentz Transformation (LT) makes three predictions which are not consistent with one another: Lorentz-FitzGerald Length Contraction (FLC), Time Dilation (TD) and light-speed equality for observers in relative motion to one another. The LT also stands in violation of the Law of Causality because it fails to recognize that inertial clocks can never change their rate spontaneously. Einstein's Light-Speed Postulate (LSP) is shown to be unviable by considering a case in which a light source passes by a stationary observer at the same time that it emits a light pulse in the same direction. It is found that, in contradiction to the LSP, that the classical velocity (Galilean) transformation (GVT) is applicable when two observers in relative motion deduce the speed of a light wave.

The Newton-Voigt Transformation (NVT) is consistent with the Law of Causality because it assumes space and time do not mix. The NVT is nonetheless consistent with the Relativistic Velocity Transformation (RVT) and also with Einstein's mass-energy equivalence relation E=mc2. The ratio Q of clock rates for two inertial rest frames S and S' is required input for the NVT. Experimental data obey the Universal Time-Dilation Law (UTDL) which states that the measured time Δt obtained by a inertial clock for a given event is inversely proportional to □(v)=(1-v2c-2)-0.5v, where v is the speed of the clock relative to a specific rest frame referred to as the objective rest frame ORS. The value of Q when the clock of the observer in at rest in S while that of another observer is at rest in the object's rest frame S' is obtained from the UTDL as the ratio □(v')/□(v). The Uniform Scaling method considers Q to be a conversion factor between the units of time in the two rest frames. It is found that the conversion factors for all other physical properties are integral multiples of Q. Kinetic scaling of the properties insures that the laws of physics are the same in each inertial frame, as required by the RP. It is also pointed out that Einstein's Equivalence Principle (EP) fails to deduce the experimental fact that the wavelength of light is invariant to changes in gravitational potential. The Universal Scaling method uses a set of conversion factors for the effects of gravity that is analogous to those for kinetic scaling

Audience Take Away Notes

- The audience will able to understand the process of learning
- It will helpful for the audience in their job
- This research that other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- It improve the accuracy of a design, or provide new information to assist in a design problem

Biography

Robert J. Buenker born to Mr. and Mrs. Joseph F. Buenker in Dubuque, Iowa. He received B.S. Degree (Maxima Cum Laude) in Mathematics and Chemistry from Loras College, Dubuque, Iowa and Ph.D. Degree in Chemistry from Princeton University, Princeton, New Jersey. He worked as Assistant Professor of Chemistry, University of Nebraska, Lincoln, Nebraska. Associate Professor of Chemistry, University of Nebraska, Lincoln, Nebraska. Professor of Chemistry, University of Nebraska, Lincoln, Nebraska Wissenschaftlicher Rat und Professor, Universität Bonn, Germany. Professor of Theoretical Chemistry, Bergische Universität-Gesamthochschule, Wuppertal, Germany. Adjunct Professor, Department of Chemistry, North Carolina State University, Raleigh, NC, USA. Emeritus Professor of Theoretical Chemistry, Bergische-Universitat, Wuppertal, Germany. Adjunct Professor, Department of Physics, University of Georgia, Athens, GA, USA.
Awards: Senior U.S.Scientist Award of the Humboldt Foundation for research and teaching at the University of Bonn, Germany.

VIRTUAL

Mohammed Al Bahri

Department of Basic Sciences, A'Sharqiyah University, Post Box 42, PC 400, Ibra, Oman

An optimal configuration of vortex domain wall pinning in constricted magnetic nanowires for storage memory devices

Racetrack memory is the one technology based on magnetic Domain Wall (DW) motion in nanowires with the potential of application advantages such as fast access to the stored information, high storage capacities and low power consumption. Therefore, a series of remarkable studies have been devoted to manipulating and control static and dynamic DWs in ferromagnetic devices such as nanowires and nanostrips.

This study aims to investigate the Vortex domain wall dynamics and its pinning through the stepped magnetic nanowire by using spin-transfer torque. Controlling Vortex Domain wall (VDW) dynamics and stability in a nanowire is a crucial issue for DW storage memory. In this study, VDW pinning was investigated by using micromagnetic simulation. A new way is proposed for VDW pinning by creating a stepped notch. This way is a convenient way to pin DW with different structures. A stepped area is constricted at the center of the nanowire with proportions of Depth (d)) and Length (□) to pin the magnetic Domain Wall (DW) with high barrier potential energy to achieve a high information storage capacity. It is found that the VDW stability structure and pinning at the stepped area depends on the magnetic material properties and the stepped area geometries. From this study, it can be concluded that the stability type of the VDW with CW chirality and up polarity during its propagation in stepped nanowire could be controlled by improving the magnetic properties like Saturation Magnetization (Ms), decreasing the current density and manipulating the stepped area Dimensions (d)) and (□).

Audience Take Away Notes

- Use the simulation in their work based on the experimental work
- It willhelpful for the audience in their job
- This research that other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- It improve the accuracy of a design, or provide new information to assist in a design problem
- List all other benefits
    - In the future, this work will help to develop storage memory with high storage density, low power consumption and non-volatility

Biography

Dr. Mohammed Al Bahri, is presently working as an asociate professor in Physics at A'Sharqiyah University in Oman. He has worked in the Ministry of Education in Oman for around 20 years in Monitoring and evaluating student learning. He got his Ph.D. degree from Sultan Qaboos University in Oman in 2018. He is working as a researcher in nanoscience magnetic materials, especially magnetic nanowires and magnetic domain walls. He has 16 papers published in various Web of Science journals 164 citations in Google Scholar. He had been awarded the best presenter at International Conference on Magnetism and Magnetic Materials (ICMMM 2020), Spain, Barcelona, 17-18 August 2020. He had been assigned different responsibilities in his current institution, like a chair of the learning and teaching committee, the chair of the community service committee, and a member of different committees.

VIRTUAL

Sharda Sundaram Sanjay

Department of Chemistry, Ewing Christian College, (An Autonomous PG College of University of Allahabad), Prayagraj-21100,Uttar Pradesh, India

Surface functionalization of nanodiamonds

The currentresearch and findingshave increased the popularity of nano diamond-based polymer nano-composites. The extraordinary mechanical, chemical, optical, and biological characteristics of the distinctive nanoscale carbon structure units known as Nano Diamonds (NDs) make them significant and efficient entities for functioning as vehicles for technical and biomedical applications. The nano diamond polymer nanocomposites reduce the number of challenges encountered in the search for high performance polymeric compounds and develop high-performance composites that may be used in electrochemical storage systems for energy. Recent research on polymer-ND composites has shown that adding NDs can improve the physical properties of polymer matrices. The surface of NDs can be functionalized using a number of surface ionogenic groups (including ether-C -O - C, peroxide-C -O -O, carbonyl-C-O, and hydroxyl-type C - O- H bonding) and hydrocarbon residues.

The functional groups, viz. -OH, -CH3, -CH2, CO2, and -C=O are the main contributors for surface functionalization of NDs. Additionally, biologically active materials may be utilized to modify the surface through chemically immobilised forms (covalent, non-covalent, or both). Enzymes, amino acids, nucleic acids, surfactants, and other biological and non-biological functional groups may also be employed to functionalize the surface of the NDs.

Additional methods for functionalizing NDs include gas phase functionalization, non-covalent functionalization usingpeptides, proteins, and polymers, along with microwave radiations. Due to their significantly enhanced high specific surface area, which results in the high adsorption ability, the functional groups including oxygen provide biocompatibility, and sp3 diamond cores as well. NDS are regarded as a favoured alternative for drug delivery applications. These functional groups, gives value addition to its structure-which in-turn contribute to its chemical properties, stability, and thermal properties.

NDs have an array of advantages and uses, but they additionally carry significant disadvantages too. For instance, an N-V centre emits relatively low emissions as compared to traditional organic dyes. It can be challenging to identify coupled NDs from background fluorescence because coupled NDs may cause structural and functional changes in related proteins.

Audience Take Away Notes

- The audience will be able to understand how to functionalize nanomaterials and nanodiamonds?
- The knowledge of functionalization could be useful to enhance to manufacture ?
- Definitely other faculty could use this research to expand their research or teaching?
- This may provide a practical solution to a problem that could simplify or make a designer's job more efficient
- It could improve the accuracy of a design, or provide new information to assist in a design problem.
- Someother benefits are given inabstract

Biography

Sharda Sundaram Sanjayhas completed(M.Sc (Analytical Chemistry) and acquired D.Phil. degree from University of Allahabad, India. Working on:(i) mixed ligandcomplexes. and (ii) Synthesis, Characterization and functionalization ofnanomaterials. Completed successfully a major research project entitled, “Synthesis, characterization of functional Nano-particles with special reference to their stimulatory action on living cells and hormones”. Authored 2 books on Nanotechnology, many papers and book chapters published in National & International Scientific publications. Delivered many invited talks were delivered in National and International conferences, seminars, workshops and webinars organised by various national and Internationally reputed institutions. Life Member of many reputed scientific associations. Presently Associate Prof. in Chemistry department of ‘Ewing Christian College, An Autonomous PG College of University of Allahabad.

VIRTUAL

Delia Teresa Sponza

Department of Environmental Engineering, Engineering Faculty, Dokuz Eylül University, Buca Izmir Turkey

Photocatalytic treatment of industrial pulp and paper mill wastewater using Fe_2o_3/Tio_2 nanocomposite

In this study the pollutants (COD,CODdis, TOC, BOD5, TSS, TDS, color) were degraded by Fe_2O_3-TiO_2 nanocomposite produced under laboratory conditions. The effects of pollutant concentration (COD dis=500, 700, 1000, 1500 and 2000 mg/l), photocatalytic power (25, 50, 75, 100 and 125 W/m2), photocatalytic time (15, 25, 35, 45 and 60 min),nanocomposite concentration (2, 4, 6 and 8 mg/l), Ph(5, 7 and 8), presence of some anions (BrO_3, and ClO_4) and increasing temperatures (20, 30 and 40 Oc) during treatment were investigated. The pollutants were removed with yields as high as 99 % saccording to Langmuir-Hinshelwood kinetic model, with pollutant rate constants varied between 2 and 3. X 10^{-2} min^{-1} in the presence of 4 mg/l Fe_2O_3-TiO_2, 1500 mg/l COD dis, 50 W/m_2 power after 25 min at Ph=5 ant 20 Oc temperature. The magnetic properties of Fe_2O_3-TiO_2 showed high reusability (99% removal for 50 times) and easy separation of the photocatalyst from the wastewater.

Audience Take Away Notes

- The audience will be able to understand the process of nanocomposite
- This will helpful for audience in their job
- This research that other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- It improve the accuracy of a design, or provide new information to assist in a design problem

Biography

Prof. Dr. Delia Teresa Sponza is currently working as a professor at Dokuz Eylul University, Department of Environmental Engineering. Scientific study topics are; Environmental engineering microbiology, Environmental engineering ecology, Treatment of fluidized bed and activated sludge systems, Nutrient removal, Activated sludge microbiology, Environmental health, Industrial toxicity and toxicity studies, The effect of heavy metals on microorganisms, Treatment of toxic compounds by anaerobic/aerobic sequential processes, Anaerobic treatment of organic chemicals that cause industrial toxicity and wastewater containing them, Anaerobic treatability of wastewater containing dyes, Treatment of antibiotics with anaerobic and aerobic sequential systems, Anaerobic and aerobic treatment of domestic organic wastes with different industrial treatment sludges, Treatment of polyaromatic compounds with bio-surfactants in anaerobic and aerobic environments, Treatment of petrochemical, Textile and olive processing industry wastewater by sonication, Treatment of olive processing industry wastewater with nanoparticles and the toxicity of nanoparticles. She has many international publications.

VIRTUAL

M P Kashchenko[1,2]*, N M Kashchenko[1]

[1]Department of Advanced Mathematics, URFU, Yekaterinburg, Russia
[2]Department of Physics, USFU, Yekaterinburg, Russia

Nanoscale aspects of the dynamic theory of martensitic transformations

MartensiticTransformations (MTs) includestructuraltransformations thatproceedcooperatively, mainly as first-order phase transitions. In the dynamic theory of MT, thegrowthof amartensite crystal is interpreted as a process that unfolds sequentially in space and time. The beginning ofcrystal growth is associated with the appearance in the elastic field of the dislocation of the Initial Excited (vibrational) State(IES),whichbreaksthesymmetryofthecrystallatticeoftheinitialphase(austenite).The oscillatory process generates a Control Wave Process (CWP), which carries a threshold deformationthat retainsthememoryofthetype ofdeformationintheregionof localizationofthe IES.

In solids, nanoscales include sizes from 1 nm to 100 nm. These scalesare connected, firstly, withthe processes of the nucleation of a new phase, which, for first-order phase transitions, must have aheterogeneouscharacter.Second,martensiticcrystalsoftenhaveafinestructure(theso-calledtransformationtwins) withcharacteristicthicknessesoftwinmicrobladesof1–10nm.Third,thedevelopment of materials with an ultrafine-grained structure (grain diameter 10–100 nm) is topical, forwhich it is fundamentally important to understand the factors that determine the critical grain size, whichisstill compatiblewiththeonsetofmartensitictransformation.

The focus is on γ–γ (fcc-bcc or bct) MT in iron-based alloys. The observed features of the MF aredescribedastheresultofaconcertedactionofrelativelylong-wavelengthandshort-wavelengthdisplacements in the composition of the CWP. The following are discussed: the mechanisms of formationof the fine structure of lamellar crystals, including the degenerate structure of transformation twins andthe formation of dislocations; the possibility of transferring information about the nature of IES from atruly nanoscale level to a scale level of 100 nm-1000 nm; the existence of a critical grain size formartensitic transformation, its dependence on the chemical composition of the alloy, and the possibility ofinfluencingthecritical sizeofexternalfields.

Audience Take Away Notes

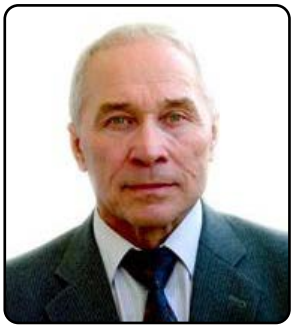
- The audience will receive unique fundamental information necessary for current scientific research, applied development, pedagogical and educational activities
  - Dynamic (wave) mechanism of formation of martensitic crystals
  - The role of the electronic subsystem in the implementation of the martensitic transformation
  - fine structure of twins of transformation and its degenerate variant
  - The birth of transformation dislocations
  - Destabilization of austenite, previously stabilized by plastic deformation, by a strong magnetic field
- Possibilities of transformation of nanograin as a whole The audience will receive unique fundamental information necessary for current scientific research, applied development, pedagogical and educational activities

- Dynamic (wave) mechanism of formation of martensitic crystals
- The role of the electronic subsystem in the implementation of the martensitic transformation
- fine structure of twins of transformation and its degenerate variant
- The birth of transformation dislocations
- Destabilization of austenite, previously stabilized by plastic deformation, by a strong magnetic field Possibilities of transformation of nanograin as a whole

Biography

Dr. Kashchenko studied Physics at the Ural Polytechnic Institute, USSR and graduated as engineer in 1971.In 1974 he received the degree of Candidate of Physical and Mathematical Sciences. In 1987 he receivedthe degree of Doctor of Physical and Mathematical Sciences, and in 1990 the title of Professor. From 1980to the present, he has been the head of the Department of Physics at the Ural State Forest EngineeringUniversity. He developed a dynamic theory of martensitic transformations and proposed a conceptualsolution to the problem of low-temperature nuclear reactions. He published 4 monographs and about 200articles.

VIRTUAL



Ernst Titovets

Department of Neurosurgery of Republican Research and Clinical Center of Neurology and Neurosurgery, Minsk, 220114, Belarus

Computer modelling of water metabolism in the brain cortex using nanofluidic approach

Brain water metabolism ensures the processes of cellular communication, transit of the signaling molecules, neurotransmitters, cytokines, substrates, gases, nutrients and drugs. It carries out important integrative function, participates in clearance of pathogenic metabolites and metabolic wastes, in spreading malignant tumors. A number of serious neurological conditions arise from impaired brain water metabolism (e.g. idiopathic normal pressure hydrocephalus, syringomyelia, migraine, traumatic brain injury and stroke, Alzheimer's disease, etc.).According to conventional views, the nanodimentional extracellular space presents a diffusion barrier where the immobile extracellular fluid serves as an external medium for the neurocytes, glia and other elements of the central nervous system.An interdisciplinary approach, adopted in this research, makes it possible to view the nanodimensional extracellular space as a nanofluidic domain where fast water movement is governed by the slip-flow principle of nanofluidics. A computer model of the brain cortex water metabolism, based on the nanofluidic concept, have been developed. The model takes into account the role of AQP4, ensuring fast water transfer across the blood-brain barrier, and the existing osmotic and hydrostatic pressure gradients.A topography of water fluxes in the brain cortex layers have been revealed important for understanding brain physiology and pathology. The model may find its use in neurobiological research on brain physiology and pathology, for optimization of the intrathecal drug delivery to the brain tumors, in studying ways of pharmacological control of brain edema and therapy of the water-metabolism-disorder-related conditions.

Keywords: Brain water metabolism, Computational model,The extracellular space andthe nanofluidic domain, Aquaporin-4-targeted therapy of water-metabolism-related conditions.

Biography

Professor Ernst Titovets, M.D., Ph.D. is a researcher, author, translator and interpreter was born in Krasnoyarsk, Siberia. He graduated from the Minsk State Medical Institute and undertook his post-graduate research in biochemistry on endergonic transport of Ca2+ by the mitochondria.Ernst Titovets obtained his Ph.D. in biochemistry from the St. Petersburg State University, Russia for his pioneering research on the biochemical action mechanism of new aminodervatives of orthobenzoquinone.Appointed to a number of scientific research councils, he has authored or co-authored four research books, 14 patents and over 400 research papers and as an interpreter, he translated three books. As an Author, he wrote a book Oswald: Russian Episode that has appeared in three editions in the USA. The book presents a historic investigation of the life of Lee Harvey Oswald, an alleged assassin of the President John Kennedy. Currently he is concentrated on a study, based the nanofluidic approach, of the brain water metabolism and related issues.

VIRTUAL

Sivasubramanian Palanisamy
Department of Mechanical Engineering, P. T. R College of Engineering & Technology, Thanapandiyan Nagar, Madurai – Tirumangalam Road, Madurai, Tamilnadu, 625008, India
Department of Mechanical Engineering, Dilkap Research Institute of Engineering and Management Studies, Neral, Karjat, Raigad, India

Utilization of natural rubber with untreated Acacia Cassia powder particle reinforced composite materials

Fibers derived from natural sources have recently gained widespread popularity. Natural fibres are preferred because they achieve the desired biodegradability, low cost, ease of acquisition, and gliding strength-to-weight ratio all at once. The purpose of this study is to investigate the potential composites of using a powder made from Acacia Caesia fibres as fillerand reinforced in natural rubber. As a large genus of shrubs and trees, Acacia belongs to the Fabaceae family of plants, specifically the Mimosoideae subfamily. These plants are more commonly referred to as wattles or acacias. Particles of acacia caesia fibre, also known as powder, are used in ayurvedic medicine to treat skin conditions and, by extension, in the beauty industry. Particles were separated from the untreated acacia caesia fibre using a ball milling process, and their size distribution was characterised using a particle analyzer (Shimadzu SALD - 2300). Additionally, the functional groups of the material were determined using Fourier-Transform Infrared Spectroscopy (FTIR), which analyses the sample's absorbance of infrared light at different wave lengths. Using a two-roll mill-mixing technique, created a composite sheet using untreated acacia caesia powder particles and natural rubber. The processing characteristics of the composites, as well as their curing behaviour, can be determined with the help of the Monsanto Rheometer. Mechanical and hardness characterization of acacia caesia powder particles reinforced with natural rubber composites were determined using a range of filler weight contents (3.33, 5, 6.67, 8.33, and 10%) in accordance with ASTM standards. The results of this study showed that the tensile strength of samples with 3.3 wt.% was the highest, that samples with 10 wt.% offered a slight improvement in tear strength, and that samples with 8.33 wt.% offered the best hardness. Scanning electron microscopy was utilised in order to investigate the composite tensile fracture surfaces in order to identify the failure criteria (SEM). According to the findings, it is abundantly clear that the Acacia caesia fibre particle may one day be utilised in the future to enhance the strength of environmentally friendly composites.

Keywords: Untreated Acacia Caesia Powder Particle, Natural Rubber, Two Roll Mill, Tensile, Hardness, Rubber Composites.

Biography

I am working as an Associate Professor in Dilkap Research Institute of Engineering and Management Studies at Maharashtra as well as working a researcher at Department of Mechanical Engineering, P. T. R College of Engineering & Technology, Tamilnadu. I have published many articles in reputed International journals, books and book chapters in the research field of Natural fiber reinforced polymer composites and Elastomer (Rubber) composites.

magnus Group

25-27 SEPT

DAY 02

POSTERS

5TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

Irina Ungureanu (Negut)[1]*, Dinu Mihaela[2], Gabriela Dorcioman[1], Bogdan Bita[1], Gratiela Gradisteanu[3]

[1]National Institute for Lasers, Plasma and Radiation Physics, 409 Atomistilor Street, 077125 Magurele, Romania

[2]National Institute of Research and Development for Optoelectronics-INOE2000, 409 Atomistilor St., 077125 Magurele, Romania

[3]Research Institute of the University of Bucharest (ICUB), University of Bucharest, 91-95 Splaiul Independentei, 050095 Bucharest, Romania

Exploring MAPLE deposition of bioglass and statins for implant-like surfaces

The controlled and precise deposition of functional coatings onto biomaterial surfaces is a pivotal aspect of modern medical and biomaterials research. Matrix Assisted Pulsed Laser Evaporation (MAPLE) has emerged as a powerful technique for achieving this, allowing the fabrication of complex and bioactive coatings. In this work, we focus on the MAPLE deposition of Bioglass and statins on implant-like surfaces. The biocompatibility and proliferation properties of our coatings was tested in vitro on 3T3 osteoblast cells. Our study's findings showed that the laser-deposited coatings are biocompatible and possess high proliferative properties. They are therefore suitable candidates for biomedical research.

Acknowledgement: This work was supported by the Romanian Ministry of Education and Research, under Romanian National Nucleu Program LAPLAS VII—contract no. 30N/2023. I.N. acknowledges the support by a grant of the Ministry of Research, Innovation and Digitization, CNCS—UEFISCDI, project no. PN-III-P2-2.1-PED-2021-3178 within PNCDI III.

Audience Take Away Notes

- Understanding of MAPLE Technique: Attendees will gain insights into the MAPLE technique and its significance in depositing precise and bioactive coatings onto biomaterial surfaces. They will learn about the unique advantages of MAPLE for creating complex coatings
- Bioglass and Statin Coatings: The presentation will delve into the specific application of MAPLE in depositing Bioglass and statin coatings onto implant-like surfaces. Attendees will learn about the potential benefits of combining these materials and their implications for enhancing biocompatibility and proliferation
- Practical Implementation: Researchers, engineers, and practitioners can apply the knowledge gained to design and develop biomaterial coatings using the MAPLE technique. They can explore the potential of combining different materials for enhanced biocompatibility and bioactivity
- Biomedical Device Design: Professionals involved in the design of biomedical devices, such as implants, can leverage the insights to enhance the performance of their products. The use of MAPLE-deposited coatings can lead to improved integration and reduced complications
- Teaching and Research: Faculty members can incorporate the presented research and methodology into their teaching curricula, exposing students to advanced biomaterial deposition techniques. The findings can also inspire further research in the field
- Problem Solving: The presentation offers a practical solution for enhancing the accuracy and effectiveness of biomaterial coatings. Attendees can apply the concepts to simplify complex design challenges and contribute to the development of innovative medical solutions
- Multidisciplinary Collaboration: The integration of MAPLE-deposited coatings opens avenues for collaboration between different fields, such as materials science, engineering, and biology. Attendees can explore interdisciplinary projects to address pressing healthcare challenges

Biography

Irina Ungureanu (Negut), Ph.D., is a 3rd Rank Scientific Researcher, at INFLPR, Romania. She devotes a big part of her research to surface modification of medical devices and the development of antimicrobial coatings. She is an author of 45 ISI indexed research papers, > 40 conferences attendance, 5 book chapters, and one patent, accumulating 700 independent citations and an H-index=13.

VIRTUAL

Vladyslav Savchenko[1], Olga Guskova[1,2]*

[1]Institute Theory of Polymers, IPF Dresden, Dresden, Saxony, Germany
[2]Dresden Center for Computational Materials Science (DCMS), TU Dresden, Dresden, Saxony, Germany

Azobenzene-organic semiconductor junctions: How the action of light on a photoresponsive anchored layer changes an ordered conjugated phase situated on top

In this work, our aim is to study the photochromic azobenzene Self-Assembled Monolayer (SAM) formed on the mica surface, along with a semiconductor layer on the surface of the SAM. Initially, a thin and uniform crystalline semiconductor layer is applied to investigate the switching effect of the prototype device using the photochromic SAM. Through a combination of AFM experiments conducted at the University of Potsdam (Prof. S. Santer) and all-atom MD simulations, we first characterize changes occurring under UV light with a pure SAM on mica. A new mechanism is proposed to explain the experimentally observed restructuring of the SAM, in which the molecules are bound to the surface via electrostatic forces. For the system with a semiconductor, we examine the distortions in uniformity caused by the photoisomerization of the underlying azobenzene phase. We characterize the studied systems in terms of the molecular switch device's performance by calculating electron and hole mobilities both without and under light stimulus. Our study focuses on maximizing the interaction of the semiconductor–SAM–electrode surface junction by implementing a thin and uniform OSC layer. This work is supported by the DFG (project GU1510/5-1).

Audience Take Away Notes

- The purpose of this investigation is to understand the effects and potential applications of a photochromic azobenzene Self-Assembled Monolayer (SAM) on a mica surface with an added semiconductor layer
- The audience will gain insight into the structural changes that take place under UV light in the pure SAM on mica, with a focus on a new proposed mechanism that explains the observed restructuring of the SAM. This explanation will provide a deeper understanding of the phenomenon
- The presentation will discuss the impact of incorporating a semiconductor layer within the SAM
- The audience will learn about the assessment of the performance of the molecular switch device
- The presentation will emphasize the focus on optimizing the interaction between the semiconductor, SAM, and surface junction

Biography

Dr. Guskova studied Chemistry at the Tver State University, Russia and graduated as MS in 2004. She then joined the research group of Prof. Khokhlov at Ulm University, Germany and INEOS RAS, Russia. She received her PhD degree in 2008 at the same institutions. After 2,5 years postdoctoral fellowship supervised by Prof. Lipowsky and Dr. Seidel at the Max-Planck Institute of Colloids and Interfaces, Germany she obtained the position of an Independent Group Leader at the IPF Dresden, Germany. She has published more than 80 research articles in SCI(E) journals.

Mechri Aouinet[1], Sahraoui Aissat[2]*

[1]Engineering Physics Laboratory, University Ibn Khaldoun, Tiaret, Algeria
[2]Research Laboratory for Industrial Technologies, Department of Mechanical Engineering, Faculty of Applied Sciences, Ibn Khaldoun University, Tiaret, Algeria

Climatic ageing of low density polyethylene in agricultural greenhouses

Low Density Polyethylene (LDPE) is a type of plastic that is commonly used to manufacture greenhouse covers due to its desirable properties such as flexibility, durability, and transparency. LDPE is also relatively inexpensive compared to other plastics, making it a popular choice for greenhouse applications. Additionally, LDPE is resistant to UV radiation, which helps to protect plants from harmful rays of the sun.

The lifetime of this material, theoretically planned for several years, is often hampered by the ageing process of LDPE is a complex phenomenon that involves several factors such as temperature, humidity, and exposure time. Over time, these factors can cause degradation of the polymer chains, leading to changes in physical and mechanical properties such as reduced strength, brittleness, and cracking.This study aims to investigate the impact of these factors on the aging process of monolayer and tri-layer PE materials of the virgin (unaged) and aged by observing changes in their mechanical properties and creep behavior.

Over duration of nine months, a genuine greenhouse located in the Tiaret region of northern Algeria was subject to natural ageing as part of this study.The mechanical properties and creep behavior of monolayer polyethylene film are negatively impacted by environmental factors, whereas the tri-layer polyethylene film is more resistant to these effects. This is due to the additional layers providing a barrier against UV radiation and other environmental factors, as well as offering improved strength and stiffness compared to the monolayer film.

Keywords: LDPE, ageing, lifetime, mechanical properties, creep.

Biography

Aissat Sahraoui obtained his engineering degree in Mechanical Engineering at the University of Tiaret, Algeria in 1990. He then obtained his master's degree in 2000 in mechanics at the University of Chlef, Algeria. He obtained his PhD in Mechanical Engineering from the University of Mostaganem, Algeria in 2012. He is an active member of the Industrial Technologies Research Laboratory of Ibn Khaldoun University of Tiaret, Algeria. He has published several research articles in different disciplines.

magnus Group

25-27 SEPT

DAY 03

KEYNOTE FORUM

5TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

Personalized and Precision Medicine (PPM) as a unique healthcare model to be set up via biodesign, bio- and chemical engineering, translational applications, biomanufacturing and upgraded business modeling to secure the human healthcare and biosafety

Traditionally a disease has been defined by its clinical presentation and observable characteristics, not by the underlying molecular mechanisms, pathways and systems biology-related processes specific to a particular patient (ignoring persons-at-risk). A new systems approach to subclinical and/or diseased states, being based on principles of systems biology and achievements of design-driven translational applications resulted in a new trend in the healthcare services, namely, Personalized and Precision Medicine (PPM).

To achieve the implementation of PPM concept in Bioindustry & Clinical Practice, it is necessary to create a fundamentally new strategy based upon the biomarkers and targets to have the unique impact. In this sense, despite breakthroughs in research that have led to an increased understanding of PPM-based human disease, the translation of discoveries into therapies for patients has not kept pace with medical need. It would be extremely useful to integrate data harvesting from different databanks for applications such as prediction and personalization of further treatment to thus provide more tailored measures for the patients and persons-at-risk resulting in improved outcomes and more cost effective use of the latest health care resources including diagnostic (companion ones), preventive and therapeutic (targeted molecular and cellular) etc.

And across worldwide basic, translational, clinical, and applied design-driven research, and throughout the industrial trends, scientific breakthroughs have been the launching point for principal bioproduct- and biotool developments in the translational trajectory. Even the most innovative healthcare technologies being translated in the right direction, would provide patient benefits only when adopted by clinicians and/or patients in actual practice. So, co-development between innovation-related builders and customers is a key agile principle. And in the coming wave of innovation in the broad-scope applications, learning rapidly what new bioproduct features work well for clinicians and patients will become even more crucial.

Translational researchers, bio-designers and manufacturers are beginning to realize the promise of PPM, translating to direct benefit to patients or persons-at-risk. For instance, companion diagnostics tools and targeted therapies and biomarkers represent important stakes for the pharma, in terms of market access, of return on investment and of image among the prescribers. At the same time, they probably represent only the generation of products resulting translational research and applications. So, developing medicines and predictive diagnostic tools

Sergey Suchkov[1-6]*, William Thilly[9], Robert Langer[9], Daniel Scherman[10], Shawn Murphy[7], David Smith[11], Hiroyuki Abe[8], Holland Cheng[12], Trevor Marshall[6]

Jeff Skolnick[14], Noel Rose[8,13]

[1]Institute for BioTEch & Global Health of the RosBioTech National University and Dept for Clinical Immunology of A.I. Evdokimov Moscow State University of Medicine & Dentistry (MGMSU), Russia

[2]EPMA, Brussels, Europe

[3]PMC, Washington, United States of America

[4]ISPM, Tokyo, Japan

[5]AHA, Houston, United States of America

[6]Autoimmunity Research Foundation, Los Angeles, United States of America

[7]Partners Healthcare and Harvard Medical School, Boston, United States of America

[8]ISPM, Tokyo, Japan

[9]MIT, Cambridge, MA, United States of America

[10]Centre de Recherche Pharmaceutique de Paris (CRP2), Faculte de Pharmacie, Universite Paris Descarte, Centre National de la Recherche Scientifique, Unite de Technologies Chimiques

requires changes to traditional clinical trial designs, as well as the use of innovative (adaptive) testing procedures that result in new types of data. Making the best use of those innovations and being ready to demonstrate results for regulatory bodies requires specialized knowledge that many clinical development teams don't have. The areas where companies are most likely to encounter challenges, are data analysis and workforce expertise, biomarker and diagnostic test development, and cultural awareness. Navigating those complexities and ever-evolving technologies will pass regulatory muster and provide sufficient data for a successful launch of PPM, is a huge task. So, partnering and forming strategic alliances between researchers, bio-designers, clinicians, business, regulatory bodies and government can help ensure an optimal development program that leverages the Academia and industry experience and FDA's new and evolving toolkit to speed our way to getting new tools into the innovative markets.

Whilst research and investment continues to develop the understanding, control and engineering infrastructural platforms necessary to tackle ever more challenging systems - and to increase the precision, robustness, speed and affordability of existing solutions - hundreds of start-up companies are already translating learnings and potential applications into commercially viable tools, services and products. Meanwhile, health-related biotechnology applications have dominated the commercialization of products to date, but significant opportunities for the production of bio-derived materials and chemicals, including consumer products, are now being developed. In this sense, systems & synthetic biology start-ups developing tools and services account for between 10%-25% of private investment activity. Around 20% of the latter start-ups address industrial biotechnology targets, but currently, only attract 10-15% private investment. Adopting a more networked approach - linking specialists, infrastructure and ongoing research to de-risk the economic challenges of scale-up and supported by an effective long-term funding strategy - is set to transform the impact of systems & synthetic biology and industrial biotechnology in the bioeconomy.

In this sense, the bioentrepreneurs thus drive and shape innovation, thereby speeding up structural changes in the economy. Entrepreneurship is thus a catalyst for economic growth and national competitiveness. Startups in bio design usually have a revolutionary idea however design driven innovation approaches should be used; to develop innovative business models that are scalable and profitable as well as to develop innovative bio marketing strategies. A startup should not be focused on the product only; market, competitors, users, suppliers to be identified real opportunities for innovation.

In the context of bio design and biotechnology, the bioentrepreneur

et Biologiques pour la Sante (UTCBS) Inserm, Paris, France

[11]Mayo Clinic, Rochester, MN, United States of America

[12]T College of Biological Sciences, UC Davis, CA, United States of America

[13]Center for Autoimmune Disease Research, John Hopkins University, Baltimore, MD, USA,Director of the Center for the Study of Systems Biology, Georgia Institute of Technology and School of Biological Sciences, Atlanta, GA, United States of America

Biography

Sergey Suchkov was born in the City of Astrakhan, Russia, in a family of dynasty medical doctors. In 1980, graduated from Astrakhan State Medical University and was awarded with MD. In 1985, Suchkov maintained his PhD as a PhD student of the I.M. Sechenov Moscow Medical Academy and Institute of Medical Enzymology. In 2001, Suchkov maintained his Doctor Degree at the National Institute of Immunology, Russia. From 1989 through 1995, Dr Suchkov was being a Head of the Lab of Clinical Immunology, Helmholtz Eye Research Institute in Moscow. From 1995 through 2004 - a Chair of the Dept for Clinical Immunology, Moscow Clinical Research Institute (MONIKI). In 1993-1996, Dr Suchkov was a Secretary-in-Chief of the Editorial Board, Biomedical Science, an international journal published jointly by the USSR Academy of Sciences and the Royal Society of Chemistry, UK.

operates in a knowledge-based and science-based design-driven Biotech and Bioindustry, where competitive advantage is achieved through the effective management of intellectual property emanating from good life science. The bioentrepreneur is often a scientist/researcherturned-entrepreneur who wishes to see their research successes put into practice through commercialization.

Healthcare is undergoing a transformation, and it is imperative to leverage new technologies to support the advent of PPM. This is the reason for developing global scientific, clinical, social, and educational projects in the area of PPM and TraMed to elicit the content of the new trend. The latter would provide a unique platform for dialogue and collaboration among thought leaders and stakeholders in government, academia, industry, foundations, and disease and patient advocacy with an interest in improving the system of healthcare delivery on one hand and drug discovery, development, and translation, on the other one, whilst educating the policy community about issues where biomedical science and policy intersect.

Friction welding of dissimilar steels

The welding of dissimilar metals is a hot topic as the field of application is increasing more and more in the industrial sector. Welding of dissimilar metals has an economic interest and friction welding is a process that has several advantages. In this presentation, the types of friction welding will be presented and their applications for the welding of non-similar steels. The choice of welding dissimilar steels is dictated by the large number of steels that exist in the industrial sector and that require their assemblies.

Audience Take Away Note

- This presentation will provide an understanding of friction welding and its application for welding dissimilar steels
- This presentation will make it possible to know the number of dissimilar steels which have been welded up to the present day

Zakaria Boumerzoug

Department of Mechanical Engineering, LMSM, University of Biskra, Biskra, Algeria

Biography

Zakaria Boumerzoug is a Professor at Department of Mechanical Engineering, Biskra University. He has supervised 30 PhD students. He has published more than 70 research articles, two book chapters and edited a book (Advanced Materials Design and Mechanics) in Materials Science field. He was as a member and also as a guest editor in some international conferences. He participated to more than thirty international conferences as speaker and invited speaker He is the guest editor of the special issue of friction welding of dissimilar metals.

Crystallographic aspects of shape memory effect and reversibility in shape memory alloys

Some materials take place in class of advanced smart materials with adaptive properties and stimulus response to the external changes. Shape memory alloys take place in this group, with the capacity of responding to changes in the environment by exhibiting shape reversibility. These alloys exhibit a peculiar property called shape memory effect, which is characterized by the recoverability of two certain shapes of material at different conditions. These alloys have dual characteristics called thermoelasticity and superelasticity, from viewpoint of memory behavior. Shape memory effect is initiated on cooling and deformation processes and performed thermally on heating and cooling, with which shape of materials cycles between original and deformed shapes in reversible way in bulk level. Therefore, this behavior can be called thermal memory or thermoelasticity. Superelasticity is performed by stressing and releasing the material at a constant temperature in the parent phase region. Superelasticity exhibits ordinary elastic material behavior, but it is performed in non-linear way; loading and unloading paths are different at the stress-strain diagram, and hysteresis loop reveals energy dissipation. These phenomena are performed by crystallographic transformations called martensitic transformation. Thermoelasticity is governed by the thermal and stress induced martensitic transformations on cooling and stressing, and reverse austenitic transformation on heating. Superelasticity is governed by stress induced martensitic and reverse austenitic transformations by stressing and releasing materials, with which ordered parent phase structures turn into detwinned martensitic structure and ordered parent phase structures, respectively. These transformations occur with the movements of atoms in atomic scale in sub-nano level. Thermal induced martensite occurs on cooling along with lattice twinning and ordered parent phase structures turn into twinned martensite structures by means of lattice invariant shears, and these structures turn into detwinned martensitic structures with deformation by means of stress induced transformation. Lattice twinning occurs in two opposite directions, <110 > -type directions on the {110}-type plane of austenite matrix in self-accommodating manner, by means of lattice invariant shear. Superelasticity is also governed by stress induced martensitic transformation and ordered parent phase structures turn into detwinned martensite structures with stressing. Copper based alloys exhibit this property in metastable beta-phase region, which has bcc based structures at high temperature parent phase field. Lattice invariant shear is not uniform in shape memory alloys and cause to the formation of complex layered structures with thermal induced martensitic transformation. In the present contribution, electron diffraction and x-ray diffraction studies performed on two copper- based CuZnAl and CuAlMn alloys. Electron diffraction patterns

Osman Adiguzel

Department of Physics, Firat University, Elazig, Turkey

Biography

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

and x-ray diffraction profiles exhibit super lattice reflections in martensitic condition. Specimens of these alloys were aged at room temperature in martensitic condition, and a series of x-ray diffractions were taken duration aging at room temperature. Reached results show that diffraction angles and peak intensities change with aging time at room temperature, and this result refers to the rearrangement of atoms in diffusive manner.

Keywords: Shape Memory Effect, Martensitic Transformation, Thermoelasticity, Superelasticity, Lattice Twinning, Detwinning.

Audience Take Away Notes

- Shape memory effect is a multidisciplinary subject, and I will introduce the basic terms and definition at the beginning of my Talk, and introduce the experimental results performed on two copper-based alloys.

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

Structural and magnetic properties of new half metallic ferromagnetism

First-principles calculations of structural, elastic, electronic and magnetic properties of full-Heusler Ir2HfB, Ir2HfAl and Ir2HfGa have been realized by Full-Potential Linearized Augmented Plane Wave (FP-LAPW) method implemented inWIEN2K code. The Perdew–Burke–Ernzerh of Generalized Gradient Approximation (PBE-GGA) carried out the computation of different parameters to describe elastic and structural properties. The calculation of structural properties revealed that the three alloys are stable in cubic AlCu2Mn-type structure in ferromagnetic state. The elastic constants calculation shows the three alloys satisfy the stability criteria. Indeed, the calculated spin-polarized electronic band structure and density of states using Generalized Gradient Approximation (GGA) show that Ir2HfZ (Z = B, Al, Ga) alloys have a metallic character. The influence of strong electronic correlation has been considered in GGA+Uand mBJ-GGA+U approximations that allows for improving the width of the band gap. The calculations carried out with GGA+U and mBJ-GGA+U show that Ir2HfAl and Ir2HfGa have a half-metallic behavior; however, Ir2HfB has a near half-metallic character. The calculated magnetic moments of Ir2HfB, Ir2HfAl and Ir2HfGa in a regular cubic structure with GGA+U and mBJ-GGA+U equal 1□B. With mBJ-GGA+U, the spin polarization values are 100% for Ir2HfAl, Ir2HfGa and 99.90% for Ir2HfBto be applicable for spintronics.

Audience Take Away Notes

- Elaborate the industrial application of ferromagnetism
- It will help the researchers and scientists
- Present the advantages of ferromagnetism
- Avoid the disadvantages of ferromagnetism

Yarub Al Douri

Engineering Department, American University of Iraq, Sulaimani, Sulaimani, Iraq

Biography

Prof. Dr. Yarub Al-Douri is from American University of Iraq, Sulaimani. Al-Douri has initiated Nanotechnology Engineering MSc Program and Nano Computing Laboratory. He has received numerous accolades including World's Top 2% Scientists by Stanford University, USA 2022, 2021 & 2020, OeAD Award, Austria 2020, JSPS Award 2019, AUA Award 2019, IFIA 2019, TWAS-UNESCO Associateship (Twice) Award 2015 & 2012, the total is 70 awards. Al-Douri is Associate Editor of Nano-Micro Letters (Q1), Editor-in-Chief of Experimental and Theoretical NANOTECHNOLOGY, Editor-in-Chief of World Journal of Nano Science and Engineering.

magnus Group

25-27 SEPT

DAY 03

SPEAKERS

5TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

VIRTUAL

Anowar Hossain
RMIT University, Australia

Camouflage textiles against advanced surveillance of defence in UV-Visible-IR spectrums for multidimensional combat backgrounds

The demonstration and structure of hypothesis is covered the design, simulation, formulation for suitability of deceiving materials on textiles substances for high performance camouflage textiles under multidimensional Combat Background (CB); exposing the Concealment, Detection, Recognition And Identification (CDRI) on spectral, chromatic, and achromatic illumination for camouflaging. The evaluation of camouflage coloration has been critically focused on standard assessments process in Ultraviolet-Visible-Infrared (UV-Vis-IR) ranges for CDRI of single and simultaneous CB. Present works on camouflage textiles depicts the illumination engineering of camouflage textiles for defence protection in multidimensional CB materials and methodology for concealment of latest surveillance technology. Research and development on camouflage textiles have been exhibited multidimensional CB environment for camouflage textiles such as dry leaves, green leaves, tree bark-woodland combat background; water-marine combat background; sand-desertland combat background; stone-stoneland combat background; snow-snowland combat background; sky combat background and ice-iceland combat background, concrete-concreteland combat background (DGTWSICB). The reflectance and chromatic profile of camouflage treated textiles has been analysed with the reflectance profile of CB materials. Aluminium, carbon black, chromium oxide, natural plant based natural dyes, natural sand-based silicon dioxide have been implemented for trialling of camouflage coloration as deceiving materials. The technology of adaptive camouflage Textiles was approached with thermochromic colorant and liquid crystal for multidimensional combat backgrounds. The principle of camouflage coloration has been considered for reflection altering of target signature against CB materials and surrounding CB materials. Experimentation of this hypothesis has also been judged the alternative way of camouflage assessment in addition of existing color matching principle with CB materials. The potential outcome of this research is not only limited to Vis ranges camouflage textiles in multidimensional CB environments; but also, UV-IR ranges for concealment and advancement of digital camera and hyperspectral camera to overcome the present challenge of camouflaging. Primary method of deceiving materials formulation was choosed for encapsulation into polyurethane-based solvent. Secondary method is an application of encapsulated deceiving materials on synthetic and cellulosic fabric such as polyamide 6, 6 and cotton fabric. The achievability and suitability of camouflage coloration against multidimensional CB environments have been experimented by established methods of textile coloration such as coating, dyeing, printing. Camouflage treated fabric has been scanned by spectroscopic, microscopic, and photographic illumination for suitability of materials, method, chromatic and achromatic properties of camouflaging. Color measurement spectrophotometer, Fourier transform infrared spectrometry, scanning electron microscopy, digital camera imaging, hyperspectral camera imaging were used for assessment methods of camouflage identification in terms of chromatic and achromatic characteristics of target signature (camouflage textiles) and multidimensional CBs. The treatment of camouflage materials or similar structure of materials or combination of materials against CBs have been

cited for high-performance camouflage research on textile substances in terms of real illumination theory of camouflaging. Therefore, the principle of camouflage technology has versatile applications of defence protection for concealment of target signature against multidimensional CB. Optical advancement in UV-Vis- IR camouflage Textiles have been designed and experimentally approached for concealment of defense surveillance against multidimensional combat backgrounds. These camouflage textiles are broadly applicable for military protection such as clothing, weapon, vehicle and location hiding nets/tents, etc in terms of chromatic/spectral matching in UV-Visible-IR spectrums. Camouflage textiles, camouflage materials design, camouflage method design have been approached for concealment of defense target signature against DGTWSICB in UV-Vis-IR spectrums.

Biography

Engr. Md. Anowar Hossain, PhD (Fashion & Textiles), Final part, School of Fashion and Textiles, RMIT University, Australia (Funded by Australian Government RTP Stipend Scholarship); Former PhD Researcher (Textile Tech., Part time), Department of Chemistry, Jahangirnagar University, Dhaka, Bangladesh; MTech in Textile Technology (Technical Textiles), Department of Jute and Fibre Technology, Institute of Jute Technology, University of Calcutta, Kolkata, India; BSc in Textile Engineering, Department of Textile Engineering, City University, Dhaka, Bangladesh started his coloration research in 2010 as dyeing officer (research and development) in Mascom composite ltd, Radix Ltd. Dhaka, Bangladesh. Engr. Md. Anowar Hossain did two years duration MTech in Textile Technology (Technical Textiles), from Department of Jute and Fibre Technology, University of Calcutta, India. He started his academic platform of research on textile coloration in 2013-2014 under 'Professor Dr. Ashis Kumar Samanta' and 'Dr. Arindam Bagchi', Department of Jute and Fibre Technology, University of Calcutta. He did his coloration research practice in Department of Chemistry, Jahangirnagar University, Dhaka, Bangladesh under 'Professor Dr. Nurul Abser' and Department of Textile Engineering, City University, Dhaka Bangladesh. He also did his coloration practice as coloration professional/academician in different reputed industries/universities in Bangladesh. He has around 30 publications of research article, book chapter, books as contribution of first author/single author circulated by national and international publishers, mostly focused on color engineering and camouflage textiles technology. Currently he is a registered Ph.D researcher at School of Fashion and Textiles, RMIT University under the supervision of 'Professor Dr. Lijing wang' and 'Professor Dr. Robert Shanks' in the area of defence textiles and coloration concentrating on camouflage textiles and major focusing on camouflage physics in terms of textile coloration and combat background funded by Australian Government RTP Stipend Scholarship. His ongoing research on 'camouflage coloration versus combat background' is a new concept of camouflage engineering and/or color engineering has been designed by sole-author, Md. Anowar Hossain as prerequisite of PhD outcome at RMIT University. Therefore, teaching experiences in BSc and Diploma in Textile Engineering level, chairman and membership of academic committee in BSc engineering level (University of Chittagong & University of Rajshahi, Bangladesh), practices of academic research (BSc, MTech and PhD in Textile Engineering level) and related publications, practices of professional research & related publications in international Journals, research supervision for Bachelor Degree in Textile Engineering, writing books on wet processing & garments engineering as well as working with realistic field based textile industries in Bangladesh and India location, academic research location in Bangladesh, India and Australia will highly manipulate for ensuring specialized output based research/teaching/research supervision/BTech, MTech and PhD thesis review/journal article review/research and textile industry consultant in textile engineering/technical textiles/dyeing & finishing and its related branches in home and abroad. He is a Consultant and Academic Assessor of Textile Engineering (Textile coloration, Defence textiles, Technical textiles) since 2010.

Engr. Md. Anowar Hossain is presently a Lecturer (study leave) in Textile Engineering, Department of Textile Engineering, City University, Dhaka, Bangladesh. He is a former Assistant Professor and Head of Department of Textile Engineering, BCMC College of Engineering and Technology, Jessore, Affiliated by University of Rajshahi. He is also a former Lecturer and Head of Department of Textile Engineering and Assistant Registrar (Additional), Newcastle University College, Chittagong, Affiliated by University of Chittagong. Engr. Md. Anowar Hossain is a former CEO of Bangladesh Textile and Fashion, Uttara, Dhaka; former Coordinator of Gothic Design Ltd., Viyellatex Group, Tongi; former merchandiser of Best Exchange Buying and Fashion, Uttara, Dhaka. Engr. Md. Anowar Hossain has certified training on coated textile production and glass fabric manufacturing at KE Technical Textiles Ltd, India; Dyeing and Finishing, Spinning, Weaving and Knitting, Merchandising at National Institute of Textile Training, Research and Design NITTRAD, Savar, Dhaka, Faculty of Niederrhein University, Germany; Dyeing & Finishing at Niagara Textiles Ltd, Dhaka, Bangladesh; Export and Import at DCCI Business Institute, Dhaka, Affiliated by ITC UNCTAD/WTO, Geneva; specialized training on laboratory and chemical management, RMIT University, Australia as well as other training in related profession of textil engineering in home & abroad.

VIRTUAL

Suwen Chen[1,2]*, Xin Guo[2]

[1]State Key Laboratory for Disaster Reduction in Civil Engineering, Tongji University, Shanghai, PR China

[2]College of Civil Engineering, Tongji University, Shanghai, PR China

Characterization of filler morphology and dispersion of silicone adhesive by scanning electron microscopy

Silicone adhesive has been used in assembly glass curtain walls for decades because of its excellent adhesion capacity for various substrates and high deformability. It is a filled elastomer with Poly Di-Methyl Siloxane (PDMS) working as matrix and nano-$CaCO_3$ or nano-SiO_2 working as reinforcement filler. Due to the complexity of its composition, the mechanical behavior of silicone adhesive, such as hyperelasticity, viscosity, Mullins effect and degradation, is still under investigation. By now, the microstructure of silicone adhesive stays unclear, and the linkage between its macroscale properties and microscale structure evolution remains a challenge. To obtain an in-depth understanding of its mechanical behavior mechanism, constitutive modelling, engineering design and, furthermore, material modification, a detailed description of microstructure of silicone adhesive is required.

In this presentation, taking DOWSILTM 995 silicone structural sealant as an example, we will present typical microstructure of silicone adhesive obtained by Scanning Electron Microscopy (SEM). By analyzing processed binary microscale images, filler morphology and dispersion will be discussed, where Gaussian mixed models are used to describe statistical features. The results show that the size of nano-$CaCO_3$ filler particles mainly include two levels of 80nm and 120nm, approximately, and filler particles tend to form clusters with equivalent diameters ranging from hundreds of nanometers to several micrometers. The dispersion of filler is inhomogeneous according to Gaussian characteristics of skewness and kurtosis. The hierarchical structure of filler is then characterized by a fractal dimension of 1.5 calculated by box-counting method, which further confirms a heterogenous dispersion of filler and will be used in future study of constitutive modelling.

The above-mentioned results give us a deeper insight into microstructure of silicone adhesive, which will enable us to better understand the mechanisms of its complex mechanical behaviors and to potentially modify target properties. The future research will focus on 3D characterization of in-situ loading conditions and aged conditions to study the evolution of microstructure of silicone adhesive under various circumstances.

Audience Take Away Notes

- Basic properties and applications of silicone adhesive in construction field
- A quantified characterization of hierarchical filler structure of silicone adhesive
- A better understanding of how microstructure affects the macroscale properties
- Methods to characterize and analyze similar filled polymers

Biography

Prof. Suwen Chen has been engaged in the area of mechanical properties of engineering materials (high-strength steel, glass, and polymers, etc.) considering coupling effects of temperature and strain rate, the blast resistance of structural members, the collapse resistance of steel structure under explosion, and the blast resistance of architectural glass curtain wall. Prof. Suwen Chen has edited and participated in the compilation of 6 standards/specifications and com-

pleted many application research topics for practical engineering projects. She currently serves in the editorial boards of Journal of Constructional Steel Research (Q1), International Journal of Protective Structures, Glass Structures & Engineering and Structural Magazine and etc. She has published more than 70 research articles in SCI/EI journals and has been authorized with 10 national invention patents.

VIRTUAL

Shaoqing Wang*, Yuegang Zhao, Xiao MA

College of Geoscience and Surveying Engineering, China University of Mining & Technology (Beijing), Beijing , P.R. China

Coal graphitization and graphene derived from different coal ranks

The following items will be discussed: how to understand coal graphitization, the effect of coal properties (rank, maceral, etc) on the graphene made from coal, the role of cohesiveness of coal during coal graphitization.

Audience Take Away Notes

- Understand coal graphitization
- The role of cohesiveness during graphitization
- How to consider contribution of different maceral when making graphene

Biography

Dr. Shaoqing Wang studied geological engineering in China University of Mining & Technology (Beijing) and graduated at BS in 2003, continued studying at the same university and received PhD degree in 2010. Fortunately, Dr. Wang studied twice in the Pennsylvanian State University, the first time is as joint-studying and the second time is visitor. Dr. Wang is mainly interested in coal geology, coal graphitization, and coal-based carbon materials, publishing more than 80 research article and obtaining some awards in the geology field.

VIRTUAL

Bakari Chaka[1]*, Aloys M Osano[1], Patricia B C Forbes[3]

[1]Department of Mathematics and Physical Sciences, Maasai Mara University, P.O Box 861-20500, Narok, Kenya

[2]Department of Chemistry, Faculty of Agriculture and Natural Sciences, University of Pretoria, Pretoria 0002, South Africa

Synthesis and characterization of biochar adsorbents from sugarcane bagasse and cow dung

This study aimed at synthesizing and characterizing the properties of two locally available 'waste biomass materials' as potential biochar adsorbents. The two biochars were Cow Dung (CDB) and Sugarcane Bagasse (SBB). These substrates were pyrolyzed in controlled anaerobic media at 300 – 400 °C. The synthesized biochar was characterized for physico-chemical properties (pore volumes, bulk density, specific surface area, point surface area) using Brauner-Emmer Teller, BET analysis at varying relative pressures of carbon dioxide and nitrogen gases. The phases and particle size of the biochar was analyzed using X-ray diffraction. Specific surface area, SSA analysis, morphology and functional groups was conducted by scanning electron microscopy – energy dispersive spectroscopy and fourier infrared spectroscopy respectively. Further elemental and oxide analysis was confirmed using inductive coupled plasma – optical emission spectroscopy and X-ray fluorescence methods. Thermal analysis was also done to check the stability of the biochar under varying conditions. The results found the SBB sample to have a smoother morphology with more elemental carbon and oxygen compared to the CDB. The average particle size of the SBB was 27.1 nm while that of CDB was 29.2 nm. The average SSAs, pore volume and median pore widths was 42,877 and 43,005 m2/g; 0.082 and 0.084 cm3/g; and 3.571 and 3.555 Å for SBB and CDB respectively. The cow dung biochar sample had more alkalis such as silica, alumina and iron content. Both samples exhibited stretching Si-O and –OH peaks relevant for adsorption. The CDB sample was found to be relatively more resilient to temperature and mass changes according to the thermal gravimetric analysis, differential scanning calorimetry and differential thermal analysis conducted. In conclusion, both samples were found appropriate for adsorption of a variety of pollutant moieties. Commercial production of these biochars for water purification is thus encouraged.

Key words: Cow Dung, Sugarcane Bagasse, Biochar, Adsorbents.

Audience Take Away Notes

- The audience will learn on properties of waste biomass materials that can be tuned for use as adsorbents as well as new adsorbent synthesis methods
- This will help them develop alternative and cheaper materials for water purification which are cheaper and more available
- This research that other faculty could use to expand their research or teaching
- A designer would tune the preparation parameters of the adsorbents to make better adsorbents
- It improve the accuracy of a design, or provide new information to assist in a design problem
- List all other benefits
    - Utilization of waste materials in a more eco-friendly manner

Biography

Mr. Bakari Chaka studies Bachelor of Science and Masters of Science in Chemistry in Maasai Mara University where he graduated in 2016 and 2020 respectively. He then enrolled in the same institution to pursue a doctorate degree in Chemistry, under the supervision of Dr. Aloys Osano (same institution) and co-supervision of Prof. Patricia Forbes (University of Pretoria, S. Africa). He is currently in his third year of study. He is a member of the Royal Society of Chemistry and has published more than 5 research articles in SCI€ journals.

Vyacheslav Shulunov

Institute of Physical Materials Science of the Siberian Branch of the Russian Academy of Science Ulan-Ude, Buryatia, Russian Federation

Nanotechnologies and artificial neural networks for global rapid low-cost detection of any respiratory infections

The presentation shows ways to ensure express, precise and inexpensive detection of all known respiratory infections in every passenger in multimillion flows not slowing them down. 3× enhanced Rapid Parallel Search (RPS) technology for identifying sick and asymptomatic virus carriers is more feasible to immediate monitor every air traveler at international airports. Accelerated RPS technology suitable for checking the entire passenger traffic of the biggest airline hub in the world by 71 apparatuses located at each registration line without delay. About 233 RPS complexes are enough for daily screening a million citizens in in big town for hundreds of biological threats at the same time and allow to keep mass sports and culture events open by screening all spectators at the entrance. RPS uses a combination of time proved methods such as Scanning Electron Microscope (SEM) and a 99.999% human error-free identification algorithm similar to "Face ID" from “Apple Inc.”. The updated RPS uses Artificial Neural Networks (ANN) that process nano and subnano photos via the online cloud. The use of ANN located in the online cloud, rather than local ANN, makes RPS more reliable and faster. High-contrast subnano images of objects for better recognition and comparison obtained using the built-in SEM intelligent image processor system with linear alignment and averaging hundreds of frames fill the 3D Multi Angle Dataset (MAD). This reliable, quick, comparatively cheap and reagent-free key makes real-time worldwide digital biosurveillance systems and early ultra-express identification of any airborne infections possible by saliva test. Global update of network RPS machines for simultaneously detecting a new viruses and microorganisms will take several minutes to downloading new MAD from the Internet. The enhanced RPS uses a synchronized reload sequence, accelerated prescan operations, and is optimized for ultra-fast identification of all airborne, salivary infections and stopping their spread at any stage.

Audience Take Away Notes

- The audience will learn how nanotechnologies make it possible to massively protect mankind against any known respiratory infections
- The RPS offers a reliable, quick, without reagent, comparatively cheap key to real-time international bio surveillance providing early, ultra-express identification of all airborne, salivary infections and stopping their spread at any stage, which will help the audience in their job
- The results of this study can be used by other educators to expand their research and teaching in the field of nanotechnology applications in medicine
- Proposed solution allows in big town to keep mass sports and culture events alive by screening all spectators at the entrance and could simplify or make a designer’s job more efficient
- RPS is making global digital health systems available for real-time biosurveillance
- The presentation shows how a synchronized reboot sequence, accelerated prescan operations, and global ANN can significantly improve the performance of biothreat testing

Biography

In 1992 Vyacheslav Shulunov entered the Buryat Branch of the Novosibirsk State University. In 1997 graduated from the Buryat State University, Ulan-Ude Russia and joined a researcher at the Institute of Physical Materials Science of the Siberian Branch of the Russian Academy of Science. He received his Ph.D degree in Thermal Physics and Theoretical Heat Engineering in 2002 from the East Siberia State University of Technology and Management. The author of 3 patents of the Russian Federation, 4 certificate of state registration of the program, 11 Web of Science and Scopus publications.

VIRTUAL

Vladimir G Chigrinov

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

Nanosize azodye layers in new liquid crystal devices

Photoalignment and photopatterning has been deproposed and studied for a long time. Light is responsible for the delivery of energy as well as phase and polarization information to materials systems. It was shown that photoalignment liquid crystals by azodye nanolayers could provide high quality alignment of molecules in a Liquid Crystal (LC) cell. Over the past years, a lot of improvements and variations of the photoalignment and photopatterning technology has been made for photonics applications. In particular, the application of this technology to active optical elements in optical signal processing and communications is currently a hot topic in photonics research. Sensors of external electric field, pressure and water and air velocity based on liquid crystal photonics devices can be very helpful for the indicators of the climate change. We will demonstrate a physical model of photoalignment and photopatterning based on rotational diffusion in solid azodye nanolayers. We will also highlight the new applications of photoalignment and photopatterning in display and photonics such as: (i) fast high resolution LC display devices, such as field sequential color ferroelectric LCD; (ii) LC sensors; (iii) LC lenses; (iv) LC E-paper devices, including electrically and optically rewritable LC E-paper; (v)100% polarizers based on photoalignment; (vi) LC smart windows based on photopatterned diffraction structures; (vii) LC antenna elements with a voltage controllable frequency and direction of radiation.

Biography

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

VIRTUAL

Sivasubramanian Palanisamy[1,2]*, Mayandi Kalimuthu[1]

[1]Department of Mechanical Engineering, P. T. R College of Engineering & Technology, Thanapandiyan Nagar, Madurai – Tirumangalam Road, Madurai, Tamilnadu, 625008, India

[2]Department of Mechanical Engineering, Dilkap Research Institute of Engineering and Management Studies, Neral, Karjat, Raigad, India

Evaluate the mechanical, hardness and morphological characterization of Acacia Caesia Bark Fibers (ACBFS) reinforced composites

Due to their high strength and modulus, fiber-reinforced composite materials have been utilised for a long time in a variety of applications, including domestic and industrial uses. Synthetic and natural matrix materials can be used to create these fibre composites for use in reinforced plastics. Utilizing this abundant natural fibre found in the Western Ghats of southern India, particularly in Kerala and Tamil Nadu, the use of Acacia Caesia Bark Fibers (ACBFs) in different weight percents (10%, 15%, and 20%) was investigated. In addition to being durable and light, natural Fibers are also inexpensive. This study describes the fabrication and characterization of natural fiber-based polymer composites using Acacia Caesia bark fibre as reinforcement in addition to epoxy resin as the matrix material. Mechanical performance of composites is determined by analysing their mechanical properties. A series of experiments were conducted to determine the significance of various fibre weight fractions on the mechanical behaviour and hardness of these epoxy matrices reinforced with ACB fibre. Scanning Electron Microscopy (SEM) was used to investigate the fractured surface morphology to conclude this work.

Keywords: Acacia Caesia, Bark Fiber, Epoxy, Composite, Mechanical Characteristics, Hardness, Scanning Electron Microscopy.

Biography

Sivasubramanian Palanisamy working as an Associate Professor in Dilkap Research Institute of Engineering and Management Studies at Maharashtra as well as working a researcher at Department of Mechanical Engineering, P. T. R College of Engineering & Technology. He had published many articles in reputed International journals, books and book chapters in the research field of Natural fiber reinforced polymer composites and Elastomer (Rubber) composites.

VIRTUAL

V Yu Goltsev[1], AV Osintsev[1], E L Strizhakov[2], S V Nescoromniy[2], S O Ageev[2,5], A N Chumakov[3], I S Nikonchuk[3], O O Kuznechik[4], E G Grigoryev[5]*

[1]Department of Strength Physics, NRNU "MEPhI", Moscow, Russia
[2]Department of Machines and Automation of Welding Production, DSTU, Rostov-on-Don, Russia
[3]Laboratory of Radiation Plasmodynamics, B.I.Stepanov Institute of Physics, Minsk, Belarus
[4]Research Laboratory New Materials and Technologies, SSI PMI, Minsk, Belarus
[5]Department of High-Energy Methods for the Synthesis of Ultrahigh-Temperature Ceramic Materials, ISMAN, Chernogolovka, Russia

Advances of high-voltage consolidation of powder materals

The main features of the method of high-voltage consolidation of powder materials and the resulting advantages and limitations of this method are considered. The method of high-voltage consolidation of powders is effective for the production of refractory composite materials that retain their strength properties at ultrahigh temperatures under aggressive external influences. The short duration of high-temperature exposure in the process of high-voltage consolidation makes it possible to preserve the structural-phase state of the initial powder material in the consolidated compact material. A feature of this method is the high density concentration of the released energy in the area of contacts between powder particles. In this case, the initial state of the surface of powder particles (the thickness and structure of oxide films, the presence of foreign impurities, etc.), the shape of powder particles and their sizes significantly affect the regularities of high-voltage consolidation processes. Along with the characteristics of the powder, the determining factors are: the rate of input of the energy of the electromagnetic field into the powder material, the magnitude and nature of the mechanical pressure acting on the powder compact in the process of high-voltage consolidation. The high energy density in the particle contact zones leads to a local change in the state of aggregation of the powder substance in these zones. Along with the inhomogeneity of powder heating in interparticle contacts, a macroscopically inhomogeneous distribution of the current density in the volume of the consolidated sample is possible. The formation of the structure of a powder material during high-voltage consolidation is determined by processes of different scales occurring at interparticle contacts, in powder particles, in the bulk of the entire sample, and by the mutual influence of these processes.

Further development of this method is associated with a detailed experimental study of thermal processes during high-voltage consolidation of powders of refractory materials using pulsed photometry. Experimental studies of the parameters of high-voltage electrical impulse action in the process of consolidation of high-temperature TaC and HfC powder compositions have been carried out. Registration of the parameters of a high-voltage current pulse and the intensity of thermal radiation of the consolidated powder materials was carried out using a measuring complex developed by the authors. This complex includes: a Rogowski coil with an integrating circuit, which registers the parameters of a high- voltage current pulse; photodiode sensors that register the intensity of thermal radiation, which is transmitted through a special optical waveguide from consolidated powder compacts; systems for triggering and synchronizing the components of the measuring complex. The analysis of the emerging thermal electromagnetic radiation from the surface of the consolidated powder sample in the process of high-voltage consolidation is carried out in the visible radiation range, ranging from λr=650 nm to λr=950 nm. A criterion has been established that determines the range of optimal technological parameters of high- voltage consolidation for the creation of refractory high-density materials. Possible directions for further research into the process of high-voltage consolidation of powder materials are proposed.

Audience Take Away Notes

- The audience will be able to use the experimental complex for registration of a high-voltage pulse current parameters and the intensity of thermal radiation of the consolidated powder materials
- This experimental complex will help the audience in their study of the process of high- voltage consolidation of powder materials
- This research of high-voltage consolidation processes of powders other faculty could use to expand their research and teaching
- The results of this research provide a practical solution to a problem of powder consolidation that make a designer's job more efficient
- This research provides new information to assist in a design problem consolidation of powder materials

Biography

Dr. Evgeny Grigoryev studied theoretical nuclear physics at Moscow Engineering Physics Institute (MEPhI), Russia and graduated as MS in 1975. He received his PhD degree in 1980 at the same institution. He has the next work experience In Moscow Engineering Physics Institute: Researcher, Senior Researcher, Associate Professor, Leading Researcher, Scientific Chief of Key Laboratory of Electromagnetic Field- Assisted Methods for Processing of Novel Materials. Since 2017 to the present, Grigoryev is the Head of the Laboratory of High-Energy Methods for the Synthesis of Ultra-high-Temperature Ceramic Materials in Merzhanov Institute of Structural Macrokinetics and Materials Science Russian Academy of Sciences. He has published more than 180 research articles in SCI(E) journals, 23 patents.

VIRTUAL

Igor V Shevchenko
M.P. Semenenko Institute of Geochemistry, Mineralogy and Ore Formation, Kiev, Ukraine

Influence of the sun on water. Explanation of “water memory” mystery

The variations of solar activity and distribution of solar energy due to the rotation of the Earth around its axis and around the Sun exert a strong influence on the self-organization of water molecules, on the size of water clusters and on their chemical reactivity. As a result, the rate of hydrolytic reactions with participation of water clusters displays diurnal, very large annual variations, and is also modulated by the 11-year cycles of solar activity. The rate of hydrolysis also depends on geographic latitude and has different values in the Northern and Southern hemispheres. In different years of the solar cycle, the difference in the reaction rate can reach 200 times. This phenomenon may be well accounted for by the decomposition of water clusters under the influence of muons which are constantly generated in the upper atmosphere by the solar wind. Since the muon flux is anisotropic, its influence depends on the area of a reaction solution which is affected by muons. For this reason, the reaction rate is highly dependent on the geometry of the reaction solution and its position in space. For example, the difference in the rate of hydrolysis of triethyl phosphite in three 5-mm NMR tubes directed North-South, East-West and Vertically can be very large and it varies greatly during the day depending on the position of the Sun in the sky.

The influence of the Sun on the stability of water clusters sheds light on the ability of water to memorize the structure of dissolved anti-LgE antibody and to retain its biological effectiveness after strong dilution. This mysterious phenomenon known as “water memory” is not always reproducible as it can only manifest itself under weak solar influence when water clusters are stable. Such periods often occur at the beginning and end of the 11-year cycle of solar activity, especially in winter away from the equator. We were able to experimentally prove that under weak solar influence, water can copy the sizes of its own clusters and other molecules.

The dependence of the self-organization of water molecules and the chemical reactivity of water clusters on fluctuations in solar activity has a strong influence on all forms of life. It underlies the biological circadian, circannual and 11-year rhythms, and also displays the connection with epidemics.

Audience Take Away Notes

- Influence of the Sun on water has a strong influence on all forms of life. It sheds light on “water memory” mystery and displays the connection with epidemics
- Measurements of the rate of hydrolysis of triethyl phosphite in different places can provide important information about the influence of space weather on the Earth
- Hydrolysis of triethyl phosphite can be used to track changes in the direction of the muon flux
- Near the Equator where there are no seasonal differences, such measurements may become an independent method for estimating solar activity

Biography

Dr. Shevchenko studied Chemistry at the Kiev University, Ukraine and graduated as MS in 1979. He then worked at the Institute of Organic Chemistry in Kiev and received there his PhD degree in 1985. In 1990 he won Alexander von Humboldt scholarship and until 1996 was invited scientist at the Braunschweig University in Germany and at the Sothern Methodist University in Dallas Texas USA. Then he worked in Kiev at the Institute of Bioorganic Chemistry and Petrochemistry and the Institute of Geochemistry Mineralogy and Ore Formation, Ukrainian Academy of Sciences. He has published more than 60 research articles.

VIRTUAL

N O Gopal

Department of Physics, Vikrama Simhapuri University College, Nellore-524324, A.P, India

Non-metal insertion into Tio_2 nanomaterials by various methods-A way to enhance the activity of Tio_2

Titanium dioxide (TiO_2) nanomaterial, a semiconducting photocatalyst in which the light induced production of charge carriers is the basic process has became the benchmark semiconductor photocatalyst. In spite of its various favorable properties, the practical application of TiO_2 is mired by two major drawbacks. One is the rapid recombination of photogenerated electron-hole pairs and the other is its high energy band gap (3.2 eV for anatase) that requires the UV light to activate it, which limits the sufficient utilization of the naturally available solar energy. These two drawbacks associated with TiO_2 have fascinated the researchers to modify it by various methods to enhance the spatial separation of the photogenerated charge carriers and to extend its optical response from ultraviolet to visible region for the efficient utilization of naturally available solar energy. An ideal morphology and high crystallinity of TiO_2 could bring its optical response to visible region and guarantee the high spatial separation of photogenerated electron-hole pairs. In this aspect, TiO_2 nanomaterials obtained by sol-gel and hydrothermal methods were found to have well defined morphology, high crystallinity and high purity. In this report, we present the results of our studies on morphologically different TiO2 nanomaterials obtained by various methods. TiO_2 nanoparticles codoped with phosphorus and boron (P,B- TiO_2) prepared by sol–gel method exhibit visible light driven MB degradation, which is much better than that of photocatalytic activity of only P doped TiO_2, and commercially available Degussa P25. TiO_2 nano-wires (Ti-NWs) and nano-flakes (Ti-NFs) were obtained from phosphorus doped TiO_2 nanoparticles (Ti-P) by hydrothermal method and by subsequent heat treatment respectively. FE-SEM micrograph of the as prepared sample depicts well formed, entangled and randomly oriented nano-wires morphology, which changes to nano-flakes morphology after heat treatment. Absorption edge of the Ti-NWs sample shows blueshift where as the Ti-NFs sample exhibit redshift compared to precursor sample as evidenced by UV-Visible absorption spectra. Methyleneblue degradation profiles depict very high activity of Ti-NFs sample compared to Ti-NWs and the precursor samples, which is due to the observed redshift in the absorption edge, change in morphology and high crystallinity of the sample which in turn increases the optical response and separation of photogenerated charge carriers as evidenced by the optical and EPR measurements respectively. Boron doped TiO_2–CeO_2 (B/TiO_2–CeO_2) nanocomposite has been synthesized using solution combustion technique, which shows the porous morphology with uniform distribution of nanoparticles in them.

Audience Take Away Notes

- Our research results would be interesting for the participants of the conference
- Those interested researchers could try to produce better materials by following our preparation procedures
- Hydrothermally derived materials could be better entities for technological applications

Biography

Dr. N.O. Gopal received his Ph.D. in physics from Sri Venkateswara University, Tirupati, India in 2004 and worked as a post Doctoral Fellow at National Dong Hwa University, Hualien, Taiwan from 2005 to 2013. He joined as an Assistant Professor in Department of Physics, Vikrama Simhapuri University College, Nellore, Aandhra Pradesh, India in May 2013. He has published 72 research papers in International journals (SCI & Scopus).

VIRTUAL

Keerthiprasad K S
Department of Mechanical Engineering, VVIET, Mysuru, Karnataka, India

Utilization of non-biodegradable industrial wastes in developing composite materials

Materials are an essential factor to build a more sustainable economy whether through materials for medical / automobile/ aerospace /electronics/ daily need components etc. Each field expecting a material with different properties. For example, aircraft and automobile industries requires light weight with high strength materials. Each day the world asking for new material with enhanced properties. On the other hand, the world is facing disposal of industrial and agricultural waste. Some of the industrial waste which cannot be decomposed, the non-biodegradable waste like plastic, fly ash, synthetic fibers, silver foil, glass objects etc. The rate of accumulation of this waste is increasing day by day. The main challenge is, reutilization of these waste to develop a new material without degrading the properties. In my work made an attempt to develop a new material using some of these wastes. Composite material with different combination and proportions are developed and characterized. In this session, the discussion on the challenges faced while developing and characterizing the composite material, testing results and also on life and utilization of material for different applications.

Audience Take Away Notes

- They learn about how to utilize the non-biodegradable industrial waste
- If they are working in automobile or any other material development industry, they can develop new materials using this waste
- Defiantly they can expand their research or teaching. There is a lot of scope
- This work provides a practical solution. After developing designer has to tell whether it is suitable or not
- New material for design problem
- Re utilization of bio-degradable waste material
- Some extent it will reduce accumulation of waste

Biography

Dr. Keerthiprasad K S studied Mechanical Engineering at Siddaganga Institute of Technology affiliated to Bangalore University and has done ME in Machine Design at BMS College of Engineering, Bangalore. In the beginning He joined industry and then joined for teaching profession. He received his PhD degree in 2010 from Visvesvaraya Technological University, Belagavi. He has developed his own new testing and casting equipment for research. He published more than 50 papers in international journals and presented more than 25 papers in international conferences. He has Conducted workshops, National Seminars, Conference, Project Expo on materials.

VIRTUAL

Michael I Tribelsky

Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia

Nanoparticles as a tool to tailor electromagnetic field at subwavelength scales

Resonant light scattering by nanoparticles provides a unique opportunity to concentrate a high-amplitude electromagnetic field in a subwavelength area of space as well as to tailor and control its pattern. In addition to purely academic interest, this is extremely important for numerous applications ranging from medicine and biology to telecommunication and data processing. Despite more than a hundred years of extensive study, the problem is still far from completion. A review of new results in this field is presented in this contribution. In many cases, despite the smallness of the scattering particles, their light scattering has very little in common with the conventional Rayleigh case. New, counterintuitive effects, especially those related to violating the quasi-static description of the scattering occurring at the action of (ultra)short laser pulses, are pointed out, inspected, discussed, and classified.

Audience Take Away Notes

- The talk gives new insights into the old problem of light scattering by particles. The results may be used as grounds for developing new nanotechnologies and metamaterials
- The discussed results are interesting both from an academic viewpoint and for practical applications
- Though the discussed results are not directly related to technological processes, they open the door to new technologies

Biography

Prof. Tribelsky received his MS from Lomonosov Moscow State University in 1973, a PhD from Moscow Institute of Physics and Technology in 1976, and a Dr. of Sci. (habilitation) from Landau Institute in 1985. He received numerous national and international awards: Leninsky Komsomol Prize (1979); COE Professorship, the University of Tokyo (2006, 2008) and Kyushu University (2007), Japan; Honorary PhD, Yamaguchi University, Japan (2016), etc. Presently, his interest lies in subwavelength optics. He is the author of several books, book chapters, review articles, and more than 100 research papers.

Edith Johanna Diaz Canas[1]*, Elcy Maria Cordoba Tuta[1], Prospero Acevedo Pena[3]

[1]Universidad Industrial de Santander, Grupo de Investigacion en Desarrollo y Tecnologia de Nuevos Materiales, GIMAT, Bucaramanga, Colombia
[2]CONACYT-Instituto Politecnico Nacional, CICATA Legaria, Calzada Legaria 694, Col. Irrigacion, 11500 CDMX, Mexico

Enhanced removal of methyl orange from aqueous solutions by sucrose-based reticulated vitreous carbon modified with N-doped TiO_2

The Reticulated Vitreous Carbon (RVC) foam underwent N-TiO_2 coating to achieve the RVC/N-TiO_2 composite. This foam was developed to remove azo dyes from textile wastewater. The RVC was fabricated using the sacrificial template method, employing a 30 ppi (pores per inch) polyurethane foam immersed in a low-cost sucrose resin. Synthesis of N-TiO_2 occurred via the sol-gel method, utilizing triethylamine as a precursor for nitrogen doping in TiO_2. The RVC/N-TiO_2 composite demonstrated significant potential in simultaneous adsorption and photocatalysis for the efficient removal (>95%) of Methyl Orange (MO). SEM-EDS analysis confirmed the honeycomb structure of RVC/N-TiO_2. While Raman spectroscopy, EDS, XPS, and FTIR analyses provided evidence of the foam's graphitization degree, the formation of anatase and rutile phases in TiO_2, and the presence of functional groups, effectively highlighting the synergy between RVC and N-TiO_2. Electrochemical tests, including Cyclic Voltammetry (CV), Open Circuit Potential (OCP), and chronoamperometry, demonstrated the occurrence of oxide reduction reactions, thereby enhancing the material's adsorptive capacity in the absence of light and facilitating semiconductor activation under visible light. These findings unequivocally support the notion that nitrogen doping improves the photocatalytic properties of TiO_2 under visible light. The adsorption isotherms revealed the adherence of the RVC/N-TiO_2 composite to both the Freundlich model and the pseudo-second-order model, indicating multilayer adsorption on the foam, contingent upon the concentration of the medium and the active sites of the material. Furthermore, the governing mechanism was the electrostatic forces resulting from the interaction between the MO solution and the RVC/N-TiO_2 foam. Lastly, the RVC/N-TiO_2 foam's reusability was validated through more than three cycles of adsorption/desorption and adsorption/photocatalysis, thus establishing its potential for the remediation of contaminated water.

Audience Take Away Notes

- The RVC/N-TiO_2 research focuses on using RVC from an environmental perspective. The synthesis method simplifies the production of the resin used in the project by using low-cost sucrose instead of toxic substances like phenol or formaldehyde. This not only reduces environmental impact but also makes the process more sustainable
- To combining RVC with N-TiO_2, the research explores a dual-component system of adsorption and photocatalysis simultaneously for to remove pollutants. This opens new possibilities for the development of hybrid materials without sacrificing the individual strengths of each component
- The research focuses on understanding how RVC/N-TiO_2 can effectively remove azo dyes from wastewater by studying the adsorption and photocatalysis mechanisms involved. By gaining insights into these processes, we can improve our understanding of how pollutants interact with new materials and develop more efficient treatment methods

Biography

Edith Johanna Diaz Canas is a chemical engineer and Ph.D. student in materials engineering at the Industrial University of Santander (UIS), Colombia. She is a member of the Research Group in Development and Technology of New Materials (GIMAT) and the Research Group in Minerals, Biohydrometallurgy, and Environment (GIMBA) at the same institution. Throughout her career, Edith worked for various industries. In the automotive sector, she researched and developed novel products aimed at enhancing fuel quality. In the textile industry, she worked on formulating natural dye stabilizers and exploring the utilization of agro- industrial waste for the fabrication of non-woven materials.

VIRTUAL

Melnyk I V[1]*, Tuhai S B[1], Scripka Yu M[1], Shved I S, Kovalchuk D V[2]

[1]Electronic Devices Dept., Electronics Faculty, National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Beresteiska Ave., 37, building 12, 03056, Kyiv, Ukraine

[2]Joint Stock Company, Scientific and Industrial Association "Chervona Hvylia", Bozhenka str. 15, 03680 Kyiv, Ukraine

Advantages of using high voltage glow discharge electron guns in nanoelectronic production

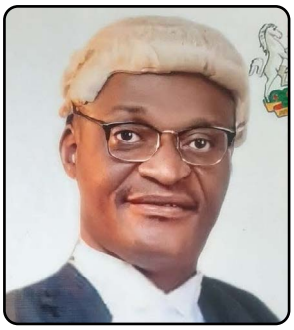
High Voltage Glow Discharge (HVGD) electron guns are widely used in the advanced branch of industry, including metallurgy, instrument-making and electronics. Such kind of guns can be successfully used for obtaining nanostructurized films and crystals, especially ceramics, which included active gas components. The distinguishing feature of such films and crystals is the high purity and stichometry. Especially effective such king of guns for obtaining the dielectric and piezoceramics films in microelectronic production, as well as for refining of refractory materials and volume 3-D printing technologies. The main advantages of HVGD electron guns are high stability of operation in the soft vacuum, simplicity of construction and realtive cheapness.

Audience Take Away Notes

- Using of High Voltage Glow Discharge (HVGD) Electron Guns is one of advanced technology for obtaining nanofilms and nanomaterials. Advantages of using this technology will be explained in presentation
- Using of HVGD electron guns can give novel product in metallurgy, electronic industry, instrument-making and in other branch of industry. Expectably such guns effective for obtaining ceramic nanostructures films and crystals. Details of theses technologies will be explained in presentation
- Certainly, it is this research that other faculty could use to expand their research or teaching
- Certainly, it does provide a practical solution to a problem that could simplify or make a designer's job more efficient
- Certainly, it improve the accuracy of a design, or provide new information to assist in a design problem

Biography

Dr. Melnyk Igor studied Electronic in Kiev Polytechnical Institute, Ukraine, and graduated as Electronic Engineering in 1989. Then he joined Research Group on Laboratory of Electron Beam Technological Devices, of Kyiv Polytechnical Institute, headed by Denbnovetsky S.V. Melnyk I. received Ph. D. in 1994 and Doctor Degree in 2009 in the same institution. He has published more than 70 research articles in SCI(E) journals.



Samuel Chisa Dike
Rivers State University, Nigeria

Powering energy transition in africa through nanotechnogy

Africa as a continent is in dire need of sustainable energy. This is premised on the need to extricate majority of the African population from poverty l to economic growth anchored on the deployment of modern sustainable and efficient energy services. There is a proven inverse relationship between the citizens of most African countries and access to affordable and sustainable energy. This is why it is imperative and germane to promote energy transition from highly carbonized fossil fuel- led energy scenarios in leading African Countries such as Nigeria and South African, to a more renewable and energy efficiency trajectory anchored on nanotechnology. It is uncontroverted that globally, house-hold energy consumption accounts to 40% of energy uses and some African countries such as Nigeria and South African, account to a reasonable global greenhouse gas emission due to their highly energy- intensive industries such as (crude oil and coal- fired industries). The poor access of most African citizens to affordable clean energy trajectory, has affected the commitment of these Countries to comply with greenhouse gas agreements and global carbon governance architecture. The desire to maintain access to sustainable and efficient energy while commendable in Africa, is subject to eradication of poverty and food insecurity which access to any energy source could guarantee. The objective of this paper therefore is to critically examine energy scenarios in Nigeria and South Africa, being notable examples of energy intensive African countries; to see how to strike a balance between the need to eradicate poverty arising from poor access to sustainable energy, and achieving economic growth anchored and guaranteed through nanotechnologies. This further anchored by employing mechanism for efficiently storing of produced energy; production of more efficient fuel cells, enhance solar silicon production, and useful wind blade. All of these innovations, the author argues, shall be premised on the deployment of nanotechnologies, which will promote not just good access to energy but propel economic growth, food production and poverty reduction in Africa.

This overall objective of this paper is to uncover and critically evaluate how the transition to sustainable energy can be powered and structured around the innovation anchored on nanotechnologies and their overall impacts on the African continent.

Kewwords: Nanotechnologies, Energy Transition Africa, Nigeria and South Africa.

Biography

Prof S. C. Dike is a Professor of Energy and Comparative Environmental Law of the Rivers State University,Port Harcourt,Nigeria. He is the President of Association of Environmental Lawyers of Nigeria and also a legal Practitioner and Notary Public of the Supreme Court of Nigeria with over 35 years experience in and out of court practice. Prof. Dike has well over 100 Published papers both nationally and internationally. He has also delivered many papers in Conferences in Europe and America. He is also a Rotarian and member of many professional associations such as Energy Institute UK.

VIRTUAL

Uroosa Ejaz

Department of Biosciences, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Karachi, Pakistan

Cellulose extraction from phragmites karka and its conversion into nano-fibers

Halophytic biomass is an abundant source of polysaccharides as they have a boundless supply of carbohydrates, which could be thought as the ultimate substrate and can be renewed into valuable chemicals and compounds such as methylcellulose and cellulosic nanofibers. Polyvinyl alcohol/ methylcellulose composites (cellulosic nanofibers) have attracted considerable attention due to the synergic relation between the two polymers and developing novel blends with improved properties. On one hand, Carboxy Methyl Cellulose (CMC) has high biocompatibility and biodegradability and has poor mechanical properties. On the other hand, poly vinyl alcohal is a versatile polymer with higher mechanical properties compared to CMC. The blending of the two polymers can help to benefit from the individual component properties. Cellulose NanoFibers (CNFs) applications as composites can be in coatings and films as well as packaging, foams and paints. CNFs also have applications in hygiene and absorbent products such as super water absorbent material, non-woven products, super absorbent polymers, antimicrobial films and absorbent structures. Other applications are in manufacturing highly scattering material for ultra-white coatings, corrosion inhibitors, capacitors, lightweight body armor and ballistic glass, computer components, loud-speaker membranes, reinforcement of conductive materials, battery separators and high-flux membranes. Therefore, this study was designed to use halophytic plant, Phragmites karka to extract cellulose and its conversion into cellulosic nanofibers. Chemical extraction of pectin, hemicellulose, lignin and cellulose were performed. Extracted cellulose was methylated by using Dimethyl sulphate, acetone and sodium hydroxide. Furthermore, methylated cellulose was converted in to Methylcellulose/ PVA composite. The structural changes in CNFs were observed by scanning electron microscopy. Results confer that degree of substitution of methylcellulose was 3 which showed the improvement in commercial applicability of the polymer. Therefore, the synthesized methylcellulose/PVA nanofibers will enhance the value to the abundant halophytic plant, Phragmite karka, and extend their range of biomedical applications.

Audience Take Away Notes

- In the 21st century, the increasing of environmental crisis caused by nonbiodegradable/nonrenewable material has pushed towards the development of new types of degradable and green bio-based materials from natural sources for various engineering applications
- For that movement, cellulose is one of the representative bio-materials that is abundantly existed in natural plant. Formation of cost-effective cellulose nano fibers from traditional natural halophytic plant
- Plant-based nanomaterials have advantages over other nanomaterials because they are biodegradable, biocompatible, and generally recognized as safe by FDA. These advantages are important for their applications in different sectors

Biography

Uroosa Ejaz is a highly motivated researcher with a MPhil in Microbiology and over 06 years of research experience. She has published 18 research articles in well reputed International Journals and also wrote 05 book chapters sponsored by Springer and Elsevier. She has work experience from Agha Khan University and Hospital, Patel Hospital, Bahria University and University of Karachi. She also worked as a research assistant in HEC funded NRPU project. Currently, she is serving as a Lecturer at SZABIST and she is also a PhD scholar in University of Karachi, Pakistan.

VIRTUAL

Saman Momeni[1]*, Abolghassem Zabihollah[2]

[1]Sharif University of Technology, School of Mechanical Engineering, Iran
[2]Tarleton State University, Department of Mechanical, Environmental, and Civil Engineering, United States of America

Vibration suppression of laminated composite wind turbine blades reinforced with nanoparticles

Non-uniform thickness laminated composites are being used in wind turbine blades. Recently, to enhance the strength and dynamic performance, nanoparticles are being added to the conventional matrix as a reinforcement. The present work investigates the effect of volume fraction of nanoparticles on the dynamic response of the blades. A laminated taper beam in which the matrix is reinforced with nanoparticles is considered to study the effect of volume fraction of nano particles on the natural frequency and damping properties of the blade. By adding nano particles up to 3% increases the natural frequency and beyond 3% and up to 7% natural frequency decreases. At 10% the natural frequency sharply declined. However, the damping coefficients of samples significantly improved.

Further, piezoelectric elements, as actuator and sensors, are mounted on the outer surface of blade, smart blade, to control the vibration in random loading conditions. An optimal control algorithm, Linear Quadratic Regulator (LQR) is implemented to suppress the vibration of the blade and to study the effect of nanoparticles in actuating force. It is observed that adding 10% of nano particles to the matrix significantly reduces the actuating voltage required to suppress the vibration. The proposed smart laminated blade improves the performance and functionality of wind turbine blades under in-deterministic loading conditions.

Biography

Dr. Momeni received his Ph.D., M.Sc., and B.Sc. in Mechanical Engineering from Sharif University of Technology, Iran. He has published several research articles in peerreviewed journal conferences and he has taught several courses at Universities at Post-graduate and undergraduate levels. As a professional engineer, Dr. Momeni has extensive experience in mechanical engineering including oil and gas.

Sahraoui Aissat*, Ali Safa

Research Laboratory for Industrial Technologies, Department of Mechanical Engineering, Faculty of Applied Sciences, Ibn Khaldoun University, Tiaret, Algeria

Improving grinding ball lifespan and efficiency through hardenability modelling and optimization

Grinding balls are spherical or cylindrical components used in grinding and milling operations to reduce the size of particles and achieve a finer product. They are made of High Chromium White Cast Iron (HCWCI) and used in a variety of industrial processes. The efficiency of the grinding process is heavily influenced by the properties of the grinding balls, including their composition, size, and hardness. As such, there is ongoing research and development to improve the performance and durability of grinding balls, with the aim of countering the extreme conditions of wear and impact that cause a reduction in their lifespan.

This study involved austenitizing balls with diameters of 50 mm and 70 mm at temperatures of 950°C and 1050°C, followed by quenching using both oil and compressed air. By exploiting the experimental HRC hardness results obtained in this work, the study aims to find a mathematical model relating the response (hardenability) to the main effects (austenitization temperature, quenching medium, and diameter balls) and their interactions. Analysis of variance (ANOVA) was used to establish the statistical significance parameters and an optimization of response by the best sub-models method is realized in the second part of this work.

It seems that the austenitization temperature and the size of the balls have a stronger impact on the hardenability of the balls than the cooling rate (quenching medium) by reducing the hardness difference between the surface and the medium of the ball to minimal values.

Keywords: Grinding Ball, HCWCI, Hardenability, Optimization, Best Sub-Models Method.

Biography

Aissat Sahraoui obtained his engineering degree in Mechanical Engineering at the University of Tiaret, Algeria in 1990. He then obtained his master's degree in 2000 in mechanics at the University of Chlef, Algeria. He obtained his PhD in Mechanical Engineering from the University of Mostaganem, Algeria in 2012. He is an active member of the Industrial Technologies Research Laboratory of Ibn Khaldoun University of Tiaret, Algeria. He has published several research articles in different disciplines.

Ioannis Dimos[1]*, Konstantinos Kalovrektis[2], Apostolos Xanakis[2], Athanasios Kakarountas[1]

[1]Dept. of Computer Science and Biomedical Informatics, University of Thessaly, Lamia, Greece

[2]Dep. of Digital Systems, University of Thessaly, Larisa, Greece

An innovative education 4.0 learning design framework to promote nanotechnology into the problem solving STEM approach within industry 4.0 era

The use of 3D printing technology to support education is not an innovative teaching approach. The adoption of this technology into teaching results in many benefits to students, namely; increased engagement, development of skills such as creativity, learning facilitation, and improvement of attitudes towards STEM subjects and careers. Besides, the advancement in Microelectromechanical System (MEMS) technology resulted in accurate and high-performance device systems. These devices are so tiny that they are not noticeable to the human eye and exhibit excellent feasibility in miniaturization sensors due to their small dimension, low power consumption, and superior performance. The area of science and engineering where MEMS are developed (dimensions in the nanometre scale) is called Nanotechnology. Nanotechnology is one of the fastest growing scientific research filed in Industry 4.0. Nanotechnology introduced industrial skills deficits as well as opportunities for new teaching practices in several subjects and educational frameworks. As these nanotechnology-enabled applications become a part of everyday life, many countries have fostered initiatives to incorporate nanotechnology concepts into their K-12 curriculum emphasizing the importance for students to have a basic understanding of material behaviour at the nanoscale. In the present work, we propose a framework education platform for learning activities in Nanotechnology under Education 4.0 for K12 curriculum. Through the proposed education platform, students will be facilitated; a) to comprehend the fundamental issues Nanotechnology, b) to comprehend the fundamental issues of MEMS structures, c) to design and develop (on large scale for 3d printing) nanotechnology artifacts, d) to improving skills such as problem-solving, creativity, collaboration, computational thinking, and adaptability under the evolution of Industry 4.0

Audience Take Away Notes

- They will know how K12 teachers can be used as 3D artifacts in the education process
- Nanotechnology importantance in STEM education
- In which way MEMS and 3D printing cultivate Education 4.0 skills
- Proposed platform leverages Computational Thinking concepts

Biography

IOANNIS DIMOS studied Informatics at the Aristotle University of Thessaloniki, Greece, in 1996. He received his MSc in Engineering (Telematics) from the University of Sheffield, UK in 1998, and he is currently doing his Ph.D. research at the Department of Computer Science and Biomedical Informatics, University of Thessaly, Greece. Currently, he is a Secondary High School teacher of Informatics. He is also the head of a Non-Government Organization “LabSTEM Robotics” where he offers STEM courses.

VIRTUAL

Zakia Hammou[1]*, Zakia Guezzen[2], Zouaoui Sereir[2], Yamna Hammou[3]

[1]Physical chemistry Department, Chemistry Faculty, University of Science and Technology of Oran, USTO, Oran, Algeria

[2]Composite Structures and Innovative Materials Laboratory, Mechanical Engineering Faculty, University of Science and Technology of Oran, BP 1505 El M'naouer, USTO, Oran, Algeria

[3]Maritime Sciences and Engineering Laboratory, Mechanical Engineering Faculty, University of Science and Technology of Oran, BP 1505 El M'naouer, USTO, Oran, Algeria

Effect of CNT volume fraction on the dynamic behavior of carbon nanotube reinforced FGM shells

In the present paper an analytical model was developed to study the non-linear vibrations of Functionally Graded Carbon Nanotube (FG-CNT) reinforced doubly-curved shallow shells using the Multiple Scales Method (MSM). The nonlinear partial differential equations of motion are based on the FGM shallow shell hypothesis, the non-linear geometric Von-Karman relationships, and the Galerkin method to reduce the partial differential equations associated with simply supported boundary conditions. The novelty of the present model is the simultaneous prediction of the natural frequencies and their mode shapes versus different curvatures (cylindrical, spherical, conical, and plate) and the different types of FG-CNTs. The results obtained show that the volume fraction and the types of NTC distribution have considerable effects on the variation of the Dimensionless Fundamental Linear Frequency (DFLF). The frequency response of the shallow shells of the FG-CNTRC showed two types of nonlinear hardening and softening which are strongly influenced by the change in the fundamental vibration mode.

Audience Take Away Notes

- The analytical model used allows vibration analysis
- Modulation equations have been developed and solved to represent the frequency-response curves as a function of the number of modes retained in our approximation
- The behavior of the shell in the vicinity of the resonance was valued by the effective nonlinearity and the displacement
- Our study is based on the effects of the volume fraction of the CNT on the natural frequencies of the shell with low curvatures reinforced by CNTs
- It has been shown that the non-dimensional frequencies depend on the number of modes retained and the values of the volume fraction of the CNT, the variation of the latter leads to a significant change in the stiffness of the shell

Biography

Dr. HAMMOU studied Chemistry at the Oran University, Algeria and graduated as DES in 2000. She then joined the research group of Prof. SEREIR at the Composite Structures and Innovative Materials Laboratory, Mechanical Engineering Faculty, University of Science and Technology of Oran. She received her PhD degree in 2022 at the same institution. She has published 3 research articles.

Participants List

Adam Juhasz	35
Alessandro Sergi	38
Alina Vladescu (Dragomir)	40
Anasiei Ioana	52
Andreas K Huttel	36
Andrey Rabin	57
Anowar Hossain	110
Bakari Chaka	115
Chung Shin Yuan	79
Delia Teresa Sponza	91
Dominika Beata Kwidzinska	27
Eder Socrates Najar Lopes	30
Edith Johanna Diaz Canas	128
Ernst Titovets	94
Erol Sancaktar	83
Evgeny Grigoryev	121
Graziella Kassick Saft	48
Igor V Shevchenko	123
Ioana–Cristina Badea	60
Ioannis Dimos	136
Irina Ungureanu (Negut)	97
Iuliia Bespalko	42
Izabell Craciunescu	81
Jaume Camarasa	32
Jyi Tsong Lin	43
Keerthiprasad K S	126
Lais Pellizzer Gabriel	30
Leelakrishna Reddy	71
Marianela Escobar Castillo	29
Mei Yi Liu	59
Melnyk Igor	130
Michael I Tribelsky	127
Milind Bhandarea	37

Participants List

Participants List

Yarub Al Douri	108
Zakaria Boumerzoug	105
Zakia Hammou	137
Zhongwei Guan	22

"We wish to meet you again at our upcoming event.."

6th Edition of International Conference on

Materials Science and Engineering

March 18-20, 2024 | Singapore | Hybrid Event

Questions? Contact

Phone: 1 (702) 988 2320 | Whatsapp: +1 (640) 666 9566

e-mail: secretary@magnusconference.com

Website: https://materials.magnusconferences.com/