PCM2023&GNN2023 CONFERENCE PROGRAM

October 27-30, 2023 | Online Microsoft Teams

China Standard Time - GMT+8

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Part I Conference Schedule Summary

Friday - October 27, 2023 / China Standard Time - GMT+8 ***Online MS Teams Link: http://www.academicconf.com/teamslink?confname=pcm2023***	
09:00-11:00 14:00-16:00	MS Teams Online Conference Testing
Saturday - October 28, 2023 / China Standard Time - GMT+8 ***Online MS Teams Link: http://www.academicconf.com/teamslink?confname=pcm2023***	
09:00-09:10	**Opening Ceremony and Keynote Speeches are chaired by** *Prof. Esteban Broitman, SKF Research & Technology Development, The Netherlands* **WELCOME SPEECH (PCM 2023&GNN 2023)** *Prof. Esteban Broitman, SKF Research & Technology Development, The Netherlands*
09:10-09:50	**Keynote Speech 1:** Solvothermal Synthesis of Ion-Doped Tungsten Suboxide and Vanadium Dioxide with Excellent Infrared Light Shielding Performance *Prof. Shu Yin, Lab. of Environmental Inorganic Materials Chemistry, Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Japan*
09:50-10:30	**Keynote Speech 2:** The Hardness of Polymers and Composite Materials at Macro- and Nanoscale *Prof. Esteban Broitman, SKF Research & Technology Development, The Netherlands*
10:30-10:50	**BREAK**
10:50-11:30	**Keynote Speech 3:** Numerical Modelling of Composite Bonded Joints and Sandwich Structures Under Impact Loads *Prof. Raul D.S.G. Campilho, Permanent Auxiliar Professor, School of Engineering, Instituto Superior de Engenharia do Porto, Portugal*
11:30-14:00	**LUNCH BREAK**
14:00-17:00	**Oral Session 1: Biomedical Materials and Environmental-Friendly Materials**

Sunday - October 29, 2023 / China Standard Time - GMT+8 *Online MS Teams Link:* ***http://www.academicconf.com/teamslink?confname=pcm2023***	
09:00-12:00	**Oral Session 2_ Nanocomposite and Multi-Functional Polymers**
12:00-14:00	**LUNCH BREAK**
14:00-16:35	**Oral Session 3_ Novel Composite Materials**

Part II Keynote Speeches

Keynote Speech 1: Solvothermal Synthesis of Ion-Doped Tungsten Suboxide and Vanadium Dioxide with Excellent Infrared Light Shielding Performance

Prof. Shu Yin
Lab. of Environmental Inorganic Materials Chemistry, Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Japan

Biography: Professor Shu YIN received a Ph.D. in applied chemistry from Tohoku University in 1999. After that, he became a research assistant, lecturer, associate professor, and then a full-time professor at the Institute of Multidisciplinary Research for Advanced Materials (IMRAM), Tohoku University. Now he is also a professor at the Advanced Institute for Materials Research (WPI-AIMR), Tohoku University. His research interests include morphological control, photocatalysts, UV-IR shielding, smart window, gas sensor, hydrothermal/solvothermal process, etc. He has won some scientific awards, such as the 69th CerSJ Awards for Academic Achievements in Ceramic Science and Technology, the APT Distinguished Paper Award, etc. His research papers were cited more than 16637 times and showed a citation h-index=69, i10=294. His research interests include morphological control of nanostructured materials, photocatalytic materials, UV-IR shielding smart window materials, 2D gas sensing materials, hydrothermal/solvothermal processes, soft chemical synthesis, etc.

Abstract: Smart window materials are leading the future of energy-saving by virtue of the autonomous response behavior to external stimuli, the development and application of which are widely believed to bring a new revolution. Among various smart window materials, tungsten suboxide (W18O49) is a kind of mixed valence state material showing some novel properties such as excellent conductivity and Infrared light shielding performance. While vanadium dioxide (VO2) is a special one showing a unique multi-stimulus responsive metal-insulator transition (MIT) accompanied by a structural phase transition, resulting in obvious changes in optical, electrical, and thermal properties, etc. These make them ideal for the formation of thin films as smart windows applications. Recently, element doping has become a powerful tool in tailoring the physical and chemical performance of oxides, especially the anion that possesses a variety of electronegativity and might result in many novel properties and potential applications. The present talk will introduce the solvothermal synthesis of infrared light-responsive tungsten suboxide and vanadium dioxide inorganic nanomaterials. Also, the investigation of various kinds of element doping / co-doping on the smart window performance was carried out. Among various ion doping, the doping of antimony changes the particle morphology and chemical properties and increases the content of free electrons

and thereby leading to the enhancement of the infrared light shielding performance of W18O49. On the other hand, the thermochromic type VO2-based infrared light-shielding thin films can effectively block the heat ray in summer but pass through the IR light in winter, showing a higher energy-saving effect than ordinary infrared light-shielding materials. It is also found that anion element doping can effectively decrease the semiconductor–metal phase transition temperature, indicating the great potential in practical applications.

Keynote Speech 2: The Hardness of Polymers and Composite Materials at Macro- and Nanoscale

Prof. Esteban Broitman

SKF Research & Technology Development Center, The Netherlands

Biography: Esteban Broitman holds a Ph.D. in Physics from the University of Buenos Aires (Argentina), and a Docent (Habilitation) degree in Tribology from Linköping University (Sweden). He has been doing research and teaching at the University of Buenos Aires (Argentina), The College of William & Mary (USA), Carnegie Mellon University (USA), Linköping University (Sweden), and Invited Professor at University of Sao Pablo (Brazil), and the Chinese Academy of Sciences (CAS - China). He is presently a Senior Scientist in the area of Coatings at the SKF Research and Technology Development Center in the Netherlands. He has published more than 200 peer-reviewed articles and book chapters, and presented numerous Plenary, Keynote and Invited Lectures. His activities focus on the use of advanced surface engineering to control friction and wear at the macro-, micro-, and nano-scales of coatings like DLC, nanocomposites, and softer materials like soft metals and polymers.

Abstract: During the last decade, novel polymers and nanocomposite materials have been developed for applications as micro- and nanodevices. In these applications, conventional mechanical characterization techniques like tensile, compression and bending tests are inapplicable due to the size of the samples. Nanoindentation technique, widely used to characterize the mechanical properties of hard metals and ceramics has started to be used also to characterize polymers and composite materials. Recently, a review has been published by the author comparing mechanical measurement techniques at different scales: “Indentation Hardness Measurements at Macro-, Micro-, and Nanoscale,” E. Broitman, Tribology Letters 65 (2017) 23.
In this talk, the application of indentation techniques to measure the hardness, elastic modulus, and creep of polymers and composite materials is discussed. A comparison between nanoindentation results and macroscopic properties is offered. Finally, indentation size effects and typical mistakes in the measurements of these materials are also critically examined. Challenges and future perspectives in the application of nanoindentation to characterize mechanical properties of polymers and composite materials are suggested.

Keynote Speech 3: Numerical Modelling of Composite Bonded Joints and Sandwich Structures Under Impact Loads

Prof. Raul D.S.G. Campilho

Permanent Auxiliar Professor
School of Engineering
Instituto Superior de Engenharia do Porto (ISEP)
Portugal

Biography: Raul Duarte Salgueiral Gomes Campilho completed his M.Sc. degree in 2006 and his Ph.D. degree in 2009, both of which at Faculdade de Engenharia da Universidade do Porto. He has authored 280 articles in journals, 27 sections of books and 9 books, and received about 9,164 citations with 51 h-index (Google Scholar). He has received 16 awards and/or honors. Raul D.S.G. Campilho spends much of his time researching Composite material, Adhesive, Structural engineering, Finite element method and Fracture mechanics. His Composite material study is mostly concerned with Fracture toughness, Adhesive bonding and Failure mode and effects analysis.

Abstract: The use of composite adhesive joints increased in the last decades through structural applications, comprising the aeronautical and automotive industries. Contrary to the static loading case, in many real situations, adhesive joints are subjected to impact loads, such as in the event of vehicle crashes. Despite this fact, numerical modelling of this loading type is seldom addressed in the literature. Additionally, sandwich structure applications also find application in different industries which, thanks to the inclusion of a low apparent density core, manage to achieve good mechanical properties in bending (increasing the second moment of area) with a low weight compromise. However, this type of material poses additional challenges due to its heterogeneous nature, generally due to stacking, resulting in complex damage mechanisms and the necessity to use failure criteria especially formulated for the evaluation and design of composite structure. This work initially evaluates the effect of the overlap length (LO) and adhesive type on the strength of composite single-lap joints (SLJ), when impact loaded, through experimental tests and cohesive zone models (CZM). The joints were subjected to a drop test and validated through the numerical model, by the analysis of stresses and damage, predicting the joints' strength for different geometries and adhesives. It was concluded that the increase of LO increases the joint strength, especially in those with a more flexible adhesive. In a second stage, a solution is proposed that drastically reduce the lack of residual strength of composite materials, i.e., after initial impact, by combining laminates of hybrid carbon fibre/Dyneema® fabrics with an elastomeric adhesive Reverlink™, in a composite sandwich with a honeycomb core. Low and high-velocity impact tests were made, and the experimental results were compared with a CZM-based numerical predictive model, showing the improved residual strength capacity of the proposed solution, compared to using typical epoxy adhesives.

Part III Oral Presentations

Online Oral Presentation Guidelines

- Online Oral Presentation will be conducted via Microsoft Teams (Click to see how to join PCM&GNN 2023 via MS Teams).
- All online presenters are requested to reach the Online Session Room prior to the scheduled time and deliver their presentations on time.
- The presentation timetable is shown in **China Standard Time (GMT+8).**
- If a presenter is not able to show up via MS Teams, the session chair / conference secretary will download and play the pre-recorded video presentation during his/her scheduled presentation time; if listeners have questions about the presentation, please contact the conference secretary to forward the questions.
- If a presenter cannot show up on time or have problems with Internet connection, the session chair has the right to rearrange the presentation order and let the next presenter start.
- Signed and stamped electronic presentation certificate would be issued and delivered via e-mail after the conference.

Best Oral Presentations Award

The session chair will select one best oral presentation from his/her session based on the following criteria:

- ✓ Research Quality
- ✓ Presentation Performance
- ✓ Presentation Language
- ✓ PowerPoint Design

➢ **Best Presenters will receive an official certificate and free registration to the PCM 2024**.

Session 1_ Biomedical Materials and Environmental-Friendly Materials

Time: 14:00-17:00, Oct 28, 2023. China Standard Time (GMT+8)
Session Chair: Dr. Alina Vladescu (Dragomir), Department for Advanced Surface Processing and Analysis by Vacuum Technologies (ReCAST), National Institute of Research and Development for Optoelectronics, Magurele, Romania
Online Session Room Link: *http://www.academicconf.com/teamslink?confname=pcm2023*

14:00-14:25	PCM3276 *(Invited)*	ZrCuCa Based Thin Films for Medical Proposes *Dr. Alina Vladescu (Dragomir), Department for Advanced Surface Processing and Analysis by Vacuum Technologies (ReCAST), National Institute of Research and Development for Optoelectronics, Magurele, Romania*
14:25-14:50	PCM3280 *(Invited)*	Urea Removal in Ultrapure Water Using Enzymes Immobilized on Magnetic Microparticles *Prof. Jin-Won Park, Seoul National University of Science and Technology, South Korea*
14:50-15:05	PCM3309	Characterization of Physical, Mechanical and Thermal Properties of Epoxy Composites Filled with Agro-waste Based Bambara Nut Shell Fiber *Dr. Ogah Anselm Ogah, Department of Polymer Engineering, Faculty of Engineering, Nnamdi Azikiwe University, Nigeria*
15:05-15:30	PCM3317 *(Invited)*	Atom-molecular Architecture of Native Bone: Composition and Spatiotemporal Changes under Biogenic and Pathogenic Conditions *Prof. Andrey Pavlychev, Solid States Electronics Department, St. Petersburg State University, Russia*
15:30-15:45	PCM3326	Recent Advances of Magnetic Gold Hybrids and Nanocomposites, and Their Potential Biological Applications *Dr. Mirza Muhammad Faran Ashraf Baig, The Hong Kong University of Science and Technology, HKSAR, China*
15:45-16:05		**BREAK**
16:05-16:30	PCM3279 *(Invited)*	Mesoporous Ultrathin Graphitic phase C3N4-based Composites for Superior Photocatalytic Performance in Refractory Pollutants Degradation *Dr. Murali Rajaram, Department of Physics, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, India*
16:30-16:45	PCM3322	Hydrochar and Its Composites for Highly Efficient Pollutant Removal *Dr. Jelena Petrović, Institute for Technology of Nuclear and Other Mineral Raw Materials, Serbia*
16:45-17:00	PCM3338	Study on Silica-based Rubber Composites Using Improved Geothermal Silica *Dr. Muh. Wahyu Sya'bani, Department of Chemical Engineering, Universitas Gadjah Mada, Indonesia*

Session 2_ Nanocomposite and Multi-Functional Polymers

Time: 09:00-12:00, Oct 29, 2023. China Standard Time (GMT+8)
Session Chair: Prof. Tokeer Ahmad, Department of Chemistry, Jamia Millia Islamia, Jamia Nagar, New Delhi, India
Online Session Room Link: *http://www.academicconf.com/teamslink?confname=pcm2023*

09:00-09:25	GNN1258 *(Invited)*	Heterostructured Functional Materials for Hydrogen Generation *Prof. Tokeer Ahmad, Department of Chemistry, Jamia Millia Islamia, Jamia Nagar, New Delhi, India*
09:25-09:50	PCM3277 *(Invited)*	Wear and Corrosion Properties of Ti Based Carbo-nitrides Obtained by Cathodic Arc Evaporation *Dr. Alina Vladescu (Dragomir), Department for Advanced Surface Processing and Analysis by Vacuum Technologies (ReCAST), National Institute of Research and Development for Optoelectronics, Magurele, Romania*
09:50-10:15	*PCM3278 (Invited)*	Hydrogen Storage in Sulphur-doped SiC Nanotubes *Dr. Ram Sevak Singh, Department of Physics, OP Jindal University, Raigarh, Chhattisgarth, India*
10:15-10:40	PCM3282 *(Invited)*	Polymer-Based Dielectric Composites for Electrical Energy Storage *Dr. Chao Yin, School of Electrical and Electronic Engineering, Harbin University of Science and Technology, China*
10:40-11:00		**BREAK**
11:00-11:15	PCM3340	Mesophase Transition and Fire Retardant Property of New Hybrid Ester-Cyclotriphosphazene Derivatives Bearing Different Terminal Group *Dr. Zuhair Jamain, Organic Synthesis and Advanced Materials (OSAM) Research Group, Faculty of Science and Natural Resources, Universiti Malaysia Sabah, Malaysia*
11:15-11:30	PCM3341	The New Formulation of Hybridization Gnp/Ag Highly Thermal Conductivity *Dr. Mohd Azli Salim, Fakulti Teknologi dan Kejuruteraan Mekanikal, Universiti Teknikal Malaysia Melaka, Malaysia*
11:30-11:45	PCM3329	Graphene-based Nanocomposites: A Versatile Tool for the Societal Challenges *Dr. Gil Gonçalves, TEMA - Centre for Mechanical Technology and Automation, Department of Mechanical Engineering, University of Aveiro, Portugal*
11:45-12:00	PCM3328	Voltammetric Sensor for Detection of Paracetamol in Pharmaceutical Formulations *Dr. Rajesh N Hegde, PG Department of Chemistry, Sri Dharmasthala Manjunatheshwara College (Autonomous), Ujire, Karnataka, India*

Session 3_ Novel Composite Materials

Time: 14:00-16:35, Oct 29, 2023. China Standard Time (GMT+8)

Session Chair: Dr. Alina Vladescu (Dragomir), Department for Advanced Surface Processing and Analysis by Vacuum Technologies (ReCAST), National Institute of Research and Development for Optoelectronics, Magurele, Romania

Online Session Room Link: *http://www.academicconf.com/teamslink?confname=pcm2023*

14:00-14:15	PCM3301	Multi-scale Prediction of 3D Printed Continuous Fiber Reinforced Thermoplastic Composites Based on Micro-CT *Dr. Ruishen Lou, Institute of Advanced Structure Technology, Beijing Institute of Technology, China*
14:15-14:30	PCM3302	Improved Manufacturing Method and Mechanical Performances of Composite Orthogrid Stiffened Cylinder *Dr. Yulin Wang, Institute of Advanced Structure Technology, Beijing Institute of Technology, China*
14:30-14:45	PCM3303	Synthesized of Graphene by Chemical Vapor Deposition (CVD) Technique: Evaluating Physical Properties and Expanding Application Frontiers *Dr. Oudjertli Salah, Research Center in Industrial Technologies. (CRTI) BP 64, Roade of Dely Brahim, Algeria*
14:45-15:00	PCM3323	Optimization of Warpage Defect in Injection Moulding Process using Polypropylene Material (DACIA Logan L90 Front Bumpe) *Dr. Soufiane Haddout, Faculty of Science,Department of Physics, Ibn Tofail University, Morocco*
15:15-15:35		**BREAK**
15:35-15:50	PCM3327	Epoxidized Natural Rubber Nanocomposites Based on Graphene/Carbon Nanotube Hybrid Nanofillers *Prof. Charoen Nakason, Faculty of Science and Industrial Technology, Prince of Songkla University, Surat Thani Campus, Surat Thani, Thailand*
15:50-16:05	PCM3332	Failure Analysis of Composite Cylindrical Shells Under Large Winding Loads *Dr. Yongsheng Kang, Institute of Physical and Chemical Engineering of Nuclear Industry, China*
16:05-16:20	PCM3337	Synthesis of New Well-defined Boron and Silicon Norbornene Derived Materials via Ring Opening Metathesis Polymerization (ROMP) *Prof. Mariusz Majchrzak, Department of Organometallic Chemistry, Adam Mickiewicz University in Poznań, Faculty of Chemistry, Poland*
16:20-16:35	PCM3339	NdFeO3-SnO2 Nanocomposite: Comprehensive Investigation of Structure, Electrical Transport and Ferroelectricity *Dr. Naseem Ahmad, Department of Physics, Kunsan National University, South Korea*

Abstract for Session 1

PCM3276
ZrCuCa Based Thin Films for Medical Proposes

Alina Vladescu (Dragomir)*, Anca C.Parau, Catalin Vitelaru, and Mihaela Dinu
Department for Advanced Surface Processing and Analysis by Vacuum Technologies (ReCAST), National Institute of Research and Development for Optoelectronic, Romania

Abstract. The current study aim is to obtain ZrCuCa based thin films using a PVD-cathodic arc approach to improve the surface properties of 316L stainless steel implant materials. The ZrCuCa-based layers that were developed have the potential to be candidates for use in the medical industry if they can combine their exceptional mechanical capabilities with the corrosion resistance of amorphous metallic glasses. Additions of Mo, Mg, Si, and Sr were taken into consideration for the ZrCuCa structure, and the quaternary systems that resulted from these additions were investigated in great depth. The electrochemical tests were carried out at the same temperature as the human body, which is 37°C. Scanning electron microscopy was utilized both before and after the electrochemical tests to characterize the morphology and topography of the sample. The roughness of the surface increased for all the coatings regardless the substrate. In vitro electrochemical studies and bioactivity experiments demonstrated that the suggested coatings improve substrate behavior in simulated conditions, highlighting their potential as medicinal biomaterials.

Keywords: cathodic arc, corrosion resistance, metallic glasses, coatings

Acknowledgements: We acknowledge the support of the Romanian Ministry of Education and Research, CNCS - UEFISCDI, project PN-III-P4-ID-PCE-2020-1264 (PCE95/2021), within PNCDI III, and to Romanian Core Program project no. PN-01/2023.

PCM3280
Urea Removal in Ultrapure Water Using Enzymes Immobilized on Magnetic Microparticles

Jin-Won Park
Seoul National University of Science and Technology, South Korea

Abstract. Ultrapure water is water from which ionic components including minerals, particulates, and microorganisms have been removed to a certain level or less. In this sense, it is also expressed by the term de-ionized water. As ultrapure water is essential for high-tech industries such as semiconductors, displays, solar power, pharmaceuticals, bio, and fine chemicals, related technology must be improved to the world's best in order to supply high-quality ultrapure water. The ultrapure water manufacturing process mainly consists of three steps: pretreatment, pure water production, and

water quality adjustment. In the pretreatment step, filtration and reverse osmosis are combined to mainly remove particulate matter and dissolved substances. However, it is not easy to remove urea to a level of 1 ppb through these processes. In this study, we aim to develop a technology to remove urea in ultrapure water using enzymes immobilized on magnetic microparticles.

Keywords: ultrapure water, urea removal, enzyme immobilization, magnetic microparticles

PCM3309

Characterization of Physical, Mechanical and Thermal Properties of Epoxy Composites Filled with Agro-waste Based Bambara Nut Shell Fiber

Ogah Anselm Ogah
Department of Polymer Engineering, Faculty of Engineering, Nnamdi Azikiwe University, Nigeria

Abstract. In order to protect the ecosystem attempts are being made to disparage deforestation. Burning agro-waste is of grave environmental concern. In this study, agro waste material which are obtained from Bambara nut shell fiber (BNSF) are employed as reinforcing filler in thermoset epoxy polymer as a substitute for wood derived products. The present study involves the fabrication of (0, 5, 10, 15, 20, 25, 30 and 35 wt. %) BNS filled epoxy composites using the hand layup technique. The results on mechanical properties such as tensile strength, modulus of elasticity, flexural strength, and impact strength revealed that these properties of BNS filler reinforced epoxy composites increased for 5wt% to 35wt% of filler loading and 15wt% shows the superior values in mechanical properties, whereas hardness increased for 5-35wt% with peak value at 35wt%.It was found that the physical properties of BNSF reinforced epoxy composites such as water absorption and thickness swelling increased with increasing filler loading whereas the density decreased with increase in filler loading compared to the control epoxy matrix composite. In addition to that, thermal stability of 5-35 wt% of BNSF reinforced epoxy composite were analyzed through TGA and DSC and compared to pristine epoxy. TGA/DTG showed that thermal stability of the BNSF/epoxy composites decreased with increasing filler loading, while DSC showed that Tg and Tm increased with increasing filler loading causing an increase in the brittleness of the material. The fiber-matrix de-bonding, poor interfacial adhesion and matrix cracks are the important failure mechanisms that are elucidated using SEM.

PCM3317

Atom-molecular Architecture of Native Bone: Composition and Spatiotemporal Changes under Biogenic and Pathogenic Conditions

Andrey Pavlychev
Solid States Electronics Department, St. Petersburg State University, Russia

Abstract. Native bone is a hierarchically organized triple (organic – mineral – water) composite. X-ray diffraction, X-ray photoemission, Raman and IR spectroscopies were applied to study the interplay of organic and mineral nanocomponents under biogenic and pathogenic conditions. The first samples group – cortical bone of young, adult and mature healthy rats – is used to inspect temporal changes in bone composite. The second samples group – saw-cuts of human femur at

arthroplasty of the osteoarthritis (OA) damaged knee compartment – is used to inspect spatial changes in the composite.
We discuss the correlated changes in the Ca 2p3/2,1/2, P 2p3/2,1/2, F, O, N and C 1s- core electrons binding energies, degrees of crystallinity, sizes of crystallites, Ca2+ deficiency and lattice-constants of calcium-hydroxyapatite (Ca10(PO4)6(OH)2).
Mineralized bone is a kind of electric battery composed from nanometric cells formed from negatively charged nanocrystals immersed into positively charged hydrated nanolayers. This nanoenergy concept is tightly related with aging processes because the nanocells are strongly charged in a newborn bone and discharge with age. The counter Ca2+ and OH– ionic currents reduce the inhomogeneity in charge distribution. The interplay of organic subsystem with nanocrystals is examined and the electrostatic energy density as a function of age is computed. The OA deviations are due to catalytic reactions, carbonization and amorphization of mineral bone at the collagen – mineral interface. These processes are enhanced in the border of "erased cartilage-mineral", but not inside the sclerosis area where the restoration of bone mineral is detected. Statistical and individual aspects of spatiotemporal changes in bone under biogenic and pathogenic conditions are discussed. The specific role of water in the composite is discussed in more details.

Acknowledgements: The work is financially supported by Russian Science Foundation Grant 23-21-00172.

PCM3326

Recent Advances of Magnetic Gold Hybrids and Nanocomposites, and Their Potential Biological Applications

Mirza Muhammad Faran Ashraf Baig
The Hong Kong University of Science and Technology, HKSAR, China

Abstract. Magnetic gold nanoparticles (mGNP) have become a great interest of research for nanomaterial scientists because of their significant magnetic and plasmonic properties applicable in biomedical applications. Various synthetic approaches and surface modification techniques have been used for mGNP including the most common being the coprecipitation, thermal decomposition, and microemulsion methods in addition to the Brust Schiffrin technique, which involves the reduction of metal precursors in a two-phase system (water and toluene) in the presence of alkanethiol. The hybrid magnetic–plasmonic nanoparticles based on iron core and gold shell are being considered as potential theragnostic agents. Herein, in addition to future works, we will discuss recent developments for synthesis and surface modification of mGNP with their applications in modern biomedical science such as drug and gene delivery, bioimaging, biosensing, and neuro-regenerative disorders. I shall also discuss the techniques based on my research related to the biological applications of mGNP.

Keywords: nanohybrids, magnetic gold nanoparticles, nanocomposites, surface functionalization, core-shell nanocomposites, magnetic-plasmonic nanoparticles, biological applications

PCM3279

Mesoporous Ultrathin Graphitic phase C3N4-based Composites for Superior Photocatalytic Performance in Refractory Pollutants Degradation

R. Muralidharan[1]*, H. Leelavathi[2] and R. Arulmozhi[2]

[1]*Department of Physics, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, India*

[2] *Department of Chemistry, SRM Institute of Science and Technology, India*

Abstract. Research on 2D nanomaterials with unique structural and electronic features has shown rising to a remarkable height and will keep on staying as a significant topic in materials science. In this regard, there are intensive interests to introduce 2D g-C_3N_4 materials and exploration of their unique tunable and controllable properties in a predictable manner. These 2D materials are achieved through various synthetic routes and the crucial role of these 2D materials is having a broad range of applications, including CO_2 photoreduction, the degradation of refractory pollutants, and the production of renewable and sustainable hydrogen fuel. Graphitic carbon nitride (g-C_3N_4) has been regarded as a promising metal-free photocatalyst for addressing the energy crisis and environmental issues because of its fascinating electronic band structures, photochemical stability, and efficient light harvesting with suitable bandgap energy of 2.7 eV. However, its photocatalytic effectiveness is constrained by low surface area and low-charge carrier mobility. Its distinct band structure provides a promising technique to enhance the charge separation, improve the surface area, and enhance light absorption when coupled with a semiconductor having a wide bandgap. Metal oxides, sulfides, and ferrites have been categorized and described as the three main systems of g-C_3N_4-based nanocomposites. The future challenges and prospective solutions that may direct the development of 2D advanced nanomaterials based on g-C_3N_4 and their photocatalysis related applications overviewed based on our recent results.

References:

[1] Xiong, J., Di, J., Xia, J., Zhu, W., Li, H., 2018. Surface Defect Engineering in 2D Nanomaterials for Photocatalysis. *Adv. Funct. Mater.* 1801983- 1802002.

[2] Leelavathi, H., Abirami, N., Muralidharan, R., Kavitha, H.P., Tamizharasan, S., Sankeetha, S., Arulmozhi, R., 2021. Sunlight-assisted degradation of textile pollutants and phytotoxicity evaluation using mesoporous ZnO/g-C_3N_4 catalyst, *RSC Adv.* 11, 26800–26812.

[3] Leelavathi, H., Abirami, N., Muralidharan, R., Kavitha, H.P., Tamizharasan, S., Sankeetha, S., Kumarasamy, A., Arulmozhi, R., 2023, Construction of step scheme g-C_3N_4/Co/ZnO heterojunction photocatalyst for aerobic photocatalytic degradation of synthetic wastewater, *Colloids Surf. A Physicochem. Eng. Asp.* 656, 130449.

[4] Zhu, Y., Peng, L., Fang, Z., Yan, C., Zhang, X., Yu, G., 2018. Structural Engineering of 2D Nanomaterials for Energy Storage and Catalysis. *Adv. Mater.* 1706347- 1706366.

PCM3322

Hydrochar and Its Composites for Highly Efficient Pollutant Removal

Jelena Petrović*, Marija Ercegović, Marija Simić, Marija Koprivica and Jelena Dimitrijević

Institute for Technology of Nuclear and Other Mineral Raw Materials, Serbia

Abstract. Water pollution caused by industrial effluents without prior purification treatment represents one of the serious environmental concerns in contemporary times. Lately, due to its surface characteristics, pronounced chemical reactivity, and efficient regeneration ability, hydrochar obtained by hydrothermal carbonization of waste biomass has been explored as sustainable adsorbents for the removal of different pollutants. Besides, potential disadvantages of this material, such as low specific surface area and porosity, are easily overcome by surface modifications and composites synthesis. Previous reported studies have shown that chemical methods that include hydrogen peroxide or alkalis treatment, and incorporation of metals onto hydrochar surface can significantly improve its adsorption performances. Within this study, the potential application of hydrochars from different precursors and its composites as efficient sorbents of organic dyes and heavy metals from aqueous solutions will be discussed. Special attention will be directed towards structural changes caused by modification, achieved adsorption capacities and potential adsorption mechanisms. In general, the valorisation of hydrochar as a polluter sorbent solves the problems of sustainable and efficient material for purification and disposal of waste with permanent consequences to the environment.

Keywords: hydrothermal carbonization, novel carbon adsorbent materials, hydrochar composites, waste minimization, wastewater purification

Acknowledgements: The authors are grateful to the Ministry of Science, Technological Development and Innovation of the Republic of Serbia for the financial support (contract no. 451-03-47/2023-01/200023).

PCM3338

Study on Silica-based Rubber Composites Using Improved Geothermal Silica

Muh. Wahyu Sya'bani[1,2,*], Rochmadi[1], Indra Perdana[1] and Agus Prasetya[1]

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Abstract. This study aims to investigate the potential of upgrading geothermal waste (GW) as an effective reinforcing filler for rubber composites. We compare the properties of purified geothermal silica (PGS) and nanoparticle geothermal silica (NGS) with dried geothermal waste. Through X-ray fluorescence spectroscopy, we determined that GW has a silica content of 93.13%, which significantly increased to 96.02% for PGS and an even higher 99.01% for NGS. Furthermore, our analysis using transmission electron microscopy revealed that NGS exhibited primary particle sizes within the range of 20-50 nm. These disparities in particle size and purities among GW, PGS, and NGS have discernible effects on the properties of rubber composites. Rubber composites employing PGS, with their enhanced purity compared to GW, demonstrated superior tensile strength, with a notable difference of 3.2 N/mm², as well as higher elongation at break, in contrast to those filled with GW. Additionally, the reduction of geothermal silica to a nanoscale size yielded improved filler dispersion within the rubber, as evidenced by scanning electron microscope results. Consequently, rubber composites incorporating NGS exhibited better vulcanization characteristics and mechanical

properties when compared to the other samples. The utilization of both PGS, which offers ease of production, and NGS, characterized by its nanoscale dimensions, holds promising benefits for both the rubber industry and geothermal power plants.

Keywords: Geothermal waste, rubber composites, vulcanization, mechanical properties

Acknowledgements: This work was supported by the Doctorate Dissertation Grant No. 2172/UN1/DITLIT/Dit-Lit/PT.01.03/2023 from Universitas Gadjah Mada. The author also gratefully acknowledges the Rubber Workshop and Polymer Laboratory at Politeknik ATK Yogyakarta for technical support.

Abstract for Session 2

GNN1258

Heterostructured Functional Materials for Hydrogen Generation

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Abstract. Multifunctional nanostructures find the possibility for their applications in water splitting processes for hydrogen generation as a renewable source of green energy. The studies of some multifunctional nanoparticles especially heterostructures by chemical synthesis reveal the formation of monophasic structures with fairly uniform distribution of nearly spherical particles, high specific surface area and visible optical band gap. Photocatalytic generation of hydrogen in water splitting process by using as-prepared doped and heterostructure nanoparticles has also been studied under the visible light irradiations which showed a significant H2 evolution reaction rate. The development of nanostructured catalysts has also been preferred to carry out the heterogeneous catalytic organic transformations because of greater number of surface-active sites for catalytic processes, high catalyst recovery rate, especially their environment friendly nature and their ease of synthesis. Herein, we also discuss some nanocatalysts for certain organic transformation reactions with enhanced activity as well as in water splitting reactions for hydrogen production.

PCM3277

Wear and Corrosion Properties of Ti Based Carbo-nitrides Obtained by Cathodic Arc Evaporation

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Abstract. The goal of the paper is to increase service life of cutting tools used in wood industry, which working into severe conditions. For this study, Ti-based carbo-nitrides were prepared by cathodic arc evaporation at different N_2 and C_2H_2 mass flow rates: series-1 (20 sccm N_2, 110 sccm

C_2H_2), series-2 (40 sccm N_2, 90 sccm C_2H_2), series-3 (80 sccm N_2, 50 sccm C_2H_2), and series-4 (110 sccm N_2, 20 sccm C_2H_2).
Surface morphology, elemental/phase composition and roughness were examined before and after wear and corrosion tests in corrosive solution (water+sand). The results showed that all the coatings enhanced the wear and corrosion resistance of the uncoated steel. By increasing of the nitrogen flow rate during the deposition process, both wear and corrosion resistances are increased. Moreover, all the coatings exhibited a 111 orientation and the hardness was more than 30GPa.

Keywords: cathodic arc, wear and corrosion resistance, carbonitride coatings

Acknowledgements: 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 to Romanian Core Program project no. PN-01/2023.

PCM3278

Hydrogen Storage in Sulphur-doped SiC Nanotubes

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Abstract. Hydrogen is a clean fuel and environmentally friendly source of energy. It can be utilized in diverse applications, including vehicles, aircraft, portable power to transportation, etc. Therefore, progressive research and development in area of hydrogen storage is ongoing. Nanotubes, having large surface to volume ratio, are attractive materials for hydrogen storage. Besides carbon nanotubes, other non-metallic nanotubes such as silicon carbide nanotube (SiCNTs) have been predicted as potential nanomaterials for hydrogen storage. In this talk, I shall focus on hydrogen adsorption properties of sulphur-doped (S-doped) SiCNTs using first-principles calculations based on density functional theory. The calculated energy band structures, density of states, charge transfer and adsorption energy will be discussed. At the end, the talk would be concluded with future prospects of work in this area.

PCM3282

Polymer-Based Dielectric Composites for Electrical Energy Storage

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Abstract. This presentation will focus on the topic of polymer films for dielectric energy storage, and introduce the fundamental principle of electrical energy storage and application background about polymer-based dielectric composite films. The research status of several representative dielectric energy storage films will be introduced briefly, such as the inorganic/organic composite films, all-organic polymer films and multilayered polymer films. Most importantly, the modified polymer films for high-temperature dielectric energy storage will be introduced in detail due to the

urgent needs in New Energy Vehicles and advanced propulsion weapons, high voltage transmission engineering.

PCM3340

Mesophase Transition and Fire Retardant Property of New Hybrid Ester-Cyclotriphosphazene Derivatives Bearing Different Terminal Group

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Abstract. A new series of hexasubstituted cyclotriphosphazene derivatives with two ester linking units were successfully synthesized and characterized. The homologs of the same series are differentiated with heptyl and nitro terminal groups. The synthesized compounds were characterized using Fourier Transform Infrared spectroscopy (FT-IR), Nuclear Magnetic Resonance spectroscopy (NMR), and CHN elemental analysis. The texture of these compounds was determined using Polarized Optical Microscope (POM), and their mesophase transition was further confirmed using Differential Scanning Calorimetry (DSC). Observation under POM showed that all compounds were found to be mesogenic with nematic phase in heating and cooling cycles. Two endotherms were observed in the DSC thermogram, confirming the transition of crystal, nematic and isotropic phases. Moreover, the fire retardant properties of the hexasubstituted cyclotriphosphazene compounds were determined using the Limiting Oxygen Index (LOI) test. Polyester resin has been used as a matrix of molding. Based on the LOI data, the compound with nitro terminal group showed the highest LOI value of 27.37 % due to the electron withdrawing properties of nitro groups, which able to induce the synergistic effect in the molecules.

Keywords: Cyclotriphosphazene, mesophase, fire retardant, ester, terminal group

Acknowledgements: The authors gratefully acknowledged the lab facility support from Universiti Malaysia Sabah (UMS) and Universiti Sains Malaysia (USM). This research was funded by Universiti Malaysia Sabah (UMS), grant number SPB0004-2020 and SBK0488-2021.

PCM3341

The New Formulation of Hybridization Gnp/Ag Highly Thermal Conductivity

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Abstract. Flexible electronics have become highly desirable for a variety of applications because of their low cost, lightweight characteristics, and flexibility. However, one of the challenges in developing a flexible electronic is depending on a suitable ink material formulation. The graphene nanoplatelets (GNP) sheets are inherently stacked together because of the strong van der Waals

interactions between adjacent layers. Silver is the most popular metallic material due to its excellent electrical conductivity and chemical stability. This thesis aimed to investigate the characteristics and applications of graphene and silver conductive ink mixed with an organic solvent, which had low resistivity, high flexibility, and high thermal conductivity. Four strategies were adopted to develop such inks. The first was to formulate a new formulation of conductive ink. The second was to characterise the electrical, mechanical, and thermal behaviour of a new formulation of conductive ink. The third was to simulate the proposed formulation characteristics using the finite element method (FEM). The fourth was to validate the thermal conductivity and resistivity relationship of the new formulation. To evaluate the performance in terms of electrical, mechanical, and thermal conductivity, this research firstly developed a GNP baseline using GNP as the only conductive filler with epoxy. Finite element analysis (FEA) was used to validate the GNP baseline stretchability and thermal conductivity formulations. Following that, research was carried out on the formulation and performance of GNP hybrids using GNP, silver flakes (Ag), and silver acetate (SA) as conductive fillers mixed with organic solvents. After the twisting and bending test, the GNP hybrid formulation reliability was evaluated. The use of GNP and silver conductive ink in combination with an organic solvent result in low resistance, high flexibility, and high thermal conductivity. GNP baseline and GNP hybrid formulations were compared in terms of electrical, mechanical, and thermal conductivity. The finding that the resistivity value of 0.1 wt.% GNP of GNP hybrid is 2.35 x 10-7 Ω.m, which is significantly lower than the resistivity value of GNP baseline, 0.249 Ω.m, demonstrates that mixing GNP with silver improves the performance of electrical conductivity. The GNP hybrid had the highest shear and thermal conductivity values of 1.98 MPa and 367.28 W/m.K. The GNP hybrid formulation could minimise the amount of silver used in the production of conductive ink. The GNP hybrid also improved conductive ink flexibility and thermal conductivity, which will have an impact on circuit manufacturing in the electronics industry.

PCM3329

Graphene-based Nanocomposites: A Versatile Tool for the Societal Challenges

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Abstract. Carbon, a fundamental element, has a fascinating history dating back to prehistoric times when humans first encountered it in the form of charcoal. Notably, one of our earliest uses of carbon was for artistic expression in ancient cave paintings.[1] The emergence of nanotechnology has revolutionized our understanding of carbon materials. Remarkable advancements in synthesizing carbon nanomaterials have opened up exciting possibilities capable of addressing various societal challenges.

Graphene-based materials (GBMs) have emerged as a particularly promising area of study. Their exceptional properties, including a high surface area, outstanding biocompatibility, and the capacity to be tailored with various structures, render them well-suited for a diverse array of applications.[2] These applications span from targeted drug delivery and bioimaging to the cutting-edge realm of photothermal therapy.[3] Furthermore, GBMs have demonstrated their potential in water purification

and remediation. Their outstanding adsorption capabilities, particularly in removing pollutants like heavy metals and organic compounds, offer viable solutions to urgent water quality challenges.[4] In the upcoming discussion, I will delve into our ongoing research efforts focused on developing novel nanostructured GBMs, with a specific emphasis on their applications in cancer nanomedicine and water remediation. Additionally, I will share my vision for the future of this dynamic and rapidly evolving field of GBMs.

References:

[1] R. Moliner, Carbon, (2016) 2-5.
[2] G. Gonçalves, Graphene-based Materials in Health and Environment, 2019, Springer Cham, ISBN 978-3-319-45639-3
[3] C. I. M. Santos et al., ACS Appl Nano Mater, 2021, 4, 13079–13089.
[4] A. Bessa et al, Chem Eng J, 2020, 398, 125587.

Keywords: graphene, nanocomposites, cancer, water remediation

Acknowledgements: G.G. gratefully acknowledges the funding by the Portuguese Science Foundation (FCT) financial support of project CARBONCT (2022.03596.PTDC), UIDB/00481/2020 and UIDP/00481/2020; and CENTRO-01-0145-FEDER-022083

PCM3328
Voltammetric Sensor for Detection of Paracetamol in Pharmaceutical Formulations

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Abstract. In this work, a voltametric sensor based on a nano-composite electrode for the detection of paracetamol was developed. The Platinum electrode was modified with CuO nanoparticles – Multi walled carbon nanotubes (CuONPs-MWCNTs) to constitute a nano-composite electrode. The developed sensor showed excellent sensitivity and good selectivity in phosphate buffer solution as supporting electrolyte at physiological pH. Under optimized conditions, the method was validated and applied successfully for the detection of paracetamol in pharmaceutical formulations and spiked urine samples.

Keywords: Nano-composite, voltammetry, paracetamol, sensor, analysis

Abstract for Session 3

PCM3301
Multi-scale Prediction of 3D Printed Continuous Fiber Reinforced Thermoplastic Composites Based on Micro-CT

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Abstract. A multi-scale framework based on micro-CT is presented for the elastic property prediction of 3D printed continuous fiber reinforced thermoplastic composites. Tensile samples and CT scanning samples are fabricated using home-built 3D printer with the same printing parameters. Firstly, tensile experiments are conducted to provide verification of the proposed method. Micro-CT scan is performed at two different resolutions to characterize and quantify the distribution of voids and fibers. Then, the multi-scale models are established according to the reconstructed micro and meso structures. Effective properties of fiber-rich region are predicted by the micro-scale analysis of the representative volume element, and then transferred into the meso-scale analysis. In meso-scale analysis, the high-fidelity generalized method of cells is applied to predicted elastic parameters of the printed samples. The relative error of the prediction is within the acceptable of engineering error. Lastly, the presented framework is implemented to discuss the effect of fiber volume fraction in the fiber-rich region. It is found that the fiber volume fraction in the fiber-rich region is critical for the accuracy of prediction while maintaining the overall fiber volume fraction.

Keywords: continuous fiber reinforced composites, elastic properties, 3D printing, micromechanics, multi-scale analysis

PCM3302

Improved Manufacturing Method and Mechanical Performances of Composite Orthogrid Stiffened Cylinder

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Abstract. Composite grid-stiffened cylinders with high load-carrying efficiency possess excellent potential in the aerospace industry. However, traditional manufacturing methods can result in dimension accuracy issues. To address this challenge, this paper presents an improved manufacturing method for composite orthogrid stiffened cylinders (COSCs) based on a combined metal mold and prepreg laying process. The improved method was used to manufacture high-precision COSCs with intersection fillets. Axial compression tests were performed to reveal the strength and failure mode of the cylinder. The results showed that rib fracture and end delamination were the primary failure modes of the COSC under compression. Compared to other relevant cylinders, the peak failure load, specific compression strength, and compression stiffness of the cylinder were significantly improved. Moreover, fillets wrapped around the intersection can provide effective protection to the fragile

intersection roots. To predict the failure behavior of the composite grid-stiffened cylinder, a series of composite progressive failure models considering linear buckling mode was proposed. Furthermore, a cyclical symmetrical finite element model was adopted to improve the efficiency of number simulation. The simulation results were found to be in good agreement with the experimental results.

Keywords: Orthgrid stiffened cylinder, Manufacture method, Mechanical property, Failure analysis, Finite element analysis

PCM3303

Synthesized of Graphene by Chemical Vapor Deposition (CVD) Technique: Evaluating Physical Properties and Expanding Application Frontiers

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Abstract. Graphene, a sheet of carbon atoms arranged in a lattice with a thickness of one atom serves as the fundamental building block of graphite the most abundant form of carbon. Graphene possesses characteristics including high electrical and thermal conductivity, remarkable chemical stability and exceptional transparency. In this context we employed the chemical vapor deposition (CVD) technique, for synthesizing graphene on copper substrates with control. By conducting measurements on its electrical conductivity, thermal conductivity and transparency we aimed to determine the materials exact physical properties and explore its potential applications in various practical fields such, as touch screens, solar panels, sensors and electronic devices.

Keywords: Graphene, CVD, thermal conductivity, chemical ctability, transparency

PCM3323

Optimization of Warpage Defect in Injection Moulding Process using Polypropylene Material (DACIA Logan L90 Front Bumpe)

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Abstract. Plastic-based products are being used more and more frequently. Due to the growing demand for thinner products, lower production costs and higher quality, there has been an increase in plastic molding research projects. Productivity can be increased by optimizing the injection molding parameters. In order for the process optimization to be successful, optimal parameters must be set. In this presentation we will discuss the warpage defect on the front bumper of DACIA Logan L90. The optimization was performed using the TAGUCHI method and the percentage contributions were calculated using an analysis of variance (ANOVA). A significant correlation was found between mould temperature (35.80%), packing time (35.59%), melt temperature (10.13%) and packing pressure (5.33%). Melting temperature (200 °C), packing time (0.8 s), packing pressure (375 MPa) and mould temperature (80 °C) were found to be the most effective parameters to minimize warpage.

The ANOVA analysis and the TAGUCHI method can be used to determine optimal parameters and their contribution percentage. As a result, it shows that design of experiments method is one of the best tools to get the best quality for a production.

Keywords: injection molding optimization, polypropylene, taguchi methodology, anova analysis

PCM3327

Epoxidized Natural Rubber Nanocomposites Based on Graphene/Carbon Nanotube Hybrid Nanofillers

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Abstract. Various properties of epoxidized natural rubber (ENR) were enhanced through the incorporation of a hybrid filler combination comprising graphene (GP) and carbon nanotubes (CNTs). The results of this study showcased the remarkable influence of this hybrid carbon nanofiller on various aspects, including cure characteristics, mechanical properties (tensile properties and hardness), thermo-mechanical characteristics, crosslink density, Payne effect, and thermal properties. Additionally, the chemical interaction between ENR and polar functional groups on the surfaces of CNTs and GP was confirmed through FTIR analysis. Furthermore, the study investigated electrical conductivity, particularly focusing on the percolation threshold concentration (PTC), and identified a notably low PTC in the ENR-CNT/GP hybrid nanocomposites.

Keywords: Epoxidized natural rubber (ENR), Carbon nanotubes (CNTs), Graphene (GP), Hybrid filler, Nanocomposite, Electrical properties

Acknowledgements: The authors would like to acknowledge financial support by the National Research Council of Thailand (NRCT) under Grant No. NRCT-RGJ63019-159. Also, University of Applied Science, Osnabrück, Germany is highly acknowledged for access to facilities and equipment.

PCM3332

Failure Analysis of Composite Cylindrical Shells Under Large Winding Loads

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Abstract. The failure of fibre reinforced resin matrix composite cylindrical shells can occur under winding loads during processing. Based on industrial CT, metallurgical microscopy and other failure detection methods, the failure analysis of the cylindrical shells was carried out, and the failure mechanism was determined by using the macroscopic finite element method and the microscopic cells method, which is mainly due to the existence of the fibre transverse tensile stress concentration in the resin matrix in the outer hoop-layer of the composites cylindrical shells. The influence of the layup angle and thickness of the angle-layer on the stress concentration of the resin matrix in the composite cylindrical shell is also studied, and the results show that the increase of the thickness of the angle-layer and the decrease of the layup angle can alleviate the stress concentration, thus preventing the failure of the composite cylindrical shell.

Keywords: entanglement action, composites, failure mechanism

PCM3337

Synthesis of New Well-defined Boron and Silicon Norbornene Derived Materials via Ring Opening Metathesis Polymerization (ROMP)

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Abstract. Over the past two decades there has been an increase of interest in polymeric materials obtained *via* Ring Opening Metathesis Polymerisation (ROMP). The above mentioned structures can be obtained from norbornene derivatives. By performing condensation reaction between norbornene-2-*exo*-3-*exo*-dimethanol and molecules containing dihydroxyl or mono-/dichloro groups, such as boronic acids, what results in formation of easily removable water as by-product, or different mono/dichlorosilanes, it is possible to acquire a wide range of interesting stereo-monomers, dedicated to 'living' ROMP catalytic process.[1,2]In order to do that, however, tolerant organometallic groups such as Grubbs catalysts are required.[3] In this way of new inorganic-organic hybrid materials with interesting photophysical or electrochemical properties can be easily formed.[4] Moreover, it is possible to perform other modifications on the new monomers *via* well-known silylative coupling or hydrosilylation catalytic transformations.
In this communication we would like to present effective synthesis reactions and characteristics of new norbornene derived materials which were used in designing polymers *via* ring opening metathesis polymerisation in the presence of first and second generation of Grubbs catalyst (G1, G2). Additionally, we would like to present one possible modification of a boronate ester by silylative coupling reaction followed by polymerisation.

Keywords: Ring Opening Metathesis Polymerization (ROMP), ruthenium Grubbs catalysts, polymeric materials, boron compounds, norbornene

References:
[1] M. Majchrzak, P. J. Hine, E. Khosravi, *Polymer (UK)*, 2012, *53*, 5251-5257;
[2] E. Khosravi, W. J. Feast, A. A. Al-Hajaji, T. Leejarkpai, *J. Mol. Cat. A: Chem.*, 2000, *16*, 1-11;
[3] R. H. Grubbs, E. Khosravi, *In Synthesis of Polymers* – a Volume of Materials Science and Technology Series; Schluter, A. D., ed.; Wiley-VCH, 1998, pp. 63-104;
[4] Wen-Ming Wan, Shun-Shun Li, Dong Ming Liu, Xin-Hu Lv, Xiao-Li Sun, *Macromolecules*, 2017, *50*, 17, 6872-6879.

PCM3339

NdFeO3-SnO2 Nanocomposite: Comprehensive Investigation of Structure, Electrical Transport and Ferroelectricity

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Abstract. SnO_2 is a well-known material for its potential applications in dye-based solar cells, gas sensors, catalyst support, transparent conducting electrodes, etc. Also, $NdFeO_3$, with G-type antiferromagnetic order, shows a typical ferroelectric nature at room temperature, describing its multiferroic behavior. Thus, the tremendous physical and chemical properties of NdFeO3 offer several types of applications in various fields, such as electrochemical sensing and CO catalytic gas sensors etc. NdFeO3 has a remarkable multiferroic nature, and SnO2 is a multitasking semiconducting material. The prime objective and major focus of this study is to try to incorporate their unique and distinct physical properties in a single material, i.e., in the nanocomposite, to enhance the multifunctionality and to make it a promising candidate for various applications like capacitors, energy storage, memory cells, sensors, etc. Motivated by the fascinating properties of already published nanocomposites, we synthesized the NdFeO3-SnO2 nanocomposite to examine its structural, morphological, and electrical properties. The dual-phase (orthorhombic and tetragonal) Rietveld refinement analysis was carried out to explore the phase and structural parameters in the $NdFeO_3$-SnO_2 composite. Raman spectroscopy is also used to study vibration modes in the nanocomposite. The fingerprint Raman modes observed in the sample support the successful formation of the $NdFeO_3$-SnO_2 composite. The optical bandgap energy is evaluated using defused reflectance spectroscopy and is found to be 3.60 eV. DC resistivity of the nanocomposite decreased with temperature and exhibited the typical semiconducting behavior. The dielectric constant and dielectric loss decreased with frequency while increased with temperature. AC conductivity of the sample increases with the increase in frequency and temperature. P-E loops at different temperatures and electric fields reflected the well-known hysteresis behavior and established the sample's ferroelectric nature. The low leakage current, high dielectric constant, and stable Hysteresis of the sample hint towards the possible use of this material in dielectric and multiferroic-based devices.

Keywords: Multiferroic, nanocomposite, SnO_2, $NdFeO_3$

Acknowledgments: Dr. Naseem Ahmad acknowledges CSIR New Delhi for the financial support in the form of SRF award letter number 09/112 06082k19 EMR-1.

Part IV Acknowledgements

On behalf of the PCM2023 and GNN2023 Organizing Committee, we would like to take this opportunity to express our sincere gratitude to our participants. We would also like to express our acknowledgements to the Technical Program Committee members who have given their professional guidance and valuable advice as reviewers. For those who contribute to the success of the conference organization without listing the name below, we would love to say thanks as well.

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