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ADV. MATERIALS SCIENCE 2024

Epoxy-based hybrid nanocomposites with nickel zinc ferrite nanoparticles and graphene nanoplatelets for advanced applications

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Epoxy is a synthetic polymer material extensively utilized in composite manufacturing due to its favorable mechanical, thermal, chemical, and corrosion-resistant characteristics. However, its inherent brittleness and low fracture toughness impose limitations on its applications. To address these concerns, the incorporation of liquid epoxidized natural rubber (LENR) has been explored to enhance epoxy resin's toughness and overall strength. The impact of adding liquid epoxidized natural rubber (LENR) to epoxy has revealed that optimal mechanical strength is achieved at a 3%wt LENR content. It's worth noting that LENR does influence the crystallization rate of epoxy resin. This study aims to develop and characterize nanocomposite materials that incorporate rubber toughening, alongside nickel-zinc (NiZn) ferrite and graphene nanoplatelet (GNP) fillers. The goal is to investigate their mechanical, thermal, and electrical properties, in comparison to the composite comprising epoxy/LENR alone. The introduction of these nanoparticles has significantly enhanced the mechanical properties of the composites even at low filler loadings. Notably, the mechanical strength of epoxy/LENR/NiZn ferrite nanocomposites exhibited improvement with the addition of NiZn ferrite. Experimental analyses indicate that the optimal strength is achieved at 4%wt NiZn ferrite and 0.6%wt GNP. Moreover, these nanocomposites demonstrate improved thermal stability across the board. Electrically, the epoxy/LENR/GNP-NiZn ferrite composite exhibited superior conductivity compared to both epoxy/LENR/NiZn ferrite and epoxy/LENR/GNP composites. Intriguingly, all nanocomposites induced a transition from insulating properties to that of a semi-conductor in the presence of 4%wt NiZn ferrite, 0.4%wt GNP, and the various hybrid combinations of GNP-NiZn ferrite. The results indicated an increased magnetic interaction within the nanocomposites upon NiZn ferrite incorporation. This heightened interaction can be attributed to the direct proportionality between the saturation magnetization (MS), remanence magnetization (MR), and the magnetic particle composition within the

epoxy matrix. While Fourier-transform infrared spectroscopy (FTIR) analysis revealed no discernible chemical changes due to the inclusion of NiZn ferrite and GNP, alterations were observed in absorption peak intensities. X-ray diffraction (XRD) analysis highlighted an accelerated crystallization rate facilitated by the presence of nanoparticles in the epoxy/LENR matrix.SEM micrograph has shown a homogeneous dispersion of NiZn ferrite within the epoxy/LENR blend. Overall, the hybridization approach has effectively elevated the mechanical, thermal, electrical, and magnetic properties of the resulting nanocomposites. This hybrid nanocomposites are potential to be applied as EMI shielding and radar absorbing materials (RAM).

Biography

Professor Dr. Sahrim Ahmad obtained his PhD from the University of Loughborough, United Kingdom, in 1988. He holds expertise in the domains of magnetism, nanocomposites, and advanced materials. Throughout his career, he has spearheaded over 55 research projects and consulting assignments, both as a principal investigator and a collaborative researcher.His pioneering work in the realm of novel radar absorbing materials (RAM), particularly in the context of transverse electromagnetic (TEM) applications, has yielded remarkable results. The outcomes of his endeavors include the successful development of products characterized by optimal attributes such as malleability, adaptability, and lightweight properties. These products seamlessly align with the diverse demands of various applications.Dr. Sahrim's scholarly contributions extend to the publication of more than 250 papers across a range of esteemed journals. Furthermore, his mentorship has nurtured the academic growth of over 60 PhD students under his guidance. Driven by his commitment to academic leadership, he previously served as the Dean of the Faculty of Science and Technology. Notably, he also assumed the role of Editor- in-Chief for the esteemed Journal Sains Malaysiana (indexed in ISI/WOS), showcasing his dedication to advancing scientific discourse.

Piezo-phototronic effect in multi-layer structured optoelectronic: Bilateral piezoelectric charge modulation

Wenbo Peng[1,2] and **Fangpei Li**[1,2]

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Piezo-phototronic effect utilizes the strain induced piezoelectric charges inside the piezoelectric semiconductors to modulate the local energy band diagram at the interface of junctions, thus controlling the photo-generated carriers' behaviors and the performance of optoelectronic devices. Since its invention in 2010, piezo-phototronic effect is vastly demonstrated in photodetectors, light-emitting diodes, and solar cells, where only one interface is modulated by piezoelectric charges. In 2018, we first propose to construct multi-layered structure for efficient utilization of piezoelectric charges with both polarities and obtain better performance optimization by piezo-phototronic effect [1], which we recently name as Bilateral Piezoelectric Charge Modulation [2]. Here, we summarize the recent progresses of our researches on bilateral piezoelectric charge modulation, including both experimental results and analytical theories.

An n-ZnO/p-Si/n-ZnO double heterojunction bipolar phototransistor is designed, and the regulation of bilateral piezoelectric charges on bipolar phototransistor's performances is studied from the perspectives of theoretical derivation and experimental research simultaneously. A theoretical model of n-ZnO/p-Si/n-ZnO double heterojunction bipolar phototransistor is established, and the influence of four polar combinations of piezoelectric charges induced by different strains formed at the interface of two heterojunctions on the characteristics of phototransistor is carefully studied. The theoretical calculation results show that, when positive piezoelectric charges are generated at both two interfaces, the regulation of strain on the phototransistor is a superposition of two positive effects, which can significantly improve the performances of phototransistor. Then an n-ZnO/p-Si/n-ZnO double heterojunction bipolar phototransistor is experimentally prepared. By rationally designing the device structure, positive piezoelectric charges could be simultaneously generated at the two heterojunction interfaces when an external compressive strain is

applied. The saturation current of phototransistor is significantly improved, and the photoresponsivity is also improved to a certain extent by the applied compressive strain. To further optimize the performances, the effects of interdigitated electrode's size, substrate and ZnO layer on the strain regulation of device performance are carefully studied. The experimental results show that when the p-Si substrate is used, the size of interdigitated electrodes is chosen as channel width W0 = 80 μm, the channel length L = 5 μm, and the number of electrodes N = 14, and the ZnO nanowires layer prepared by low temperature hydrothermal growth method is used as both emitter and collector, the strain induced bilateral piezoelectric charges regulation of the obtained bipolar phototransistor is the best. At a compressive strain of -1.37%, the photoresponsivity is enhanced about 2000%, indicating the significant modulation of applied strain on the performances of heterojunction bipolar phototransistor.

Biography

Dr. Wenbo Peng is now an Associate Professor at School of Microelectronics, Xi'an Jiaotong University. He received his PhD degree in major of Electronic Science and Technology at 2016 and bachelor degree in major of Microelectronics at 2010, from Xi'an Jiaotong University. He has been a visiting scholar in School of Materials Science and Engineering, Georgia Institute of Technology from Aug 2014 to Jul 2016, working on the research fields of piezotronics and piezo-phototronics under the supervision of Prof. Zhong Lin Wang.

His research interests mainly focus on advanced low dimensional piezoelectric semiconductor materials, devices and physics, and novel intelligent sensing integrated chips. He has received several fundings from NSFC, Shaanxi Province and companies. He has authored and co-authored over 50 peer-reviewed journal publications in related research fields, parts of which are published on high quality international journals, including Advanced Materials, Advanced Functional Materials, Advanced Energy Materials, Nano Energy, ACS Nano, Nano Letters, etc. His publications have been cited over 2400 times, as documented at Google Scholar (h-index: 26). He has given several Keynote/Distinguished/Invited Talks in renowned international conferences. He is the Fellow of International Association of Advanced Materials.

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Investigation of Runx1 as a potential therapeutic target for cerebral infarction

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[3]Department of Physiology, West China School of Basic Medical Sciences and Forensic Medicine, Sichuan University, China

Stroke, also known as cerebral infarction, is the second leading cause of death in the world and the leading cause of death in China. The high mortality and morbidity of stroke result in immense public healthcare burden with serious socioeconomic consequences. Since no existing treatment can consistently mitigate the effects of stroke, new therapeutic targets and new effective drugs are urgently needed to improve the outcomes of stroke treatment. Runt-related transcription factor-1 (RUNX1), a member of the core-binding factor family of transcription factors, is classically considered the master regulator of developmental hematopoiesis because of its important role in the specification of the hematopoietic lineage during embryogenesis. Whilst the focus of RUNX1 research has predominately been in the hematopoietic field, recent evidence reveals emerging functions of RUNX1 in different tissues under pathological conditions. Dr. He's previous study on myocardial infarction (MI) performed with a cardiomyocyte-specific RUNX1-deficient mouse shown that RUNX1 has a critical role in cardiomyocytes after MI and in the in vivo mouse MI model reducing RUNX1 expression preserves cardiac contractile function and prevents adverse cardiac remodeling. Importantly, RUNX1 can be pharmacologically inhibited by its chemical inhibitors and thus can be tested as a potential druggable target in a range of pathological contexts. However, the expression pattern and functional roles of RUNX1 in the brain after cerebral infarction are unknown. In the present study, we have established a rat model of middle cerebral artery occlusion (MCAO). Rats were subjected to MCAO by means of surgically inserting a monofilament into the middle cerebral artery. RUNX1 expression level and infarct size were assessed. We demonstrate for the first time that RUNX1 expression is increased in the brain after MCAO, and interestingly

the increased RUNX1 expression is associated with increased infarct size. Our results suggest that understanding of the role of RUNX1 in the brain could contribute to potential therapeutic strategies for cerebral infarction. Our on-going study seeks to investigate whether the increased expression of RUNX1 in the brain can be therapeutically targeted to protect brain after stroke.

Biography

Weihong He is a principal investigator and associate professor at the Department of Physiology, West China School of Basic Medical Sciences and Forensic Medicine, Sichuan University. Weihong obtained a MD (2012) at West China School of Medicine & West China Hospital, Sichuan University, and completed a PhD (2017) at the BHF Glasgow Cardiovascular Research Centre, University of Glasgow. Weihong was associate professor at Jining Medical University (2018-2020). Since 2020, Weihong has led a research group to study the pathophysiology of cardiovascular diseases and to investigate novel therapeutic drugs for the treatment of myocardial infarction and cerebral infarction at Sichuan University. He also teaches physiology and mentors both national and international students. Weihong has expertise in a number of methodologies which span the level of biochemistry, cell biology, isolated organ, and whole animal in vivo disease models.

Precise damage segmentation in infrastructure surface using fine-tuning U-Net based-deep learning

Ching-Lung Fan
Department of Civil Engineering, the Republic of China Military Academy, Taiwan

In this paper, we propose the utilization of Fine-tuning U-Net for the precise segmentation of damage in infrastructure surfaces. U-Net, a specialized variant of Convolutional Neural Networks (CNNs), excels at extracting distinctive features indicative of damage from images. Our approach focuses on the classification and segmentation of exposed rebar and spalling, two critical types of damage in infrastructure structures. To fully unleash the potential of U-Net in image analysis, we meticulously fine-tune its network architecture and hyperparameters. Our experiments yield a remarkable damage segmentation accuracy of 82%, and importantly, our model exhibits no signs of overfitting. These promising results underscore the potential of deep learning techniques, specifically tailored to damage image analysis, in providing invaluable insights for inspectors regarding the severity of identified damages.

Introduction: The detection of damage on infrastructure surfaces is of paramount importance for maintenance and safety. In recent years, the emergence and advancement of deep learning methodologies have revolutionized image recognition, making them a highly promising solution for the precise identification of infrastructure damage. In this paper, we present a novel application of Fine-tuning U-Net for the segmentation of infrastructure damage, leveraging visual data obtained from damaged surfaces. Our proposed method excels in extracting subtle yet critical features indicative of damage from images. The dataset employed in our study comprises high-resolution images captured using a smartphone, with a resolution of 3,264×2,448 pixels. To fully harness the potential of U-Net for effective training and testing on this dataset, we meticulously fine-tuned the network architecture and hyperparameters. Fig. 1 illustrates the architecture of the Fine-tuning U-Net model, specifically tailored for this study.

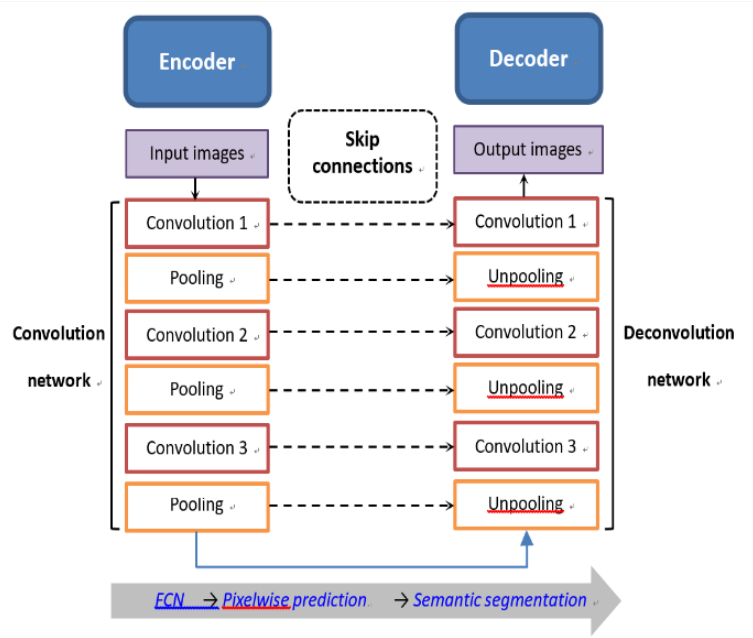

Fig. 1 U-Net architecture of the semantic segmentation

Results: Fig. 2 and Table 1 showcase the outcomes of Fine-tuning U-Net for damage detection on infrastructure surfaces. The segmentation accuracy achieved by the Fine-tuning U-Net model is an impressive 82%, and we are pleased to report that the model exhibits no overfitting. Notably, our approach successfully classifies and segments exposed rebar, spalling, and undamaged areas in the infrastructures. This section delves deeper into a discussion of the results, exploring the implications of our findings for the field of infrastructure surface inspection and maintenance. We compare our approach with existing methods, highlighting the advantages of employing deep learning techniques for damage assessment. Additionally, we address potential limitations and suggest avenues for future research, such as expanding the dataset or optimizing computational resources.

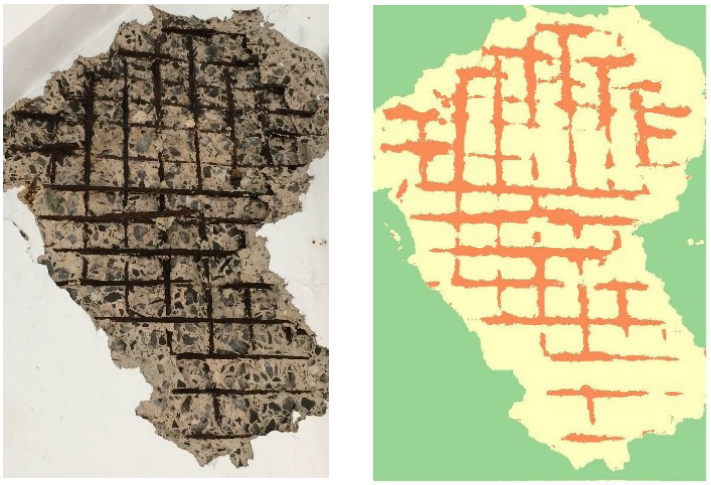

Fig. 2 Damage of segmentation results for the infrastructure

Index(%)	Rebar	Spalling	Undamage
Precision	70.76	74.19	96.53
Recall	63.97	73.07	95.92
F1	67.19	73.62	96.22
Accuracy	82		

Table 1. Performance evaluation results of Fine-tuning U-Net

This study underscores the exceptional adaptability of deep learning techniques tailored to the analysis of damage images. Our application of Fine-tuning U-Net for damage detection on infrastructure surfaces holds great promise for practical applications in the realms of building maintenance and safety. The remarkable segmentation accuracy achieved by our Fine-tuning U-Net model, coupled with its robustness against overfitting, highlights the potential for automated inspection systems to provide inspectors with invaluable insights into the severity of identified damages

Biography

Ching-Lung Fan, Ph.D., is an associate professor at the Republic of China Military Academy, specializing in machine learning, deep learning, data mining, and construction performance and risk management. In 2019, he earned a Ph.D. from the National Kaohsiung University of Science and Technology. Dr. Fan received the Phi Tau Phi Scholastic Honor Society award and was honored for outstanding papers at the 25th Symposium on Construction Engineering and Management/International Conference on Big Data, Sensing, and Machine Learning (2021) and the 34th Conference on Military Engineering (2022). In 2023, he joined Sigma Xi, The Scientific Research Honor Society.

Band-gap and surface modifications of TiO_2 for photocatalytic decompositions under visible light

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National Research and Innovation Agency (BRIN), Indonesia
[2]Research Group of Environmental and Inorganic Photochemistry,
Center for Natural Sciences, University of Pannonia, Hungary

Heterogeneous photocatalysis has been an intensively investigated in the field of science for decades. The band gap of TiO_2 is rather wide (3.2 eV), therefore titanium dioxide can utilize only a small part of the sunlight's energy. However, there is an increasing demand for extending the sensitivity of this catalyst towards the visible-light region.

Doping TiO_2 with nitrogen is a widespread technique to create defects in the crystal lattice, thus reducing the band-gap energy and shifting the absorption into visible region. In addition, the surface modification with noble metal such Ag also demonstrated an ideal strategy to enhance the visible-light absorption via surface plasmon resonance (SPR).

In this work, nitrogen-doped TiO_2 catalysts with hollow (h-N-TiO_2) and non-hollow (nh-N-TiO_2) structures were synthesized by co-precipitation and sol-gel methods. Different approaches, such as nitrogen source and concentration, temperature of the synthesis, calcination time and temperature were tested to examine the optimum outcome regarding photoactivity. Furthermore, Ag nanoparticles were successfully loaded on the surface of N-TiO_2 by using photo-deposition technique.

The photocatalytic performance of the catalysts was examined with coumarin and 1,4-hydroquinone. The results showed that surface structure, crystallinity, nitrogen content, and specific surface area were found to be crucial features in the photocatalytic performance of the catalysts. Due to its hollow structure and larger specific surface area, the photoactivity of h-N-TiO_2 was higher compared to non-hollow nh-N-TiO_2 catalyst.

Furthermore, various silver amounts were successfully loaded on the surface of N-TiO_2 catalysts by using a facile photo-deposition technique. The results exhibited that Ag-

loading on the surface of nh-N-TiO_2 could double the photocatalytic performance with an optimum Ag concentration of 10^{-6} mol g^{-1}, while a slight but monotonous decrease was caused in this respect for the h-N-TiO2 catalyst upon increasing Ag concentration.

Biography

Abdul Wafi, a global citizenship from Indonesia, Currently, he was a Research Fellow in the Research Center for Advanced Materials, National Research and Innovation Agency of Republic of Indonesia (www.brin.go.id). His research interests are synthesis and characterization of metal-oxide nanomaterial (particularly TiO2) as a photocatalyst. This material could be applied for water purification, water splitting, carbon capture, etc. The photocatalyst was modified through the surface and band-gap structure in order to enhance its light-harvesting, particularly under solar and visible irradiation as a sustainable energy source and free of charge. He has experienced in several syntheses of nanomaterials and its characterization techniques involved data analyses from FTIR, Raman, XRD, DRS, FESEM, HRTEM, EDS, BET, DTA-TGA, etc. Furthermore, he was also familiar with several analytical measurements including UV-Vis Spectrophotometer, HPLC, Photo-luminescence, TOC Analyzer, etc.

Modeling and simulation of Triple Metal Gate Junctionless Ferroelectric (TMGJFe) FET for enhanced analog performance

Jasdeep Kaur[1], Shalu Garg[1], Anubha Goel[2], Subhasis Haldar[3] and **R.S. Gupta[2]**

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Maharaja Agrasen Institute of Technology, India
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Motilal Nehru College University of Delhi, India

In this manuscript, a Triple Metal Gate Junctionless Ferroelectric (TMGJFe) FET with high-K dielectric (HfO2) has been proposed to examine the analog performance of the device in terms of drain current (Ids), transconductance (gm), and output conductance (gd). Also, electrical characteristics have been studied. A fair comparison has been done between TMGJFe FET and Double Metal Gate Junctionless Ferrolectric (DMGJFe) FET on the basis of gate controllability and drain derivability. Si:HfO2 has been implemented as a ferroelectric interface layer. Due to the negative capacitance phenomenon of the ferroelectric layer, subthreshold swing (SS) has been reduced below 60 mV/decade, which increases the switching speed of the device. Hence, a reduction in the threshold voltage occurs. Atlas 3D simulator has been implemented for simulations.

Biography

She has served as Dean-Academic (2020-23) and Head of The Department of Electronics & Communication Engineering (2015-18). She is the Training and Placement Officer since 2018. As a IEEE Senior Member & Vice Chair-Delhi section-2023 represented in the Triennial Section Congress-2023 at Ottawa, Canada.

She has publications in International/ National Journals and Conferences and has team of active research scholars. As CI of the SMDP– (Chip to System Design), project of MieTY, Govt of India, has headed the team for fabrication of BGR. In 2019, was selected and participated in the International Visitor Leadership Program, fully sponsored by the USA State Federal Government on "Advancing Women in STEM Fields" from October 7-25, 2019. She is on panel of many Government/NGOs too.

Spectroscopic/colorimetric dual-mode rapid and ultrasensitive detection of reactive oxygen species based on shape-dependent silver nanostructures

Varsha Usha Vipinachandran and **Susanta Kumar Bhunia**

Vellore Institute of Technology, India

Excessive production of reactive oxygen species (ROS) from endogenous and exogenous pathways is linked to oxidative stress and various diseases. Although a variety of ROS probes have been developed, their multistep synthesis strategies and complicated instrumental operating procedures limit their frequent use. In this work, different shaped silver nanostructures including nanoparticles, nanoprisms, and nanocubes were utilized to demonstrate simple spectroscopic and colorimetric techniques for sensitive ROS detection. The nanostructures displayed different sensing behaviours recorded via plasmon tuning with morphological changes upon exposure to ROS. Among the nanostructures, silver nanocubes were found to be extremely efficient in recognising a particular ROS, namely hypochlorite ions. The detection limits of this ROS were calculated to be 23.76 nM, 85.71 nM, and 36.37 nM for silver nanoparticles, nanoprisms, and nanocubes, respectively. A time-dependent microscopic examination was carried out and revealed that the presence of hypochlorite ions deteriorates structural morphologies. The formation of highly reactive chlorite, chlorate, and chloride ions in hypochlorite ion solution was ascribed to the significant spectroscopic and microscopic changes in all the nanostructures. The attenuation of plasmonic peaks and etching of nanostructures by ROS were supported by the increment of the oxidation state of silver. In addition, silver nanocubes were successfully applied to recognize ROS in Spinacia oleracea and real water samples. The results confirm the potentiality of silver nanostructures for sensitive detection of ROS in biological and environmental systems.

Biography

I am an avid researcher pursuing a PhD at Vellore Institute of Technology under the guidance of Dr. Susanta Kumar Bhunia. I have been working on nanomaterial synthesis and their application for over four years. Expertise in the synthesis and fabrication of nanomaterials like plasmonic materials with various nanostructures, carbon dots, metal-organic frameworks, graphitic carbon nitride, Mxene, treated carbon nanotubes, polycarbosilane-based composites, and reduced graphene oxides for chemical and photocatalytic studies and sensing of toxic chemicals and storage applications. During my master's degree, I worked on rocket coating material based on polycarbo silane and carbon nanotubes for ISRO (Indian Space Research Organization). Currently, nine articles have been published (including reviews) and two more are in the process of being communicated.

Decision making in a complex environment based on cognitive layers

Sadegh Banitalebi

Imam Hossein University, Iran

The concepts of dominating sets and cobondage sets are fundamental concepts in the graph theory and have usages in several fields, particularly in the fields of operations research, neural networks, electrical networks, and monitoring communication. dominating sets can play a significant role in recognizing, controlling and optimizing the complex environment. The purpose of this presentation is graph model of decision-making based on factors affecting a control goal. The method we follow to achieve this goal is based on drawing cognitive maps.

Biography

Sadegh Banitalebi a graduate of PhD in mathematics and he was doing research in the field of mathematical modeling, fuzzy mathematics, fuzzy logic and cognitive modeling.

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The effect of ferrite bead on conducted emission in an automotive LED driver module with DC-DC converters

Oğuzhan Coşkun[1,2], Recep Eken[1,3], Özgür Çevik[1,4] and **Güneş Yılmaz[1]**

[1]Electrical and Electronics Engineering, Bursa Uludag University, Turkey
[2]EMKO Elektronik A.Ş., Turkey
[3]DAIICHI Elektronik A.Ş., Turkey
[4]FEKA Otomotiv A.Ş., Turkey

Commonly, ferrite beads are used for reducing high-frequency emissions generated by electronic modules. Even though the high impedance attribute of ferrite beads at high frequencies is useful in reducing radiated emissions (RE), their inductive character in the low-frequency region necessitates consideration of conducted emissions (CE). In this research, the behavior of the ferrite bead used for reducing the emissions generated by the LED driver module of the front fog lamp of a passenger vehicle has been experimentally investigated in the low-frequency region. For this purpose, the CE test, which is one of the most crucial electromagnetic compatibility (EMC) tests in the automotive industry, has been performed. Moreover, two different designs of the concerned PCBs have been research and developed. Then, CE tests have been carried out for both designs in a semi-anechoic chamber. Thus, the highest CE values for the model including ferrite bead have been obtained as 82.49 dBµV for 210 kHz but for the model including 0R (zero - ohm) have been acquired as 78.81 dBµV for 182 kHz, respectively. Using empirical results obtained in this research, effect of ferrite bead in the 150 kHz - 108 MHz frequency range has been examined and interpreted with the help of corresponding simulations.

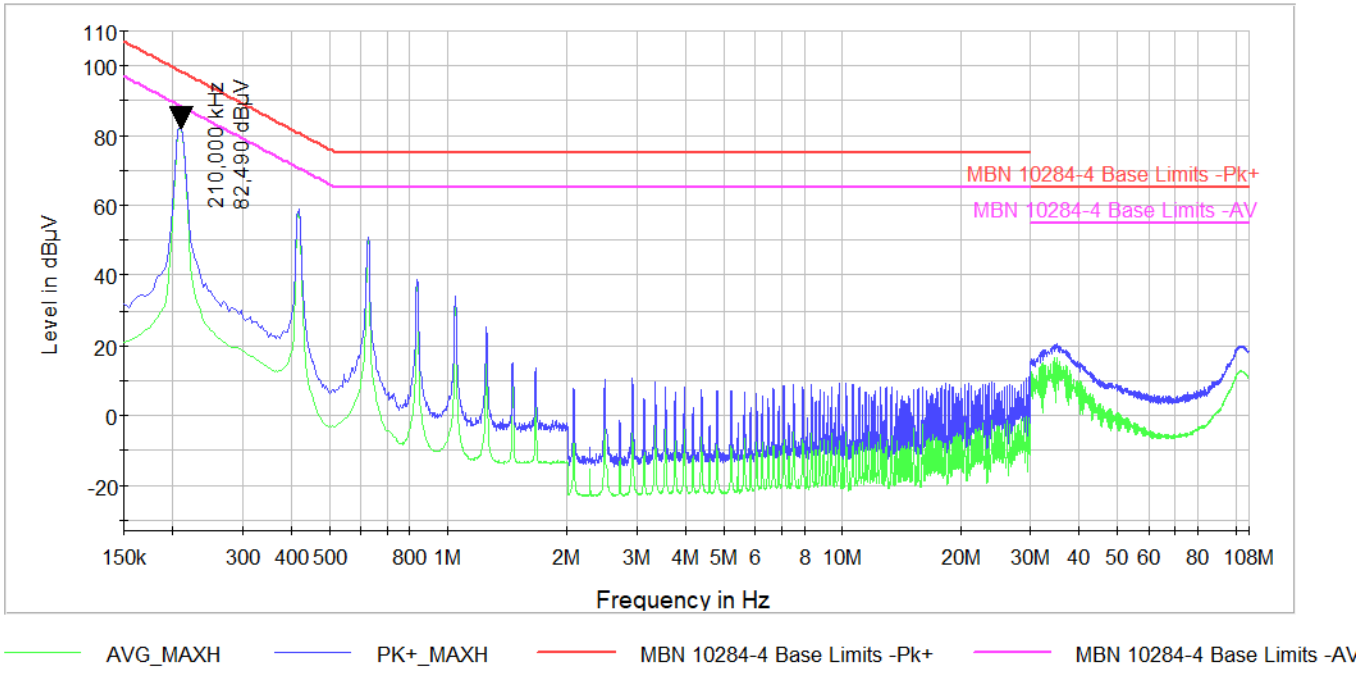

Fig. Conducted emission test results obtained from PCB including ferrite beads.

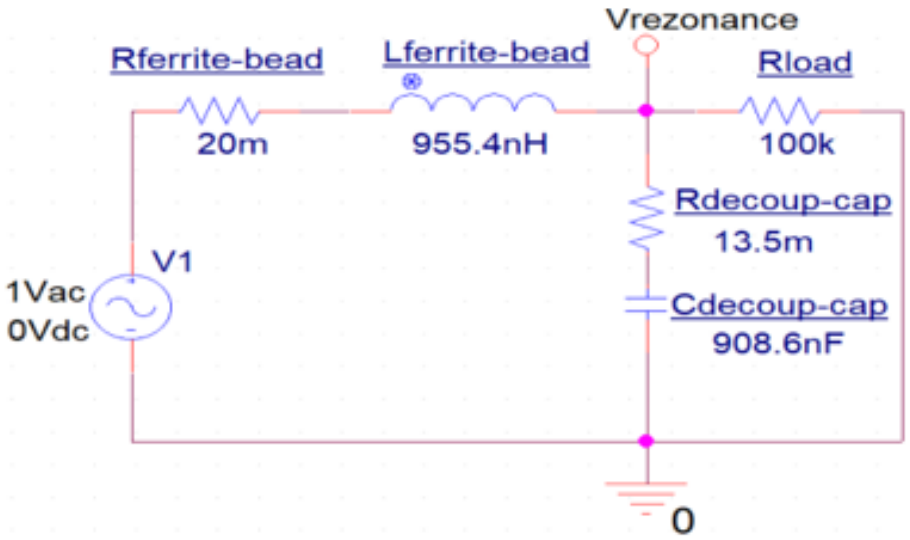

Fig. Series RLC resonant circuit of ferrite bead and decoupling capacitor used in the simulation program.

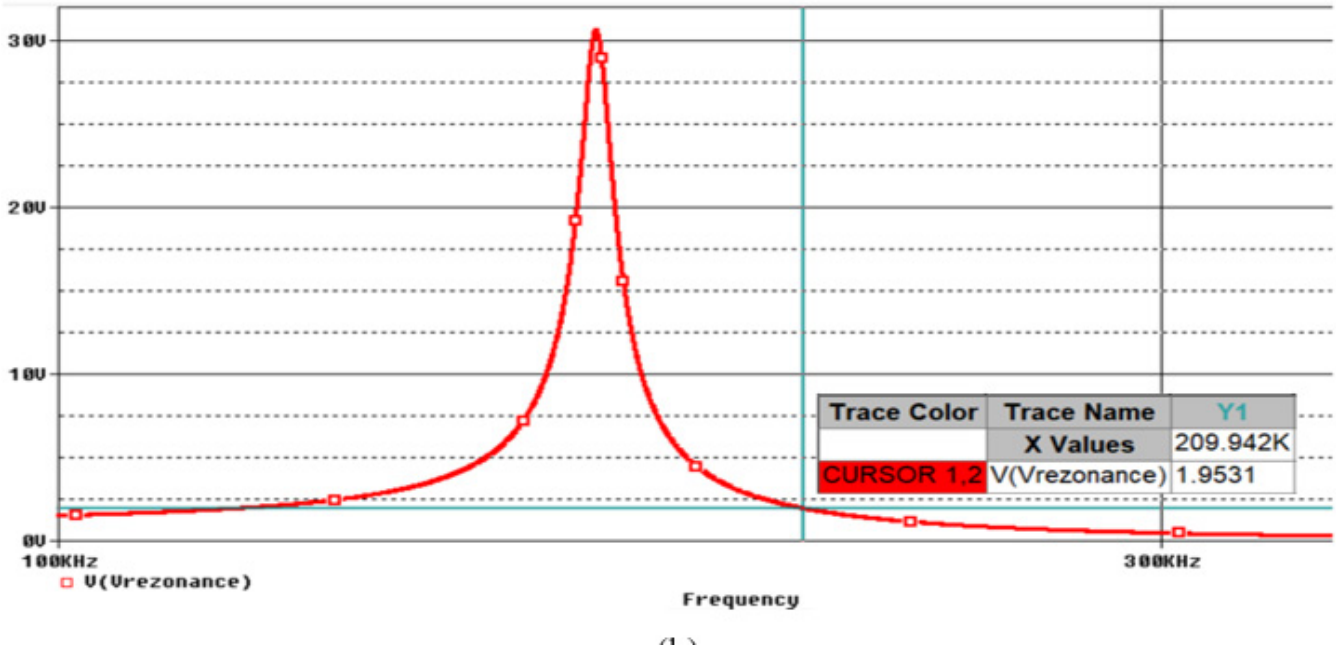

Fig. RLC series resonant circuit simulation results at the switching frequency

Biography

Oğuzhan Coşkun received his bachelor's degree in Electrical and Electronics Engineering from Bolu Abant İzzet Baysal University in 2016. He obtained his Master's degree in the same department at Bolu Abant İzzet Baysal University in 2018. In 2023, he earned his Doctorate degree from Bursa Uludağ University in the field of Electronics Engineering. Furthermore, he has been serving as a researcher/specialist at EMKO Elektronik A.Ş. under the TÜBİTAK 2244 - Industrial PhD Fellowship Program. He is employed as a Senior Electronic Design Engineer at the company. His current research involves EMI reduction in PCBs, PCB modeling, EMC tests, embedded systems, and industrial control and communication cards.

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Degradation evaluation of pressboard insulation of converter transformer by applying FDS and digital image processing tool

A.S. Bhalchandra[1], Shrikant S. Mopari[1], D. S. More[2], Pannala Krishna Murthy[3], K. M. Jadhav[4] and **R C. Kamble[5]**

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[2]Electrical Engineering Dept., Walchand College of Engineering, India
[3]Electrical Engineering Dept, Khammam Institute of Technology & Sciences, India
[4]Dept. of Physics, MGM University, India
[5]Dept. of Physics, Savitribai Phule Pune University, India

The reliable operation of power system transmission in the case of high voltage direct current transmission (HVDC) is mainly dependent on the converter transformer and is a challenging task. The smooth operation of the converter transformer is basically dependent upon the inter-turn and inter-disk insulation across the winding.

An attempt is made to examine the effect of the pressboard insulation material under frequency and elevated temperature. In the present study, oil-impregnated pressboard insulation degradation under FDS was studied at temperatures ranging from 30°C to 130°C with an incremental rise of 20°C with frequency variation from 1 Hz to 10 MHz. The various dielectric parameters were measured as a function of elevated temperatures and frequency which show exponentially decreasing nature, while conductivity increases. This confirms the degradation of pressboard insulation. The scanning electron microscopy (SEM) techniques were applied to understand the surface morphological changes inside the pressboard insulation. The fibre width was measured by randomly selecting the average of three local areas of the SEM image which decreases with elevated temperature. Various digital image processing tools were employed to study the pressboard insulation degradation. The canny operator applied for edge detection shows 49.75% and 71.93% changes for 110°C and 130°C as compared to the virgin sample. The porosity and pore size distribution measured using SEM images show increasing trends with elevated temperatures. Using MATLAB Simulink, a single-phase, 315 MVA valve side star winding with 60 discs of single-phase converter transformers model was developed. An impulse of 100 kV, 1.2/50µsec is applied across

the star winding of the converter transformer and the pressboard insulation degradation can analysed based on FDS data with the help of mathematical morphology and wavelet transform technique. During the impulse test, the neutral current is captured and the energy of the wavelet coefficients suggests a considerable contribution to analyzing the pressboard insulation degradation of the converter transformer across the winding. This result provides early detection of degradation of pressboard insulation which will be helpful in reducing the outage time of the converter transformer during operating conditions.

Biography

Shrikant S. Mopari currently working toward a Ph.D. degree in the Department of Electrical Engineering, Walchand College of Engineering, Sangli, India. He had a teaching experience of 20 years and 1 year of industrial experience. In 2010, he joined the Government College of Engineering, Chh. Sambhajinagar (Aurangabad) as an Assistant Professor. Over 15 International Publications to his credit. He guided more than 30 UG projects and 20 PG projects. His research interests include Power electronics, High Voltage Direct Current Transmissions (HVDC), and FACT.

Prof. Dr. A. S. Bhalchandra received her Ph.D. in Electronics Engineering from S.R.T.M. University, Nanded, India, in 2004. Currently, she is a professor of the Electronics Department, and Principal Government College of Engineering, Chh. Sambhajinagar (Aurangabad). She has guided 9 research students and 50+ m Tech students. She has received funding from DRDO and the Government of Maharashtra and contributed to 100 plus papers in reputed journals and conference proceedings. Her research interest includes image processing, signal processing, and communication.

Piezoviscous-polar lubrication of hybrid conical undulated journal bearing

Arvind K Rajput and **Vishal Singh**

Department of Mechanical Engineering, IIT Jammu, India

In recent years, many researchers have strived thrust research activities in the area of conical journal bearing due to their inherent capabilities of supporting radial and axial load simultaneously. It is important to consider realistic geometry in the analysis of journal bearing operating under stringent and severe operating conditions. Linear harmonic vibration during machining of a conical journal may produce micron order undulations on the surface of journal. These undulation results in a significant impact on the generation of oil film profile. Moreover, a lubricant comprising of long chain polymer additives may have polar effect due to couple stresses. Further, pressure viscosity interaction in oil may also occur at high pressure situation thereby it may affect the actual viscosity of the lubricant. The flow behaviour of piezoviscous-polar lubricant in a conical bearing is modelled in cylindrical coordinates. Consideration of piezo-viscosity and polarity due to couple stresses results in modified non-linear form of Reynold Equation. The governing equation is numerically solved by using finite element method. The numerical results indicate that journal undulations provide relatively higher oil film pressure due to local convergence in oil film, consequently exhibit higher stiffness coefficients. Moreover, the use of piezoviscous-polar lubricant may raise the values of direct stiffness coefficient, upto 18% and direct damping coefficient upto 32% vis-à-vis Newtonian lubricant.

Biography

Dr. Arvind Kumar Rajput works as an Assistant Professor in the department of Mechanical Engineering at Indian Institute of Technology Jammu (India). He did his Ph.D. degree in the area of Hydrostatic Lubrication from the department of Mechanical Engineering, Indian Institute of Technology Roorkee (India) in 2014. He has published his research work in prestigious international journal viz. Tribology International, Lubrication Science, IMechE part-J, Journal of Engineering Tribology, Acta Mechanica etc. He is a recipient of various awards for academic and research activities viz. Teaching Appreciation award, DST Young Scientist Research Grant, DST International Travel Fellowship, CICS International Travel Fellowship. He has guided one Ph.D. students and three students are currently doing Ph.D. under his guidance. He is currently involved in various research projects in the domain of tribology.

Elimination of secondary oxide phases in CdTe nanostructured thin films prepared by conventional spray pyrolysis, and the influence of thermal annealing

H. Robatjazi and **H. Eshghi**

Faculty of Physics, Shahrood University of Technology, Iran

In this presentation, thin films of cadmium telluride (CdTe) were prepared using conventional pyrolysis spray method on glass substrates at different temperatures (250°C, 300°C and 350°C). Field emission scanning electron microscope (FESEM) images showed that the substrate temperature significantly affects the morphology and thickness of the grown layers, and as the temperature increases, the morphology of the layers is very sensitive to the growth temperature. From the cross-sectional images, it is clear that as the temperature of the substrate increases, the thickness of the layers decreases (from 2.1 µm to 700 nm and 550 nm) and at a temperature of 350 the surface with columnar configurations made of relatively large nanosheets with a size of about 150 Covered up to 200 nm. Seebeck effect measurements showed that all studied layers have p-type conductivity. The results of X-ray diffraction and Raman spectroscopy showed that the layer grown at 350 °C has better crystalline quality of CdTe, although it still contains secondary oxide phase components (TeO2, TeO3, and CdTeO3), consistent with the electrical resistivity analysis of the data. is the temperature. To remove the oxide phase components in this sample, we used the annealing process in the presence of N2 gas flux for 1 hour at two different temperatures of 400°C and 450°C. According to the FESEM images, it is clear that increasing the annealing temperature increases their average size (200-250 nm) while the constituent grains are tightly packed. XRD diffraction, Raman spectra, and activation energy estimated from electrical resistivity analysis versus temperature data confirmed that annealing at 400 °C, the optimal annealing temperature, was sufficient to remove secondary oxide phase components.

Biography

Hossein Robatjazi was born in Shirvan, Iran in 1994. He is currently working in a factory as a lab supervisor. He received his MS (solid states of physics) from Shahrud University of Technology, Iran in 2019. His MS dissertation focused on synthesis and characteristics of nanostructured thin films. The method used to synthesis was spray

pyrolysis approach. He also worked as a lab assistant and TA in same University. His recent publication was about elimination of secondary oxide phases in CdTe nanostructured thin films prepared spray pyrolysis and influence of thermal annealing. Currently his working on synthesis of antifouling boiler materials in alaforce plastofoam factory, Tehran, Iran. His research interests are in the area of synthesis of nanolayers and thin films, solar cells, nanostructured and nano particles.

Conjugated oligomers with Hetero-rings to improve photovoltaic performance

O. NINIS

Energy, Materials and Computing Physics Research Team,
Ecole Normale Supérieure, Abdelmalek Essaadi University, Morocco

Massive research efforts have been devoted to organic Solar Cells (OSCs). Although OSCs based on Bulk heterojunction have reached interesting solar-to-electrical power conversion efficiency values of 18%. Organic electronics based on π-conjugated molecules have become more interesting in much recent researches due to two major advantages over traditional semiconductors. On one hand, it allows the design and implementation of devices on flexible and transparent substrates, opening up new possibilities for a wide range of applications. On the other hand, it has lower costs compared to inorganic semiconductors, making it an attractive aspect for researchers.

our work focuses on introducing a new heterocyclic copolymer. We examined in detail the corresponding oligomers. Various theoretical results were obtained using approaches based on Density-Functional Theory (DFT) and Time-Dependent DFT. DFT calculations are intriguingly involved in determining the characteristics of electronically excited states, particularly those directly linked to the optical spectra (absorption and emission) of molecules. The results cover the attainable properties using commonly accessible programs, delve into addressing environmental influences like solvents and surfaces, and highlight recent applications in these domains. The significance of theoretical calculations in molecular design, particularly in the field of conductive organic materials, arises from various experimental limitations, highlighting their value. In this regard, we analyze the geometry of a set of oligomers based of EDOT (3,4-ethylen dioxythiophen) and VC (vinyl-carbazol). The band gap with simulated spectra (UV–Vis spectra, emission spectra) and several photovoltaic properties like open-circuit photovoltage (Voc) and light harvesting efficiency (LHE) are predicted and discussed for giving theoretical knowledge of studied compound efficacity in photovoltaic application.

Biography

Dr. Ouafae Ninis, born on January 20, 1985, in Taza, Morocco. My first professional calling was in science teaching, at the age of 24 I pursue a career in teaching as high school teacher of physics-chemistry. Venturing into academia, I get my Master's degree and I wanted to prepare a doctoral thesis on new technology for solar energy in University of Fez. My early research focused on theoretical studies of absorption, emission and photogeneration of organic molecules, then I became more interested by the polymer electronics and material modelling. After graduation, I joined ENS as assistant professor. I'm actually interested in making collaborations on my research topic in order to develop and explore new issues related to the application of polymers and oligomers in electronic, especially in photovoltaic devices.

Formation of a solid solution in a polycrystalline Sc2O3 upon irradiation with xenon ions with energies of 140 and 300 keV

A.E. Solovyeva

SFTI, Syxym, Abxazia

Cubic samples of Sc2O3 with a size (10-6 m3) were prepared from powders of grade OS = 99.9 by pressing without a binder, at a pressure of 0.40–0.50 GPa and a temperature of 25 o C. The samples were annealed at 1800 o C in vacuum (5 hours of exposure) and then subjected to oxidation at 1400 o C in air to constant weight. The X-ray density of the obtained samples was 3.9 kg/m3. The structure and thickness of the studied layer were determined by the Sc2O3 X-ray method according to the dependence constructed from each reflection, taking into account absorption and scattering in depth. The X-ray penetration depth for Sc2O3 was 6 μm at angles 0 -70 □. The samples were irradiated in a holder with a fixed position at 25°C in a system with a cryogenic casing at liquid nitrogen temperature with an implantation dose of 5□1016 cm-2 at energies of 140 and 300 keV. The inelastic collision of heavy ions with the surface of the samples leads to an explosion. A shock wave is formed, which propagates in the form of transverse and longitudinal waves deep into the material, drawing xenon ions by inertia into the channels of the structure. Xenon ions are decelerated and lose some of their valence electrons upon collision, and a bond between xenon ions and oxygen anions and scandium cations occurs. An interstitial solid solution containing XeO2 with an fcc structure in the Sc2O3 lattice is formed (Fig. 1). This structure is stable after irradiation. The anomalous increase in X-ray reflection in irradiated Sc2O3 samples was understood using the two sciences of solid state physics (change in lattice parameter, macro and micro stresses along the depth of Sc2O3) and quantum mechanics and determine the radiation energy, which is associated with the change in frequency and wavelength along the depth of the sample depending on the irradiation energy.

Fig. 1. Structural model of dissolution of xenon ions in the scandium oxide lattice when irradiated with xenon ions of different energies

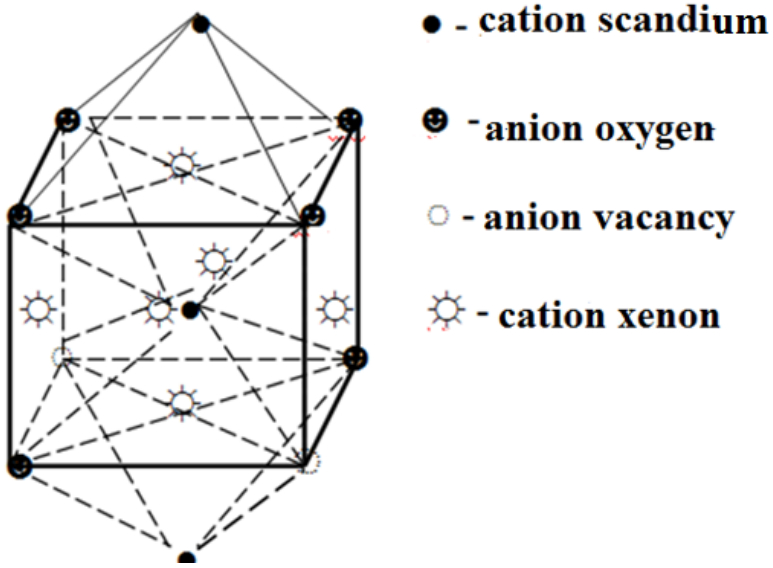

Table 1 Results of analysis of reflections from the (440) plane in an scandium oxide lattice at a depth of 4,6 μm depending on the energy of irradiation with xenon ions

. Parameters	Standard	140 keV	300 keV
ν – Vibration frequency,▪ 10^{17}, Hz	19,48	23	27,5
N - Photon flux ▪ 10^{17}, imp./s	17,05	17,05	17,05
λ - wave length, ▪10^{-9} m	0,154	0,130	0,109
Flow energy, keV	8,05	9,5	11,3

Biography

In 1966 she graduated from the Polytechnic Institute with a degree in metal physics, and in 1995 she defended her doctoral dissertation in solid state physics. She work as a consultant on structural research of materials at the Physico-Technical Institute in Sukhum, Republic of Abkhazia.

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Application of reflecting coating on a building's roof thermal performance- A review

F Wurood Asaad M, S. Lina M. Shaker, Ruaa H. Abbas and **Ahmed Mahdi**

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Effective building cooling techniques are crucial for energy efficiency, especially in hot climates. One such method involves the application of reflective coatings to building surfaces, which can significantly reduce heat absorption and lower cooling demands. These coatings, including paints, sealants, varnishes, and specialized options such as elastomeric and anti-graffiti coatings, not only enhance a building's longevity and appearance but also provide protection against environmental factors. Reflective coatings are designed to minimize heat absorption, enhance surface reflectivity, and reduce glare. They are widely used in applications such as mirrors, optical devices, solar panels, and reflective clothing. However, there remains a research gap in the development of cost-effective, scalable, and long-lasting radiative cooling materials that can be seamlessly integrated into architectural design. To fully realize the potential of these materials, further research is needed to evaluate their long-term durability, real-world performance, and their ability to maintain high cooling efficiency under various conditions. Addressing these challenges is critical for the widespread adoption of radiative cooling technologies in the construction industry and urban planning to combat climate change and reduce energy consumption.

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Smart nanocomposites of conjugated polymers for sensing applications

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[2]V. E. Lashkaryov Institute of Semiconductor PhysicsNAS of Ukraine, Ukraine
[3]Center for Energy and Environment, IMT Nord Europe, Institut Mines-Télécom, University of Lille, France

Interest in smart materials stems from their multifunctionality and ability to reversibly respond to external stimuli by changing their characteristics (electrical conductivity, color, optical, volume, temperature, hydrophilicity/hydrophobicity, shape, etc.). In particular, smart hybrid nanocomposites which combine the properties of multifunctional conductive and/or non-conductive conjugated polymers or biopolymers and inorganic or organic (nano)materials sensitive to various physical influences, allow to register or at list to sense changes in the surrounding atmosphere or exhaled breath of patients, to deliver drugs or diagnostic agents in living organisms, to adsorb heavy metal ions and toxic organic compounds from various natural waters, to shield/absorb electromagnetic radiation, etc. However, efficiency of participation of such smart nanocomposites in these applications depends on intermolecular interactions between their components, which strongly affect properties of the material as a whole. That is why we direct our research to better understand how these interactions affect structure, morphology and properties of nanocomposites of conjugated polymers (polyaniline, polypyrrole, poly(3-methylthiophene), poly(3,4-ethylenedioxythiophene, etc.) compared to the pure components. In this report we consider how and why such materials can reversibly react to the composition of the external environment, in particular to vapors of various compounds, and how such reactions can be controlled. In particular, the influence of specific interactions at the interface between nanocomposite components and polymerization conditions on structure, morphology, electrical characteristics and their role in sensing behavior and applications of the conductive nanocomposites to detect toxic volatile substances (ammonia, amines, organic solvents, chemical warfare agent simulants) will be considered. Some attention will be paid to using the developed materials for the removal of harmful compounds from water environments, and for interaction with external physical stimuli (electromagnetic interference shielding, etc.).

Biography

Professor Alexander Pud since 2009 is the Head of the Department of Chemistry of Functional Materials of the V.P. Kukhar Institute of Bioorganic Chemistry and Petrochemistry of NAS of Ukraine. He graduated from Kiev Polytechnic Institute, Department of Electrochemical Productions Technology (1979). In 1985 and 2004 he received PhD degree and Dr. Sci. (HDR) in Polymer Science, at Chemistry Department of Taras Shevchenko National University of Kyiv. In 2011 he became the Professor in Physical Chemistry. His research interests currently are in fields of formation, properties and functioning of intrinsically conducting/conjugated polymers (ICP), and nanocomposites in dispersion and solid-phase media; synthesis, properties and applications of multifunctional host-guest (core-shell) hybrid nanocomposites of ICP (e.g. polyaniline, polythiophene, polypyrrole and their derivatives) with both polymers of other nature and inorganic nanoparticles (semiconductor, dielectric, magnetic etc.).

Microstructure, mechanical and corrosion properties of anodized ultrafine-grained titanium based materials for medical application

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[2]Innovation Centre of the Faculty of Technology and Metallurgy, Serbia

The Ti-13Nb-13Zr (TNZ) alloy and commercially pure titanium (cpTi), before and after the high pressure torsion (HPT) process preformed under pressure of 4.1 GPa with a rotational speed of 0.2 rpm up to 5 rotations at room temperature, was examined. All titanium based materials were subjected to electrochemical anodization. The electrochemical anodization was done in 1M H3PO4 + 0.5 wt. % NaF electrolyte during 60 and 90 minutes, for the desired potential of 25V with a scan rate of 100 mVs-1. As the result of the surface modification nanostructured titanium based oxide layer was obtained. The anodized materials surface was analysed using the scanning electron microscopy (SEM), the atomic force microscopy (AFM) and the X-ray diffraction (XRD). The electrochemical impedance spectroscopy (EIS) technique was used to determine the corrosion resistance of the titanium based materials before and after HPT and electrochemical anodization. These materials were exposed to a solution simulating conditions in the human body (Ringer's solution and artificial saliva) with pH of 5.5 at a temperature of 37 °C. The mechanical behaviour of anodized materials surface was examined by nanoindentation test. The control of nanoindentation test was done by total displacement. The test was performed on a nanoindenter G200, Agilent Technologies, using as an indenter the Berkovich-type diamond tip. As results, the mean value of ten measurements of the surface modulus of elasticity and nanohardness were obtained. Results show that electrochemical anodization led to the formation of the nanotube oxide layer on the surface of titanium-based materials. All examined titanium based materials showed adequate corrosion protection for application as implant in human body. While, electrochemical anodization led to a decrease or an increase of the corrosion protection, depending on the nanotube oxide layer morphology.

Biography

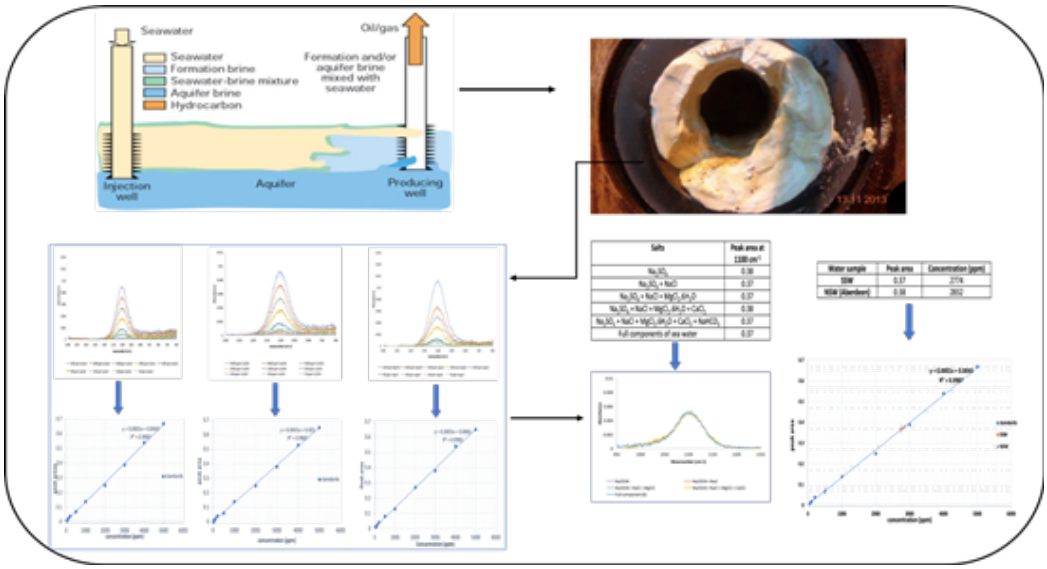
Dragana R. Mihajlović (born as Barjaktarević), PhD in Technical and Technological sciences - Materials Engineering, is a Research Associate in University of Belgrade, Faculty of Technology and Metallurgy. Dragana R. Mihajlović focused her scientific research on several areas: the application of the high - pressure torsion process in order to obtain the ultrafine-grained microstructure of metallic biomaterials, the application and optimization of the electrochemical anodization process to obtain the nanostructured surface on metallic biomaterials, the examination of mechanical properties, corrosion damage and biocompatibility of the metallic materials used for the replacement of bone tissues in the human organism, as well as the creation and analysis of numerical models using the finite element method in the licensed software package Abaqus.

Novel approach to assess seawater breakthrough using FTIR spectroscopy

Hauwa A. Rasheed

Nile University of Nigeria, Nigeria

Seawater is the most often used source of water for injection into reservoirs during secondary recovery operations in oilfields to maximize production. However, when such a procedure is employed, serious damage such as scale formation, may result due to the compositional differences between seawater and formation water. Scale is an assemblage of mineral deposits, and can form in all stages of production as long as water is present. Scale formation is a serious issue for the oil and gas industry. It is one of the major reasons for the decline in oil production worldwide. For that reason, a rapid and easy technique was developed making use of attenuated total reflectance Fourier-transform infrared spectroscopy (ATR-FTIR) to monitor the composition of the produced brine for any indication of seawater breakthrough as well as estimating the seawater fraction. The concentration of sulphate ions (SO42-) present in the produced water, which is primarily responsible for scale formation was determined using this technique. The estimated limit of detection (LOD) and limit of quantification (LOQ) for SO42- were found to be 50 ppm and 100 ppm, respectively. The presence of other ions in the water does not affect the instrument's sensitivity in terms of detecting and determining the concentration of SO42-. Plotting the linearity between the actual and measured concentrations revealed a strong correlation between the two values, indicating that FTIR can be a potentially quick, simple, dependable, and inexpensive method to assess seawater breakthrough.



Biography

Hauwa completed her undergraduate degree in chemistry at Bayero University Kano and a MSc in Oil and Gas Chemistry from University of Aberdeen, UK. Hauwa is now a PhD student at Department of Industrial Chemistry, Nile University of Nigeria. She is currently working on the Synthesis and Optimization of Carboxymethyl Cellulose from Agricultural wastes for use in Oil and Gas field operations.

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Green particle board production from Agro-forest residue valorization

Prosper Mensah[1], Maila Janaína Coêlho de Souza[2], Rafael Rodolfo de Melo[3], José Benedito Guimarães Junior[4], Adriano Reis Prazeres Mascarenhas[4], Edgley Alves de Oliveira Paula[3], Talita Dantas Pedrosa[3], Daniel Maskell[5] and **Francisco Rodolfo Junior[6]**

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[2]Agricultural Sciences Academic Unit, Federal University of Rio Grande do Norte—UFRN, Brazil
[3]Agricultural Science Center, Federal University of the Semiarid—UFERSA, Brazil
[4]Department of Engineering, Federal University of Lavras—UFLA, Aquenta Sol, Brazil
[5]Department of Architecture and Civil Engineering, University of Bath, UK
[6]Department of Engineering, Federal University of Piauí - UFPI, Rodovia Bom Jesus—Viana, Brazil

Reusing agro-industrial residues does not only help to mitigate environmental impact but also enables valorization through the development of new products. The aim is to enhance the physical and mechanical properties of particleboard panels produced with Eucalyptus wood and different proportions of residue products—coconut fibre (Cocos nucifera L.). Physical properties (density and dimensional stability) and mechanical properties (static bending and internal bond resistance) were assessed, and panels reinforced with coconut fibre showed the best qualities with higher density, greater dimensional stability, and less water absorption. Static bending resistance and internal bond resistance also increased significantly. The results indicate that the density of the particleboards produced ranged from 630 kg/m3 to 810 kg/m3. The water absorption property of the particleboards also ranged from 36.79% to 65.52% and 50.06% to 115.80% for 2-hour and 24-hour immersions respectively. Additionally, the thickness swelling of the particleboards ranged from 5.11% to 30.10% and 8.06% to 38.70% for 2-hour, and 24-hour immersions respectively. The results further indicate that the modulus of elasticity, modulus of rupture and internal bond strength of the particleboards produced were adequate and acceptable. The micrographs indicate that the cohesion in the matrix is a recipe for better physical and mechanical properties performance of the produced

panels. This demonstrated the potential of achieving compatible characteristics for civil construction and furniture production through the inclusion of residue materials. The impact of this research is obtained from the utilization of an important agro-industrial residue in the manufacture of permanent composites.

Biography

Prosper Mensah is a collaborative and a meticulous research scientist. His area of interest includes but not limited to characterisation of timber, wood-based and non-wood-based composite products for efficient utilisation, conduct research into non-timber forest products, industrial utilization of available biomass for the production of fibreboards to build cost effective and affordable furniture and housing in Ghana, characterisation of smaller diameter logs, durability studies in wood and fibreboards. Has knowledge in timber and non-Timber products, sustainability supply chain management, wood machines with hands-on experience in sawmilling of wood, furniture manufacture and testing. Contribute to an effective teaching, training and he is a handyman. He is an excellent problem-solver, detailed oriented and possesses good oral and written communication skills. He has contributed in extending knowledge as could be verified in his associations. He obtained his Ph.D. in Wood Science and Technology from the University of Education, Winneba, Ghana in 2021.

Quantum correlations in two interacting spins under thermal effect

M. Yachi

Laboratory of Innovation in Sciences, Technologies and Modelisation,
Faculty of Sciences, Chouaib Doukkali University, Morocco

We study the thermal quantum correlations and quantum coherence in an anisotropic two- qubit Heisenberg XY system with Dzyaloshinskii-Moriya interaction in thermal equilibrium at temperature T and in the presence of a uniform magnetic field B. Our results show that magnetic anisotropy increases the entanglement and the quantum correlations appear in all temperature intervals. By increasing the magnetic anisotropy, it is found that the quantum coherence appears from a minimum temperature. Additionally, by increasing the magnetic anisotropy, we show the violation of Bell-CHSH inequality, and consequently the enhancement of quantum entanglement.

Biography

Mouhcine Yachi, currently a third-year PhD student at the Faculty of Sciences, Chouaib Doukkali University. At 30 years old, he has authored a paper in the Journal of Physics A: Mathematical and Theoretical.

Comparative study on industrial processabilities of cellulosic raw materials for eco-friendly textile production

Kaniz Moriam[1,2], Heikki Hassi[3], Eric Enqvist[3], Huy Quang Lê[2,3] and Michael Hummel[2]

[1]Massachusetts Institute of Technology, USA
[2]Aalto University, Finland
[3]SciTech Service Limited, Finland

Lyocell, considered as sustainable industrial technology for regenerated cellulosic fibers production, has been expanding in capacity in recent years. Even though currently mostly using a particularly designated pulp class (lyocell-grade dissolving pulp) as raw materials, the lyocell process can potentially convert a wide range of cellulose-based raw materials into fibers due to the efficient dissolution capacity of N-methylmorpholine N-oxide (NMMO) monohydrate. This work assesses the suitability of different cellulose-based raw materials for the NMMO-lyocell technology with an emphasis on industrial processabilities. The selected raw materials were tested for dissolution extent in NMMO, after which the cellulose solutions (dopes) were comprehensively analysed with emphasis on rheological properties as bases for evaluating the possible behaviours in the lyocell process.

Biography

Kaniz Moriam is a postdoctoral research fellow at the Massachusetts Institute of Technology, USA. She earned her Ph.D. in chemical engineering from Aalto University, Finland, in 2022. After completing her PhD, she worked as a senior scientist for a year at a Finnish company called SciTech Service Limited. Currently, her research at MIT focuses on devising strategies to enhance the efficiency of textile recycling through an in-depth exploration of the rheological properties of cellulose solutions and the optimization of fiber spinning techniques. Additionally, she is working to promote and augment the production of environmentally friendly and biodegradable cellulose-based textiles.

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Two-stage cultivation as effective strategy for enhanced productivity in plant and microalgal cell culture systems

M.A. Abdullah[1], H.E.A. Ali[2] and **E.A. El-fayoumy[3]**

[1]SIBCo Medical and Pharmaceuticals Sdn. Bhd., Malaysia
[2]Department of Radiation Microbiology, National Center for Radiation Research and Technology (NCRRT), Egyptian Atomic Energy Authority (EAEA), Egypt
[3]Department of Botany and Microbiology, Faculty of Science, Cairo University, Egypt

Depleting fossil fuels, destruction of flora and fauna and climate change have made plant and microalgal cell culture systems being seen as viable alternatives for the production of bio- and green fuels, biochemicals, biomaterials and biopharmaceuticals. The challenges that have hampered rapid progress have been attributed to the slow cell growth, low productivity, and poor metabolite secretion. Especially for plant cells, there are issues related to cell aggregation, shear sensitivity, and excessive foaming. Optimization strategies include improvement of medium components and cultural conditions. More rational approaches may involve strain improvement and directed evolution, understanding the biochemical and signal transduction pathways and making use of the advanced omics technologies for metabolic and genetic engineering of products of interest. Two-stage cultivation strategy can be adopted as a more rapid approach to overcome the drawbacks of single-stage cultivation by promoting biomass production and compound accumulation through controlled or stress conditions, thus elevating the productivity and identifying the induced compounds that can be targeted for further optimization work. In the case of Morinda elliptica cell cultures, the formulated Intermediary and Production medium strategies have enhanced productivity and Anthraquinones production by several fold compared to under Maintenance medium or elicitation with biotic or abiotic elicitors. With Centella asiatica cell cultures however, only stress-related compounds are induced, but not the targeted Asiatic and Madecassic acid, and Asiaticoside and Madecassoside. In the two-stage cultivation of Chlorella vulgaris, the combined stress factors involving light intensity, salinity, and nitrogen limitation have led to simultaneous production of biomass and high-value products with enhanced antioxidant activities. The different levels of antioxidant activities suggest the variety of induced phytochemical compounds under defined stressed conditions.

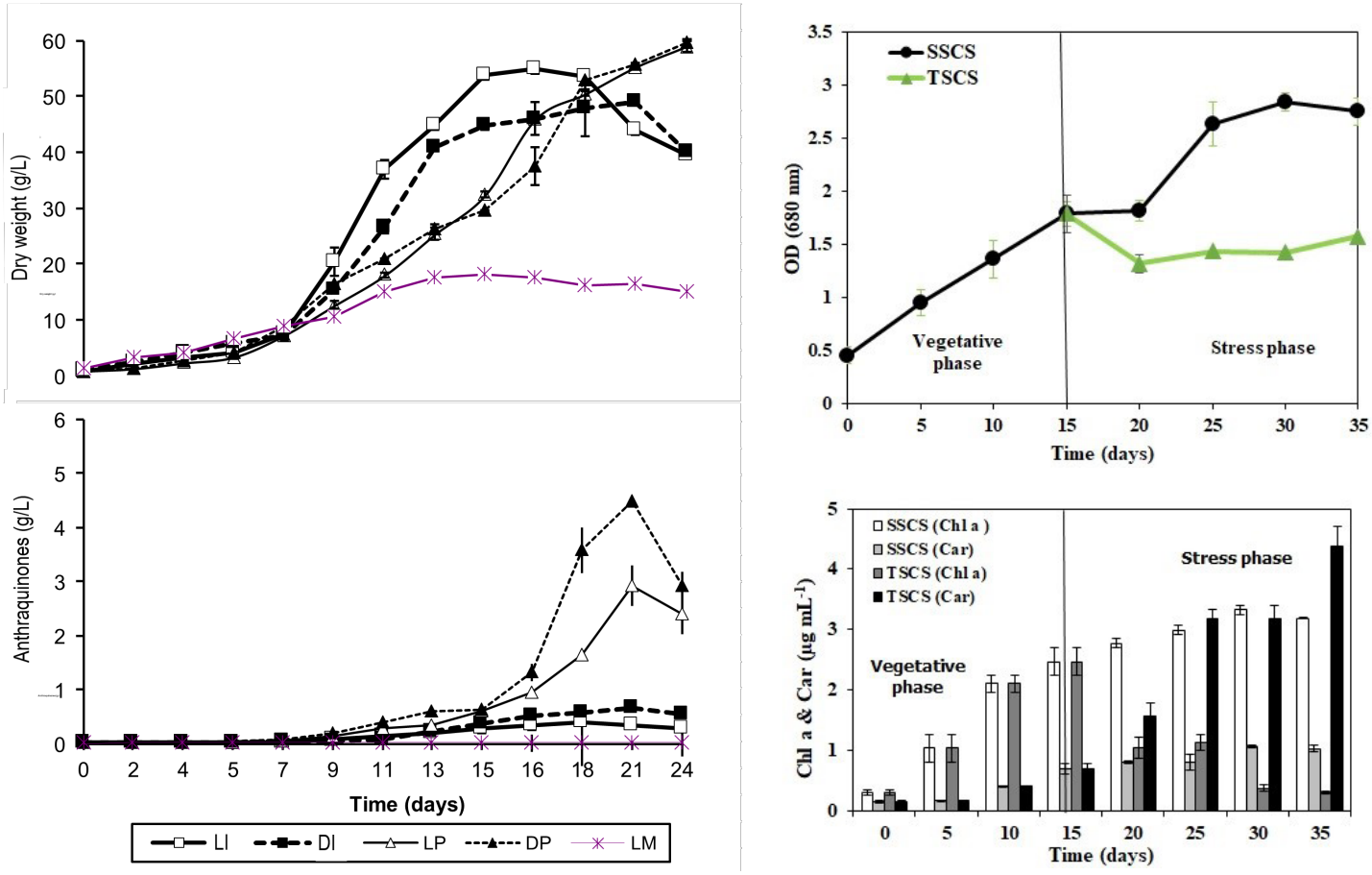

Figure 1: a) Cell growth and Anthraquinones production of Morinda elliptica under Light (L) and Dark (D) exposure in Maintenance (M), Intermediary (I) and Production (P) medium strategies; b) Two-stage cultivation system (TSCS) of Chlorella vulgaris under vegetative and stress phases against Single stage cultivation system (SSCS) for the productions of Chlorophyll a (Chl a) and Carotenoids (Car)

Biography

Mohd Azmuddin Abdullah obtained an M. Eng in Chemical Engineering and Biotechnology (1994) from the University of Manchester Institute of Science and Technology, United Kingdom, and a PhD in Bioprocess Engineering (1999) from Universiti Putra Malaysia (UPM). He was a Visiting Scientist (1997) in Kinki University, Japan, and a Post-Doctoral Fellow (2000-2001) at the Biomaterials Science and Engineering Laboratory, Massachusetts Institute of Technology, USA. He was an Academic in UPM (1994-2004), Universiti Teknologi PETRONAS (2004-2014), and Universiti Malaysia Terengganu (2015-2021). He is the Director of R&D in SIBCo Medical and Pharmaceuticals Sdn. Bhd. since August 2021. He has authored 200 articles, presented in 45 conferences and filed 6 patents, and 3 trademarks, on bioenergy, bioproducts and biopharmaceuticals. In 2015, he was awarded the Teaching Excellence Award by the Association for the Advancement of Biodiversity Science, India, and in 2017, the Scientist Medal by the International Association of Advanced Materials, Sweden.

Hypoxic bone mesenchymal stem cell-derived exosomes direct Schwann cells proliferation, migration, and paracrine to accelerate nerve regeneration via circRNA_Nkd2/miR-214-3p/MED19 axis

Haopeng Wang and **Shiting Li**

Shanghai Jiaotong University School of Medicine Xinhua Hospital, China

Background: Facial nerves have the potential for regeneration following injury, but this process is often challenging and slow. Schwann cells (SCs) are pivotal in this process. Bone mesenchymal stem cells (BMSC)-derived exosomes promote tissue repair through paracrine action, with hypoxic preconditioning enhancing their effects.

Objective: The main purpose of this study was to determine whether hypoxia-preconditioned BMSC-derived exosomes (Hypo-Exos) exhibit a greater therapeutic effect on facial nerve repair/regeneration and reveal the mechanism.

Methods: CCK-8, Edu, Transwell, and ELISA assays were used to evaluate the functions of Hypo-Exos in SCs. Histological analysis and Vibrissae Movements (VMs) recovery were used to evaluate the therapeutic effects of Hypo-Exos in rat model. circRNA array was used to identify the significantly differentially expressed exosomal circRNAs between normoxia-preconditioned BMSC-derived exosomes (Nor-Exos) and Hypo-Exos. miRDB, TargetScan, double luciferase assay, qRT-PCR and WB were used to predict and identify potential exosomal cirRNA_Nkd2-complementary miRNAs and its target gene. The function of exosomal circRNA_Nkd2 in facial nerve repair/regeneration was evaluated by cell and animal experiments.

Results: This study confirmed that Hypo-Exos more effectively promote SCs proliferation, migration, and paracrine function, accelerating facial nerve repair following facial nerve injury (FNI) compared with Nor-Exos. Furthermore, circRNA analysis identified significant enrichment of circRNA_Nkd2 in Hypo-Exos compared with Nor-Exos. Exosomal circRNA_Nkd2 positively regulates mediator complex subunit 19 (MED19) expression by sponging rno-miR-214-3p.

Conclusion: Our results demonstrate a mechanism by which Hypo-Exos enhance SCs proliferation, migration, and paracrine function and facial nerve repair and regeneration following FNI through the circRNA_Nkd2/miR-214-3p/Med19 axis. Hypoxic preconditioning is an effective and promising method for optimizing the therapeutic action of BMSC-derived exosomes in FNI.

Biography

Haopeng Wang, is a PhD student at Shanghai Jiao Tong University, studying at the Cranial Nerve Disease Center of Shanghai Jiao Tong University under the supervision of Prof. Shiting Li, 1st rotating president of the World Neurosurgeon Federation of Cranial Nerve Disorders. Haopeng Wang specialized in both clinical and basic research in the field of facial nerve injury and repair, and is passionate about improving facial paralysis. He engaged in FNI regeneration research for many years, and has been conducting research on exosomes to accelerate FNI regeneration for more than 2 years in Cranial Nerve Disease Center of Shanghai Jiao Tong University. This is the first time that his findings be reported in international conference.

Video steganalysis system for the cross domain steganography

Surendra Bhosale and **Shamal Salunkhe**

Department of Electrical Engineering, Veermata Jijabai Technological Institute, India

The Cross-domain Steganalysis research focusses on multiple domain video steganography, single steganalysis technique to detect the secret messages and deep learning for classification and computational efficiency for Steganalysis. The video steganography has been performed using the techniques, namely, Partition Modes (PMs), Motion Vector (MVs), Intra Prediction Modes (IPMs), Quantization Parameters (QPs), and DCT coefficients. These different domain steganography methods had associated steganalysis techniques.

Most of these methods are at a preliminary stage, more generalized solutions for secure video processing is expected. The use of steganography domains for secrete message embedding belongs to individuals, but generalized video steganalysis regardless of the video steganography method is a key requirement of real-time applications.

There are four main objectives of this research viz, to design novel video steganalysis techniques for cross-domain video steganography methods, to design and implement video steganography techniques across the different domains, to propose cross-domain steganalysis by estimating the global features set for multi-domain video steganography methods, to design the cross-domain steganalysis using deep learning classifiers for performance improvement and to design, model, and evaluate the performance of proposed steganalysis methods with state-of-art techniques using different datasets.

Proposed model for video steganalysis system:

Following are the steps of proposed model:

1. Brose the input pair of cover and stego video sequences from the dataset
2. Perform the steganography using either PM-domain or MV-domain, or IPM-domain techniques.
3. Fed the outcome of steganography techniques as compressed video to cross-domain features extraction.

4. Perform the filtering on each frame.
5. Extract the domain-independent features called Global Features Set (GFS) from the compressed video sequence.
6. Extract the domain-dependent features called Domain Specific Features (DSF) from the compressed video sequence.
7. Build the joint cross-domain feature vector for steganalysis.

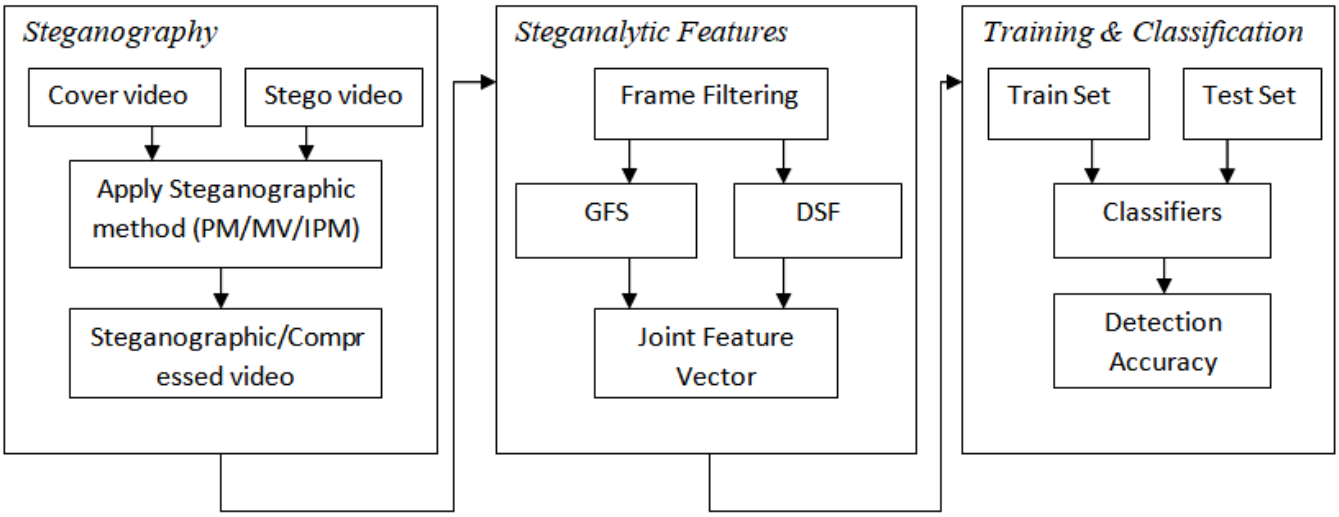

Figure 1. Proposed video steganalysis system

Dataset: For the performance analysis, we used uncompressed video sequences. Every video sequence is progressively scanned and stored as a raw video file in the 4:2:0 Chroma sampling format (YUV420p). This dataset consists of 100 uncompressed video sequences at CIF resolution with an average of 220 frames per sequence.

Performance Metrics: The commonly used performance metric to evaluate the performance of Steganalysis methods is Detection Accuracy. It is computed as:

$$Accuracy = 1 - \frac{1}{2}\left(P^{FA} + P^{MD}\right) \quad 1)$$

Steganographic Methods: To evaluate the proposed detection method performance of the proposed features, three types of video steganography, i.e., PM-based steganography, MV-based steganography, and IPM-based are used steganography as targets for experiments. For PM-domain, we implemented method given in [2] called as Tar1, for MV-domain, we implemented method given in [3] called as Tar2 and for IPM-domain, we implemented method given in [4] called as Tar3.

Steganalytic Methods: To compare proposed feature set with the previous methods in three embedding domains, two types of steganalytic methods are also selected to build detectors for comparative analysis. We compare the performance of proposed CDVS technique with MVC [5] and H.Zhang [6]. Both these steganalytic techniques are independent on steganography domains.

Simulation Results:

Table 1. Performance of detection accuracy using Tar 1

Embedding Rate	H.Zhang	MVC	CDVS
0.05	0.924	0.928	0.9351
0.1	0.941	0.949	0.956
0.2	0.956	0.961	0.969
0.3	0.973	0.981	0.989
0.4	0.979	0.984	0.991
0.5	0.9841	0.985	0.994

Table 2. Performance of detection accuracy using Tar 2

Embedding Rate	H.Zhang	MVC	CDVS
0.05	0.914	0.918	0.928
0.1	0.931	0.937	0.947
0.2	0.945	0.949	0.959
0.3	0.965	0.971	0.979
0.4	0.968	0.972	0.983
0.5	0.978	0.981	0.989

Table 3. Performance of detection accuracy using Tar 3

Embedding Rate	H.Zhang	MVC	CDVS
0.05	0.923	0.927	0.931
0.1	0.938	0.942	0.947
0.2	0.951	0.957	0.961
0.3	0.959	0.964	0.968
0.4	0.967	0.971	0.981
0.5	0.971	0.975	0.986

Table 4. Comparative of features extraction time

Methods	Accuracy (%)	Classification Time (Seconds)	CDVS
H.Zhang	0.9537	4.12	0.931
MVC	0.9584	3.71	0.947
CDVS	0.9662	3.42	0.961

Synthesis of novel vicinal diaryl triazoles with sulfur and hydrazine linkers as highly potent anticancer and antioxidant agents

S. M. Hashemi[1], M. Ansari[1], A. Rafiei[2], Z. Yazdani[2] and **A. Khalilpour[3]**

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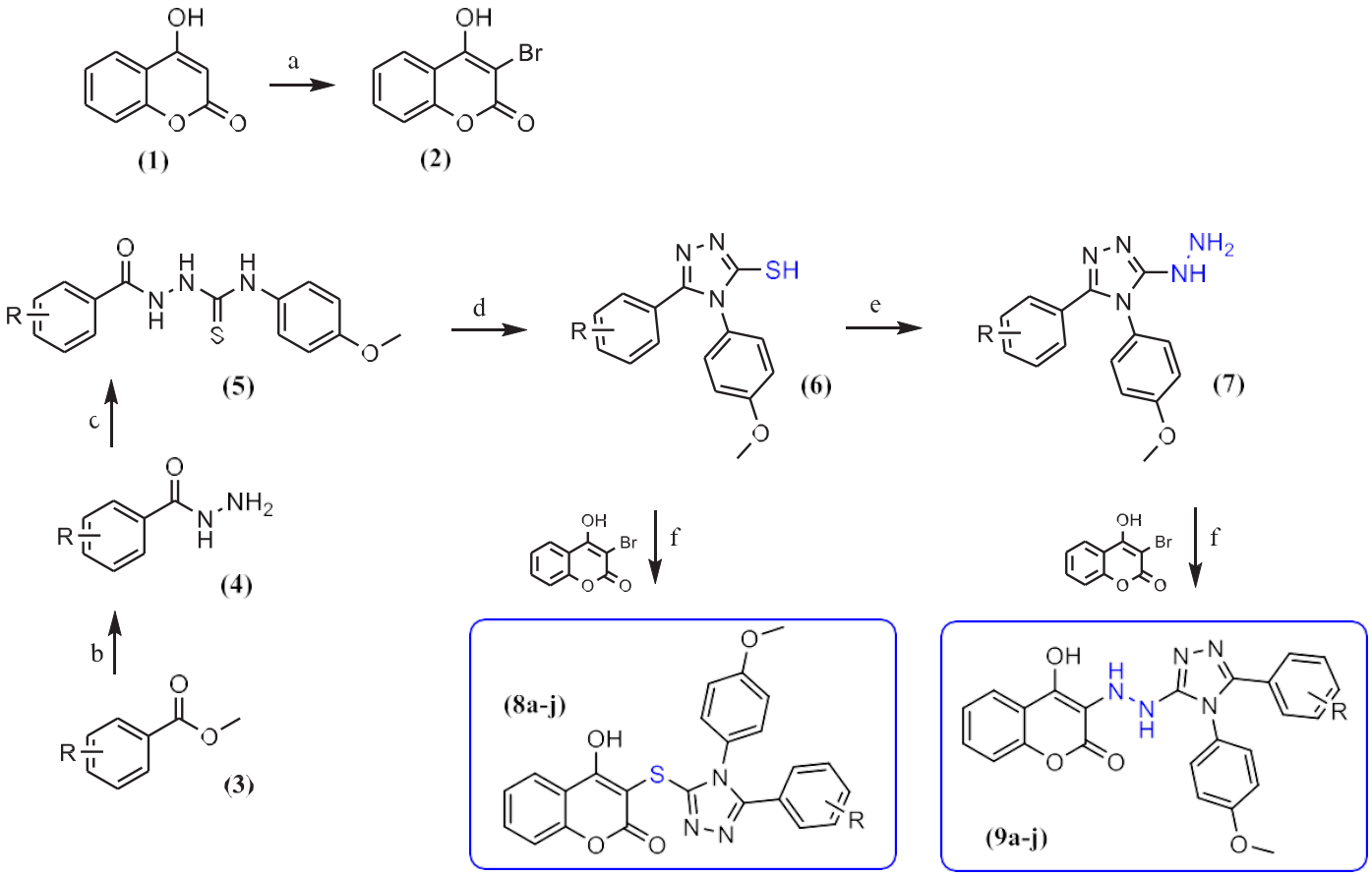
[2]Molecular and Cell Biology Research Center, Department of Immunology, Faculty of Medicine, Mazandaran University of Medical Sciences, Iran
[3]Department of Environmental Health Engineering, Faculty of Paramedical Sciences, Babol University of Medicinal Sciences, Iran

Objective: Heading the list of the critical health-related issues worldwide, cancer continues to be a one of the most serious life-threatening diseases. Moreover, development of new antioxidants is a field of growing interest because some synthetic antioxidants such as BHA and BHT are now suspected to be potentially harmful to human health.

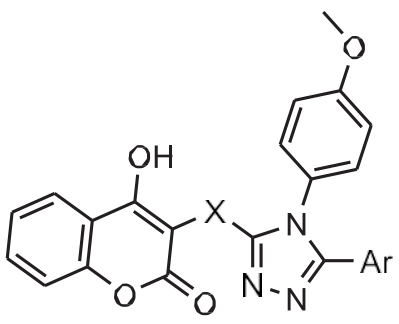
Methods: Accordingly, two series of 1,2,4-triazole–ring-containing combretastatin analogs; 8a-j with sulfur linker and 9a-j with hydrazine linker were synthesized (Scheme 1). All twenty compounds were tested in vitro for their anticancer activity on three different cancer cell lines including A549, MCF7, and HepG2. In addition, the antioxidant activity of all derivatives was evaluated using FRAP assay and DPPH test (Table 1).

Results: A superior cytotoxic activity of all compounds with sulfur linker (8) as compared to doxorubicin, on A549, MCF7 cancer cells, was observed. Furthermore, the best results against HepG2, were obtained for 8e, 8c, 8f and 8g. The compounds 8e, bearing 3,4,5- methoxy phenyl moiety, was the most potent radical scavenger in the DPPH method and were also had the superior capacity in the FRAP assay.

Conclusion: The SAR analysis indicated that the sulfanyl triazole fragment is better than hydrazineyl triazole for anticancer activity. The in vitro cytotoxic activity of vicinal diaryl triazoles bearing sulfur linker, 8, make them as good leads for the development of new anticancer agents. The obtained data from cytotoxic and antioxidant assays indicated that the introduction of a sulfur linker along with a 3,4,5-tri-methoxyphenyl moiety in 8e results in excellent anticancer potency and antioxidant ability to the prototype triazolyl coumarin compounds.



Scheme 1. Synthesis of 1,2-diaryl-1,2,4-triazoles 8a-j and 9a-j. Reagents and conditions: (a) Br2, CHCl3, rt, 12h; (b) hydrazine hydrate, EtOH, reflux, 3h; (c) 4-methoxyphenyl isothiocyanate, EtOH, reflux, 5h; (d) NaOH 1M, reflux, 3h; (e) hydrazine hydrate, EtOH, reflux, 3h; (f) NaHCO3, EtOH, rt, 24h.



Compound	X	Ar	Anticancer activity (µg/ml)			Antioxidant activity	
			A549	MCF-7	HepG2	FRAP value (mmol Fe^{2+}/l)	DPPH (% inhibition)
8a	S	Ph	5.58	4.38	14.32	183	46
8b	S	4-Me-Ph	4.15	4.58	18.56	207	50
8c	S	4-OH-Ph	3.91	4.90	8.30	250	69.82
8d	S	4-OMe-Ph	4.78	5.52	24.02	266	81
8e	S	3,4,5-$(OMe)_3$-Ph	6.43	5.21	4.29	442.5	88.37
8f	S	3-Br-Ph	7.05	8.13	9.90	229	80
8g	S	4-F-Ph	4.28	4.24	8.03	138	30.2
8h	S	4-NO_2-Ph	4.64	4.80	33.19	215	55
8i	S	2,4-Cl_2-Ph	4.04	6.25	17.16	225	60
8j	S	4-Pyridyl	5.20	4.27	15.86	163	40
9a	NHNH	Ph	36.87	40.98	41.83	426	62.5
9b	NHNH	4-Me-Ph	17.30	35.70	44.81	382.5	55
9c	NHNH	4-OH-Ph	16.21	23.08	47.27	216	50.9
9d	NHNH	4-OMe-Ph	25.68	20.02	55.90	172.5	30.2
9e	NHNH	3,4,5-$(OMe)_3$-Ph	28.82	15.16	19.70	397.5	66.6
9f	NHNH	3-Br-Ph	23.25	14.15	18.92	190	59.5
9g	NHNH	4-F-Ph	17.66	27.90	32.42	451	85.5
9h	NHNH	4-Cl-Ph	22.79	24.27	26.59	133.2	26.36
9i	NHNH	2,4-Cl_2-Ph	16.63	27.00	22.23	182.5	40.2
9j	NHNH	4-Pyridyl	22.75	18.20	22.61	184	40.8
Doxorubicine			11.34	12.89	12.48		
BHT						-	95

Table 1. Cytotoxic activities (IC50, µg/ml), DPPH (inhibition%) and FRAP Values (mmol Fe2+/l)) of compounds 8a-j and 9a-j.

Biography

Dr. Seyedeh Mahdieh Hashemi is currently an assistant professor at Mazandaran University of Medical Sciences in Iran. She received his Ph.D. in medicinal chemistry from the Faculty of Pharmacy at the Mazandaran University of Medical Sciences, in 2015.

Dr. Hashemi has shown a successful mentorship and collaborative record during her career. She has supervised 25 graduate students. Dr. Hashemi serves as an editorial board member or editorial advisory board of several journals.

The emphasis of Dr. Hashemi's research lies on the interface between chemistry and biology, with specific proposals being focused on the fields of medicinal chemistry, and organic chemistry. Her research can be described as "applying synthetic organic chemistry to problems in biology". Specific areas currently under investigation include designing and developing anticancer, anti-diabetes, anti-convulsant, neuroprotective and antifungal agents. Dr. Hashemi's contributions have resulted in 24 peer-reviewed publications, 3 issued patents, and 9 meeting abstracts.

Collocation method for fuzzy fractional integro-differential equations

Suvankar Biswas

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Fractional-order calculus offers more significant potential for managing complex systems than traditional integer-order calculus because it is more capable to describe the nonlinear and nonlocal characteristics of time series. And fuzzy Mathematics is one of the best ways to handle uncertainty, particularly when the uncertainty is based on a non-random process. The uncertainty may arise due to a lack of information about a problem or the data from a source that is not fully trustworthy or multiple pieces of information that are conflicting with each other. Therefore, combining these two concepts gives a huge advantage over classical equations. In more recent times, FFDEs have been presented as a means of addressing the uncertainty that arises in several mathematical simulations of various real-life situations. Many researchers are devoted their interest to working on FFDEs and their applications. Therefore, it has been decided to examine a linear fractional order fuzzy integro-differential equation. Consideration has been given to the most popular and sophisticated Caputo fractional order derivative. A collocation method based on the Lagrange interpolation basis polynomial has been created by modifying the usual collocation method for this equation. The collocation points are chosen based on Chebyshev extreme points or Gauss-Lobatto-Chebyshev points of order N. The fractional Gauss-Jacobi quadrature method has been used to approximate the fractional integral terms of the proposed equation. The existence and uniqueness conditions are analyzed for the solution of the equation. The Convergence analysis of the proposed numerical technique is done. Some numerical experiments have been performed to verify the proposed method. Five different kinds of errors have been computed and compared to do the error analysis. The numerical results of the proposed technique have been compared with an existing method.

Biography

Suvankar Biswas graduated from A. P. C. College under West Bengal State University in 2011. He completed his post-graduation from the Indian Institute of Engineering Science and Technology, Shibpur (IIEST, Shibpur) (Formerly, Bengal Engineering and Science University, Shibpur.) in 2013. He has been awarded by Prof. S. C. Dasgupta Gold Medal and Arun Chandra Mitra Memorial Medal for securing highest marks among the candidates of the Master of Science in Applied Mathematics and Master of Science examinations respectively, in 2013 conducted under the Faculty of Basic and Applied Sciences, IIEST, Shibpur. He completed his Ph.D. in "Studies on Differential and Integral Equations in Fuzzy Environment" from the IIEST, Shibpur in 2018. Now he is working as an Assistant Professor at Indira Gandhi National Open University, New Delhi – 110068, India. His areas of research interest are Numerical Analysis, Differential Equations, Integral Equations, Integro-Differential Equations, Fuzzy Mathematics, and Mathematical Biology.

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Role of metal-polymer hybrid composites as fillers for reinforcement of epoxy resin and improving its properties

Ramya Rajan, Jayadev D and **Saritha Appukuttan**

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Epoxy-based nanocomposites represent a distinct category within the realm of polymer composites, occupying a significant place due to their exceptional characteristics. Epoxy-based nanocomposites have been used in several sectors, including as aerospace and automotive, for their protective coating properties, including anti-corrosion and antibacterial functionalities. Additionally, these nanocomposites have also found application in the biomedical area. One notable drawback associated with epoxy materials is to their inherent brittleness, which renders them susceptible to cracking. Nevertheless, the incorporation of diverse fillers into epoxy matrices to form epoxy nanocomposites has been shown to enhance their mechanical properties, therefore enabling them to endure greater levels of mechanical stress. Nanomaterials, fibres, polymers, and particle debris are often used to augment the toughness of epoxy materials[1]–[4].

Our study explores the multifaceted aspects of the hybrid metal-polymer composites when used as reinforcing agent for epoxy resin. These materials exhibit enhanced thermal and mechanical characteristics, while also demonstrating antibacterial properties. This presentation aims to share a novel methodology that exploits the preparation of metal-hybrid polymer composites under photocatalytic condition and employ the combined attributes of metal hybrid polymer composites as reinforcements for matrices composed of epoxy resin to enhance the performance of epoxy resin, hence presenting intriguing prospects for the utilization of advanced materials [5].

Biography

Ramya Rajan is a passionate and dedicated innovation driven professional with 21 years of experience in chemistry research and process development. She began her career as a scientist at Syngene, Bangalore in 2002 and later served as the Research Head for Neucon India in Goa. Joining Syngenta Research and Technology Center in Goa in 2006, she rapidly got promoted to become a Team Leader, dedicating 16 years to the organization. Recently, she embarked on a new role as Team Leader, Process Chemistry at Deccan Chemicals, Goa.

Driven by a profound interest in Nanotechnology and polymer science, Ramya has been a part-time research scholar with Dr. Saritha A, an eminent professor at Amrita University, since 2017, focusing on Nanomaterials. Her expertise spans core chemistry research, including the design and synthesis of biologically active molecules, process development, and PhD research in Nanomaterials. Ramya's contributions have resulted in 6 journal articles, 4 book chapters, and 55 patent applications, with over 200 patents stemming from her work.

She excels in leading cross-functional teams across the entire product development lifecycle, notably achieving successful market launches, such as a broad-spectrum fungicide. Ramya is committed to knowledge dissemination within the chemistry research community, as evidenced by her presentations at various conferences and publications. With a wealth of industry and research experience, she remains dedicated to advancing scientific research.

Energy harvesting by cyclic tensile loading and buckling via an electrospun polyblend elastic layer of PVDF/PU

B.Adeli, A.A.Gharehaghaji and **A.A.A.Jeddi**

Department of Textile Engineering, Amirkabir University of Technology, Iran

Energy harvesting through piezoelectric materials is considered an alternative to conventional power sources. Polyvinylidene fluoride (PVDF) is a piezoelectric material that has garnered significant attention from researchers. Blending PVDF with thermoplastic polyurethane can enhance its elastic properties. Numerous studies have successfully generated electric currents from piezoelectric materials by applying pressure and impact. This study, however, explores the generation of an electric current in piezoelectric materials by applying cyclic tensile loading. For this purpose, a tensile loading device was designed and built at the laboratory scale. Subsequently, a PVDF/PU polymer alloy layer (in a 25:75 ratio) was fabricated using the electrospinning method and installed in the loading device for testing. The results demonstrated that the electrical resistance decreased upon applying tension to the layer. Employing cyclic loading on the alloy layer resulted in an output voltage ranging between 3 and 9 mV, which confirmed the feasibility of energy harvesting from the polyblend layer. In a novel approach undertaken in this study, an electric current was generated by applying cyclic tensile loading, resulting in subsequent buckling. The potential energy harvesting mechanism from cyclic tensile loading and buckling is also elaborated. In addition, the study assessed and reported the effect of increasing the cyclic loading frequency on energy harvesting.

Biography

Dr. Behrang Adeli, a native of Khorramabad, Iran, and an alumnus of Amirkabir University of Technology, holding a Ph.D. in Nanotechnology with an emphasis on Nano Fiber and Nano Polymers blending, garnered in 2022. His academic path commenced with a foundation in Textile Engineering from Isfahan University of Technology, where he attained his Bachelor's and Master's degrees in Textile Technology in 2003 and 2007, respectively.

His doctoral research, entitled "Production of PVDF/PU nanofiber layers to investigate the effect of tensile cyclic loading on the electric current generation," underscores his commitment to innovation and advancing knowledge within the field. He has several ISI publications to his credit, reflecting a deep engagement with textile engineering and nanotechnology.

Professionally, he has served as the Direct Manager of Kavosh Novin Sepanta since June 2022 and hold the position of Commercial Manager at Arta Tejarat Zarrin since February 2012. His managerial acumen is further evidenced by his tenure

as the Head Manager at Iran Six Stars P.P Bag Weaving Co., as well as his role in production management at Mehrtab Spinning Co.

His technical expertise is broad, encompassing proficiency in Microsoft Office, AutoCAD, MATLAB, and Image processing, alongside programming languages such as C++ and PASCAL. Additionally, he was skilled in statistical software, particularly SPSS and SAS, and graphic software, including Photoshop and Premiere.

Language proficiency in Persian English and a G7 course in German, coupled with his interdisciplinary skills, positions he uniquely within the global academic and professional landscape. His extracurricular pursuits, poetry, painting, and photography, complement his professional endeavors, providing a well-rounded persona.

He was particularly proud of the collaborative and teamwork skills honed during his formative years at the Brilliant Talents Schools (Sampad Center), which continue to inform his approach to interdisciplinary research and educational undertakings. His interest in psychology is a testament to his dedication to understanding the human aspects behind technological and scientific advancement.

With a firm belief in continuous learning, he has augmented his expertise through various technical and training courses. These pursuits not only reflect his dedication to personal growth but also his commitment to contributing meaningfully to the sectors he serves.

In summary, his academic qualifications, robust research background, comprehensive technical expertise, and dynamic approach to leadership in textile and nanotechnology industries provide a strong foundation for his ongoing contributions to the field.

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Modelling of corrosion rate in the drinking water distribution network using Design Expert 13 software

Reena Singh[2], Saurabh Kumar[1] and **Nityanand Singh Maurya[2]**

[1]IIMT University Meerut, India
[2]National Institute of Technology Patna, India

This study focused on the modelling of corrosion rate of the water distribution network of Patna, (Bihar), India using Design Expert 13 software. A total of nine variables, including pH, temperature, total dissolved solid (TDS), alkalinity, calcium hardness, chloride, sulphate, dissolved oxygen (DO), and time, were considered for modelling. The physicochemical parameters were determined through regular monitoring of water samples. The corrosion rate was determined by direct monitoring of water distribution pipes using adjustments of seven GI coupons for 45, 90, 135, 180, 225, 270, and 315 days. Modelling was performed using the low level and high-level experimental range for pH, temperature, TDS, alkalinity, calcium hardness, chloride, sulphate, DO, and time were 7.28, 23, 430, 115, 24, 18, 10.94, 3.5, 0 and 7.86, 28, 704, 284, 180, 98, 38.7, 6.8, and 315, respectively. Using the Box- Behnken design (BBD), 160 runs were conducted, including ten replicates at the central point of each block. The results of ANOVA indicate that values of R2, adjusted R2, and predicted R2 are 0.9714, 0.9507, and 0.8941, respectively. The value of R2 (0.9714) was close to 1, which indicates a good fit. The adequate precision was found to be 30.8442, indicating a good signal. A coefficient of variance discusses reproducibility, and in this case, it was 9.90%. On the basis of the ANOVA result, the quadratic model is well-fit and can be accepted as a suitable model. A total of seven parameters such as chloride, sulphate, hardness, alkalinity, pH, calcium, and hardness were used for the design of the experimental corrosion rate (CR). These individual CR vs. synthetic aqueous solutions were used to validate the interaction of the response surface. It was found that the trend of individual corrosion rates in synthetic aqueous solutions and the interaction of composite variables with corrosion rates in a quadratic model of response surfaces were clearly correlated.

Biography

Dr. Reena Singh, an accomplished academician, serves as an Assistant Professor at NIT Patna. She has obtained her PhD from National Institute of Technology Patna in 2019 With 15+ years of experience, she's a respected authority with vast expertise. Passionate about research, she published 20+ papers in esteemed journals and presented 15 conference papers, advancing knowledge in her domain. She has submitted two Ph.D and mentoring 7+ research scholars. Dr. Singh's contributions to literature include five book chapters, showcasing her multidimensional scholarship. As a devoted educator, she inspires and guides countless students, leaving a lasting positive impact on their lives. Her leadership qualities shine through organizing two short-term courses that enrich the academic community. Dr. Reena Singh's remarkable career, scholarly achievements, and impactful mentorship make her a shining beacon in higher education. Her passion for research, dedication to teaching, and commitment to nurturing young minds inspire the future generation of scholars.

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Sol-gel synthesis, characterization and luminescence investigation of trivalent rare earth doped garnet phosphor

Anita Verma[1], Ravi Sharma[2] and **Vijayalaxmi Biradar[1]**

[1]Kalinga University, India
[2]Govt. SGS Girls College Devendra Nagar, India

In recent decades a remarkable evolution has been noticed in the field of optical and luminescent applications using phosphor materials. All phosphor materials have their specific luminescence characteristics and these characteristics basically depend on the activator ion and crystallographic structures of the host lattice. Recently it has been observed that among all the inorganic host materials, garnet is an interesting host material for activator ions due to its eminently good physical, chemical stability, high luminescent effectiveness, high thermal properties and structural flexibility. Trivalent samarium doped CaY2Al4SiO12 phosphor was prepared via Sol–gel synthesis method for different concentration. X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), energy dispersive spectroscopy analyses (EDS) tool were used to analyse the crystal structure, morphology and elemental composition of prepared samples. Luminescence behaviour of the sample is discussed by the photoluminescence (PL) technique. The prepared phosphor shows a characteristic orange-red emission at around 568 nm with an excitation wavelength of 405 nm. The PL emission spectrum was predominated by an orange - red emission with a highest peak at 568 nm. The most intense PL emission was found for a 3 mol % doping concentration of Sm3+ ions. The CIE coordinates reveal that the phosphor has orange-red colour emission on the CIE diagram. Thermo-luminescence (TL) is a technique to investigate the electron traps present in the luminescence material. TL technique has numerous applications, such as in the field of biology, medicine, geology, radiation dosimetry, age determination and solid state defect structure analysis etc. The thermo-luminescence (TL) glow curve is the plot between the TL intensity and the temperature. Each trapping level in the substance can create corresponding TL peaks associated with distinct trapping levels. To analysis these distinct trapping levels deconvolution of TL glow curve is necessary. The computerized glow curve deconvolution (CGCD) investigation has been broadly used to resolve a complicated TL glow curve into separate constituent peaks. To study the TL of the prepared samples, a 60Co- □ (gamma) source was used for

irradiation and to determine the trapping parameters such as activation energy (E), order of kinetics (b) and frequency factor (s) of the samples, Chen's peak shape method was used. Results of CIE, colour purity and CCT values support warm appearance (for coffee shops, restaurants etc.) and the potential of this phosphors as an orange emitter in lighting and display devices. Sm^{3+} doped $CaY_2Al_4SiO_{12}$ phosphor showed a very long dose range for γ (gamma) doses and low fading. So it would be used for TL dosimeter application.

Biography

Anita Verma is the Assistant Professor, in the Department of Physics at Kalinga University, Raipur, Chhattisgarh, India. She received her bachelor's degree in Physics from Pandit Ravishankar Shukla University, Raipur, India in 2008. She completed her M.Sc., M.Phil. and Ph.D. in Physics from the School of Studies in Physics and Astrophysics at Pandit Ravishankar Shukla University, Raipur, India in 2023. Since then, she has worked as an Assistant Professor at Kalinga University, Raipur, India. Her investigations are mainly about material science – phosphors, photoluminescence, thermo-luminescence, synthesis methods like sol-gel synthesis, green synthesis etc. So far, she has published over 10 research papers in prestigious journals and international congresses.

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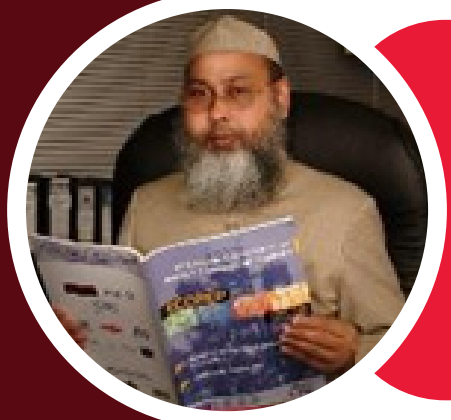

Ethylene-alpha olefin elastomers: Liquid phase catalyst active center residential environment and copolymerization microkinetics

Muhammad Atiqullah

Research Institute, King Fahd University of Petroleum & Minerals, Saudi Arabia

The applications of polyolefin thermoplastics have saturated. Ethylene-alpha olefin elastomers are, therefore, gaining more attention. Solution copolymerization processes make such elastomers using alpha olefin-rich comonomer feeds, and metallocene and postmetallocene precatalysts at laboratory to industrial temperatures and pressures. The process needs accurate solubility of ethylene in the solvent-alpha olefin mixture. Hence, this study models ethylene solubility in toluene□1-hexene and n-hexane□1-hexene mixtures at the above conditions. The model was developed using Peng-Robinson EoS and vdW1f mixing rule, Flory-Huggins interaction parameter, and Shulgin's activity coefficient□Henry's constant formalism. It, unlike those reported in literature, eliminates cumbersome a priori assumptions and iterative calculation of vapor-liquid phase fraction, bubble point, and dew point, and calculation of liquid phase fugacity coefficient. Hence, it is more advantageous. The model-predicted ethylene solubilities in toluene, n-hexane, and 1-hexene well match the experimental values at laboratory to industrial temperatures and pressures (Part I).

Part II well predicts ethylene solubility in solvent-alpha olefin mixture using Part I results and correlates the liquid phase mixture fluid compressibility to catalyst active center residential environment. This offers a new approach to investigate catalyst phenomena such as structural effect, activation, deactivation, and stability, as well as copolymerization phenomena, for example, monomer saturation and starvation, mechanism and kinetics, monomer reactivity ratios, micromixing effects, etc. Both phenomena can be now studied using a common footing. This is the very special contribution of this study to literature.

The current practice of calculating kinetic model parameters, copolymerization reactivity ratios, and microstructural properties and parameters, using (i) ethylene solubility only in the solvent such as toluene or n-hexane and (ii) ignoring that in 1-hexene, is significantly erroneous. The present work corrects it and solves a long-standing polymer reaction engineering problem.

Biography

Dr. Atiqullah is currently a Consultant at National Company for Manufacturing Systems (NCMS), Riyadh, Saudi Arabia. He is an Ex-Senior Research Engineer at the Interdisciplinary Research Center for Refining & Petrochemicals (IRCRAC), Research Institute, and a Professor at King Fahd University of Petroleum & Minerals, Saudi Arabia. He chaired the organizing committee of an international materials science conference in 2022. He is Editor-in-Chief at Research and Development in Materials Science Crimson USA. He is a reviewer in 26 ISI journals. He is a recipient of several KFUPM awards. He is the lead inventor of 6 US patents. He has over 50 publications in Q1/Q2 journals. He is a regular keynote lecturer in his research area and a Japan Petroleum Institute (JPI) research fellow. He has successfully managed research projects for BASF The Chemical Company, KACST, SABIC, Saudi Aramco, and Caltech USA. He is a nominee for the international Premier Residency Special Talent Award from Research Development Innovation Agency (RDIA) and King Abdulaziz City for Science & Technology (KACST), Riyadh, Saudi Arabia.

Propagation Impairment in free space Terahertz communication at Sub-Tropical Territories

D. Chakraborty[1] and **M. Mukherjee**[2]

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The Terahertz (THz) band (0.1THz-10THz) provides some extraordinary advantages over frequency bands of cutting-edge commercial utility. The non-ionization as well as non-invasive properties, have made THz an astounding topic of today's research, especially in the field of 6G and communication systems with enormous data-rate. But, absorption of THz signal in water is quite high, which, as a consequence, leads to a large degradation of THz signal in moisture (during free space communication of this signal). During its propagation through atmosphere, the THz signal can be severely distorted by the crystalline atmospheric scatterers, where liquid water content is sufficiently high. There are different types of atmospheric aerosols, where Fog is generally treated as the suspended one and Rain is of the falling type. Both of Fog and Rain based atmospheric incidences can degrade the THz link drastically. Depending on the weather constraints (temperate, tropical etc.), the dimensions of the atmospheric aerosols vary also. For the first time, the authors have indigenously developed an experimentally validated non-linear terahertz attenuation model simulator to simulate the terahertz attenuation spectra in tropical fog with varying visibility and in rain with varying rain rates. The fluctuation of refractive-indices of water droplets has been simulated at the early stage. Modified Mie-theory and power-law with weather dependent boundary conditions have been uniquely applied to simulate the THz attenuation spectra in tropical weather scenario. Besides, the scintillation effect in THz wireless communication has also been investigated by the authors' group. It has been found from the indigenous simulator that within 2THz to 4THz regime, the fog-based attenuation of THz signal reaches the peak, while the rain-based attenuation spectra reaches the peak in the range of 7THz to 9THz, under tropical weather situation. To the best of authors' knowledge this is the first report on THz signal degradation due to the presence of atmospheric hydrometeors under tropical climate scenario.

Biography

Dr. Debraj Chakraborty was born in 1984. He had received his M.Sc. degree in Electronic Science from Calcutta University in 2008. After that he had also received M.Tech. degree in Radio Physics and Electronics from the same university in 2010. He has been awarded Ph.D.(Tech.) in Electronics and Communication Engineering from Adamas University, Kolkata, in 2022 and Post-Doctoral degree from DRDO, Ministry of Defence, Govt. of India sponsored project in 2023. He has several publications in SCI journals. He has teaching experience of more than 10years. Presently he is working as a faculty of ECE in Swami Vivekananda University, Kolkata.

Dr. Moumita Mukherjee is alumni of R K S M Sister Nivedita Girls' School - Kolkata, Presidency College and Calcutta University. She received M.Sc. (Physics) with specialization in Electronics & Communication, M.Tech. in Biomedical-Engineering and Ph.D. (Tech.) in Radio-Physics and Electronics (2009), University of Calcutta, India. She did her doctoral & post-doctoral studies under DRDO, Ministry of Defence, Govt. of India. She received 'visiting scientist' & 'postdoc' positions from INEX, Newcastle University, UK & Technical University, Darmstadt, Germany. Dr. Mukherjee was attached with DRDO Centre under Ministry of Defence, Govt. of India (2009-2015) as Scientist (Reader grade).In continuation to that she joined Adamas University and presently working as Professor – Dept. of Physics & Dean (R&D) after completing her terms as Associate Dean & Academic coordinator (2016-2020), Associate Professor (2017-2020) & Assistant Professor (2015-2017), in the same University. With a total seventeen years of R&D and teaching experience, she is Visiting / Adjunct Professor of JAP-BMI under Calcutta University and the West Bengal University of Health Sciences. Her research interest is focused on THz-electronics and communication, Semiconductor devices, Graphene electronics, Photo-sensors, nano-biosensors and Medical Electronics & instruments. She has published more than 150 peer-reviewed research papers, till date, in reputed international refereed journals and reviewed proceedings with citation globally (citation: 900+, h-index: 16). Dr. Mukherjee is member of IEEE, IEEE ED society, life member of IEI, Biomedical Society of India and Indian Science Congress.

The nucleation of crystals in volcanic glass

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Currently, researchers are paying special attention to obtaining a product from natural raw materials. Plasma aggregates, which are increasingly used for the synthesis of silicate melts, are promising methods for producing opaque quartz glass for the production of refractory quartz ceramics. The main advantages of plasma technologies in comparison with traditional synthesis methods are, first of all, a high degree of productivity of technological processes, energy saving and environmental safety. In this paper, we investigated the synthesis features and properties of quartz glass obtained from quartz sand of the Ramenskoye deposit, and also modeled the operation of refractory quartz ceramics made of opaque quartz glass.

The shrinkage rates of quartz glass specimens are estimated. It is well known that the shrinkage in the firing of quartz ceramics is 3.5–5.0%, depending on the density of the raw material. At a temperature of about 1200°C, a slow crystallization process of quartz glass begins with the formation of high-temperature □-cristobalite, which, upon cooling, transforms into low-temperature □-cristobalite. In turn, □-cristobalite, by reducing its volume, weakens the thermal resistance of products. The complexity of this process is that cristobalitization and sintering coincide in temperature. The service process of quartz glass is simulated. The value of the maximum shrinkage increases with increasing temperature. The entire range of investigated temperatures for the primary and refiring of quartz glass can be divided into two quite distinct intervals. The first interval is the average temperature up to 1200°C. Under these conditions, the structure of the glass remains mostly “frozen.” In this case, the expansion coefficient in glass is positive and changes relatively little with temperature changes during repeated firing. Fluctuations in the CTLE values and linear dimensions in this area are related to the structure of a particular sample and its internal defects. This temperature range is the most interesting range for most modern practical

applications of quartz glass. The second interval is a high temperature interval above 1200°C. In these conditions, the substance is in a metastable state. It exhibits a sharp dependence of the expansion coefficient on temperature with the change in sign approximately in the middle of the interval. For subsequent firing (after the third cycle), the two characteristic intervals are not determined, the change in the length of the sample is insignificant, and the CTE changes only slightly. The X-ray diffraction method in the studied samples recorded the formation of cristobalite, the amount of which increases with increasing temperature and duration of exposure. The maximum value is 23% with isothermal holding for 5 h at 1400°C and 35.5% after 10 heating-cooling cycles up to 1400°C at a heating rate of 2.5°C/min. The rate of change in the linear size and the absolute value of shrinkage increases with the increasing heating rate. The amount of shrinkage decreases with an increase in the number of heating's and with an increase in the amount of cristobalite.

Biography

Galina A. Sycheva in 1972 graduated from the Leningrad Technological Institute (St. Petersburg, Russia), defended her diploma on the topic: "Study of the temperature dependence of the rate of crystal formation in glass in connection with the choice of rational silicate technology" at the Department "Chemical Glass Technology and Glass Ceramics." She received a specialty - engineer, chemical technologist. In 1987 she defended her thesis on the topic "The origin of crystals in silicate photosensitive glasses." She works at the Institute of Silicates Chemistry named after I.V. Grebenshchikov of the Russian Academy of Sciences. Currently, Galina A. Sycheva is the head of the laboratory of the structure and properties of glass. In the field of scientific interests are the processes of nucleation of crystals in simple (model) and complex glasses (based on blast furnace slags, natural glasses), as well as the study of the features of crystallization and the properties of opaque quartz glass going to the production of high-temperature quartz keramics.

Effect of printing parameters on the mechanical properties and energy absorption characteristics of 3D printed specimen from Polylactic Acid (PLA) filament

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Additive Manufacturing (AM) is playing a vital role in the optimization of composite materials for improved mechanical properties. Polylactic acid (PLA), a biomass thermoplastic monomer made from corn starch is the most used filament material in AM, hence the need to carefully explore all parameters that could enhance its performance. In this study, three printing parameters; printing speed, infill density and layer thickness were considered on three levels each. The experimental design was done using the Taguchi L-9 orthogonal array which resulted in a total of 27 experimental sample configurations. Each of the samples were weighed and the time to print each sample was recorded. Tensile test using the universal tensile testing machine (Instron Series 3369 machine) according to ASTM D638 was performed. Force-displacement readings were recorded from which the energy absorption characteristics were determined. Statistical analysis using ANOVA was performed considering the influence of each of the parameters on maximum tensile stress, load at maximum tensile stress and Modulus respectively for each sample. The sample configurations with the highest energy absorption and mechanical properties were analyzed for various applications. The sample with the configuration of Infill density of 15%, printing speed of 70mm/s, and 0.1mm layer thickness exhibited the highest tensile s`trength. However, it was discovered that the infill density has the highest influence on the mechanical properties of the 3D printed PLA material in tensile testing.

Biography

Dr Ajayi has B.Tech, MSc and PhD in Mechanical Engineering. He is currently a Senior Lecturer with the Obafemi Awolowo University, Ile-Ife. His research interests are in Additive manufacturing, robotics, materials optimization and Computer Aided Design and manufacturing. He has initiated, collaborated and published several research works in these areas. He started the additive manufacturing - 3 D printing laboratory in the department and he is the head of the computer aided design and manufacturing laboratory, where he teaches, conduct research works and consultancy with his research students. His efforts in this laboratory have generated a number of products, the most recent being a one-square meter CNC milling/engraving machine for drilling, boring and engraving of woods, acrylic and aluminum materials. As a versatile researcher, he belongs to a number of research groups for collaborative research works in the medical sciences, agricultural sciences, chemistry, biological and space science.

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