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7TH EDITION OF

ADVANCED MATERIALS SCIENCE WORLD CONGRESS

LONDON

MARCH 24-25, 2025

SCIENTIFIC PROGRAM

DAY 01
MONDAY

MARCH 24, 2025

HALL 01

08:00-08:30	**Registrations**
08:30-08:40	**Inaugural Ceremony**
Moderator	**Thiago C Canevari,** *Mackenzie Presbyterian University, Brazil*

Sessions: Materials Science and Engineering | Nanomaterials and Nanotechnology | Smart Materials | Biomaterials | Energy Materials | Crystallography | Graphene Technology | Chemistry | Carbon and 2D Materials | Semiconductors | Optics | Green Technologies | Metals and Alloys | Perovskites | Artificial Intelligence | Robotics | Catalysis

Distinguished Speaker Talks

Session Chair	**Weizhong Dai,** *Louisiana Tech University, USA*
Session Chair	**José Joaquim Costa Cruz Pinto,** *University of Aveiro (Retd.), Portugal*
08:40-09:00	Title: Learning and Performance in the Age of Artificial Intelligence **Gary J. Dickelman,** *EPSScentral LLC, USA*
09:00-09:20	Title: Neural Network Method for Solving Parabolic Two-Temperature Micro/Nanoscale Heat Conduction in Thin Films Exposed to Ultrashort-Pulsed Lasers **Weizhong Dai,** *Louisiana Tech University, USA*
09:20-09:40	Title: New Insights on Molecular Cooperativity in Amorphous Condensed Matter **José Joaquim Costa Cruz Pinto,** *University of Aveiro (Retd.), Portugal*
09:40-10:00	Title: *In vitro* Assessment of a New Block Design for Implant Crowns with Functional Gradient Fabricated with Resin Composite and Zirconia Insert **Nicolas Gutierrez,** *Universitat Internacional de Catalunya (UIC), Spain*

10:00-10:20	Title: “Double Dovetail Tenon”: A New Connector for Multi-Storey Timber Construction A Case Study on Fire Protection with this Connection **Anton Kraler,** *University of Innsbruck, Timber Engineering Unit, Austria*
GROUP PHOTO 10:20-10:30	
REFRESHMENT BREAK 10:30-10:50	
10:50-11:10	Title: Solution Conductivity and Solution Layer Thickness as Factors Determining the Rate of the Photocatalytic Reaction Rate **Emil Ivanov Lilov,** *University of Chemical Technology and Metallurgy, Bulgaria*
11:10-11:30	Title: Synergetics Principles of the Regularity of the Development of Microcracks in Elements of the Friction Units **Ahad Khanahmad Janahmadov,** *Azerbaijan National Academy of Aviation, Azerbaijan*
11:30-11:50	Title: Three-Dimensional Elasticity Analysis of Sandwich Cylindrical Shell by Numerical Integration Approach **Yogesh M. Desai,** *Indian Institute of Technology Bombay, India*
11:50-12:10	Title: Copper Oxide Nanostructures with Nanoneedles Shape Obtained by Direct Reaction with Nitrogen-Doped Carbon Quantum Dots: Development of an Electrochemical Sensor to Glyphosate **Thiago C Canevari,** *Mackenzie Presbyterian University, Brazil*
12:10-12:30	Title: Testing Cut-Resistance of Protective Textiles **Nandan Kumar,** *High Performance Textiles Pvt Ltd., India*
12:30-12:50	Title: Influence of Gauges in the Numerical Simulation of the Time-Dependent Ginzburg-Landau Model **Cyril Tain,** *Laboratoire de Mathématiques de l’INSA Rouen Normandie, Univ Rouen Normandie, CNRS, Normandie Univ, France*
GROUP PHOTO 12:50-13:00	
LUNCH BREAK 13:00-13:40	
13:40-14:00	Title: Characterization of Varnish Adhesion on Polyamide Monofibers: An Innovative Approach **Meriem Benzarti,** *Université de Haute Alsace, France*

14:00-14:20	Title: Proof that Minority Current Carriers Produce Superconducting Current in Superconductors **Yurii Uhryn,** *Ivan Franko Drohobych State Pedagogical University, Ukraine*
14:20-14:40	Title: Studies on the Behaviour of Steel Fibre Reinforced Concrete under Monotonic and Repeated Cyclic Stress in Tension **Suresh G.S.,** *The National Institute of Engineering (Retd.), India*
14:40-15:00	Title: Study on Mechanical Properties of Fiber Metal Laminates and its Application in Automobile Body **Wenbin Hou,** *Dalian University of Technology, China*
15:00-15:20	Title: Synthesis of Pure Hydroxyapatite (HA) from Indian Clam Seashells and Deposition of the same by Atmospheric Plasma Spray (APS) Technique on Ti-Alloy Substrate for Biomedical Applications **Kazi Sabiruddin,** *Indian Institute of Technology Indore (IIT Indore), India*
15:20-15:40	Title: CO_2 Capture with Activated Carbon from Hydrothermal Treatment of Synthetic Urban Wastes **Alejandro AMAYA,** *Universidad de la República, Uruguay*
15:40-16:00	Title: Superaustenitic Stainless Steels: Characteristics, Properties and Applications **Alessio Malandruccolo,** *University of Trento, Italy*
REFRESHMENT BREAK 16:00-16:20	
16:20-16:40	Title: The Role of Digital Twins Concept in Old Tbilisi Superblocks Model Development **Nino Chachava,** *Georgian Technical University, Georgia* **Nikoloz Lekveishvili,** *NINCLP Engineering Idea, Georgia*
16:40-17:00	Title: Stimuli Responsive Hydrocolloid Encased Bioactives: Release Behaviour and Kinetics **Minni Singh,** *Punjabi University, India*
17:00-17:20	Title: Unlocking the Key Factors, Mechanisms and Solutions of OCTG Material Failure for China Oil & Gas Industries **Lihong Han,** *CNPC Tubular Goods Research Institute, China*

17:20-17:40	Title: A New Concern of Plastic Waste-Fostering Antimicrobial Resistant (AMR) Biofilms in Water Bodies **Preethy Chandran,** *Cochin University of Science and Technology, India*
17:40-18:00	Title: The Development of Recycled Oyster Shell Waste in Polymer Modified Green Concrete Towards Enhanced Mechanical Properties and Environmental Benefits **Fanny Tang,** *Hong Kong Metropolitan University, Hong Kong*
18:00-18:20	Title: Mechanical and Microstructure Properties of Eco-Friendly Sand Concrete Incorporating Cane Ash **Razika Charime,** *University 20 August 1955, Skikda, Algeria*
18:20-18:40	Title: Development and Applications of Textile Nanocoatings using Cellulosic Nanowhiskers **Kunal Singha,** *National Institute of Fashion Technology, India*
NETWORKING	
End of Day 1	

SCIENTIFIC PROGRAM

DAY 02
TUESDAY

MARCH 25, 2025

HALL 01

08:30-08:40	**Introduction**
Moderator	**Anton Kraler,** *University of Innsbruck, Timber Engineering Unit, Austria*

Sessions: Materials Science and Engineering | Nanomaterials and Nanotechnology | Smart Materials | Biomaterials | Energy Materials | Crystallography | Graphene Technology | Chemistry | Carbon and 2D Materials | Semiconductors | Optics | Green Technologies | Metals and Alloys | Perovskites | Artificial Intelligence | Robotics | Catalysis

Distinguished Speaker Talks

Session Chair	**Gary J. Dickelman,** *EPSScentral LLC, USA*
Session Chair	**Jorge A. Gonzalez,** *Florida International University, USA*
08:40-09:00	Title: Properties and Dynamics of Long-Range Topological Objects in Heterogeneous Media: Applications in Advanced Materials Science and Technology **Jorge A. Gonzalez,** *Florida International University, USA*
09:00-09:20	Title: Numerical Simulation of Electrostatically Supported Painting Processes using a High-Speed Rotary Bell from Liquid Charging, Break-Up to Spray Propagation **Qiaoyan Ye,** *Fraunhofer Institute for Manufacturing Engineering and Automation, Germany*
09:20-09:40	Title: A Mathematical Model for Aerospace Product MRO Scheduling with Remanufacturing **Yasser Ghamary,** *Concordia University, Canada*
09:40-10:00	Title: Integrating Sensory Modalities and Technologies in Artistic Contexts **Piper Hutson,** *Lindenwood University, USA*
10:00-10:20	Title: Water as a Material for Sustainable and Biocompatible Antennas **Benigno Rodríguez Díaz,** *Universidad de la República, Uruguay*

GROUP PHOTO 10:20-10:30	
REFRESHMENT BREAK 10:30-10:50	
10:50-11:10	Title: Bacterial Nanocellulose Produced as a By-Product of the Brewing Industry and used as an Adsorbent for Synthetic Solutions for Co (II), Cu (II), Ni (II) and Fe (III) **Gabriela Martins de Paiva,** *Federal University of São João del-Rei, Brazil*
11:10-11:30	Title: Coupling X-Ray Beam Induced Current ToF-XBIC with High Time Resolution to Characterize Semiconductor-Based Detectors **Thu Nhi Tran Caliste,** *European Synchrotron Radiation Facility, France*
11:30-11:50	Title: Evolution of LDL Research: New Technologies and New Discoveries **Chu-Huang (Mendel) Chen,** *The Texas Heart Institute, USA*
11:50-12:10	Title: Hydrogel Coatings on Universal Medical Devices with Water-Responsive Janus Adhesion and Acidity-Triggered Transformation for Adaptive Antibacterial Treatment and Fluorescence Diagnosis **Li Ming,** *Peking University People's Hospital, China*
12:10-12:30	Title: Low Cost Materials for Several Applications, Obtained by the Simple Spray Pyrolysis **Beya Ouertani,** *University of Carthage & Research and Technology Center of Energy (CRTEn), Tunisia*
12:30-12:50	Title: Advancing Fit Technologies: Key Trends and Requirements for Clothing Element Assessment **Olga Paraska,** *Khmelnytskyi National University, Ukraine*
GROUP PHOTO 12:50-13:00	
LUNCH BREAK 13:00-13:40	
13:40-14:00	Title: Cause-Effect Analysis for Process Parameters in the Formation of the Shell Zone during DCC Process of Al Alloys **Alessio Malandruccolo,** *University of Trento, Italy*
14:00-14:20	Title: Irradiation Damage Mechanism and *In-situ* Micro-Mechanical Properties of Advanced First-Wall W-Y_2O_3 Material **Jun Huang,** *Hefei University of Technology, China*
14:20-14:40	Title: Mathematical Modeling of the Change of Electric Potential Energy during the Formation of Covalent Polar and Ionic Chemical Bonds in a Two-Atomic Molecule **Lyakishev Vladislav Konstantinovich,** *Irkutsk State University, Russia*

14:40-15:00	Title: Life Cycle Cost Analysis Comparison Between Structural Steel and Light Gauge Steel Structures **Lama Mohamed Ashraf Ibrahim Emam Aly,** *German University in Cairo, Egypt*
15:00-15:20	Title: A Novel Polymer Nanoparticle for Drug Delivery System **Omed Qadir Hama Ameen Al-Jaf,** *Charmo University, Iraq*
15:20-15:40	Title: Interconnecting Internet of Things Devices to a Mobility-Supporting Lora Network Using HWMP for Energy-Efficient B.A.T.M.A.N. **M. Archana,** *Annamalai University, India*
15:40-16:00	Title: Electrochemical-Piezoelectric Detection of Heavy Metal Ions in Potable Water using Ultrathin-Film of Functionalized Nanotubes and its Machine Learning Analysis **Parul Taneja,** *Symbiosis University of Applied Science, India*
REFRESHMENT BREAK 16:00-16:20	
16:20-16:40	Title: Foam- Surfactant Template Synthesis of Nanomaterials for Boosting the Electrochemical Energy and Sensor Reactions **Mohamed Ali Ghanem,** *King Saud University, Saudi Arabia*
16:40-17:00	Title: Study of Photocatalytic, Photodetection as well as Photovoltaic Studies Based on $Cd_x Zn_{1-x} S$ Nanoparticles **Satyajit Saha,** *Vidyasagar University, Midnapore, India*
17:00-17:20	Title: Development of Novel Spin-Controlled Optoelectronic Eco-Friendly and Energy Efficient *hybrid* Inorganic-Organic Heterostructure **Puja Dey,** *Kazi Nazrul University, India*
17:20-17:40	Title: Nanotechnology: An Emerging Field for Enhancing Micronutrient Enrichment in Millets *via* Biofortification Strategies-Present Knowledge and Prospects for the Future **Anbu Malar. M,** *Stella Maris College (Autonomous) Chennai, India*
17:40-18:00	Title: Optimization of Process Parameters in Friction Stir Processing for the Development of Polymer-Derived Aluminium Matrix Composite **Sujith Kumar Kavanur Ramesh,** *PES University, India*
18:00-18:20	Title: Methods of Application of Nanoscale Coatings on Textiles **Anjali Agrawal,** *National Institute of Fashion Technology, India*
18:20-18:35	Title: Research about Silicon Based GaN Devices and the Related System **Hongyu Yu,** *Shenzhen Polytechnic University, China*

HALL 02

Interdisciplinary Talks in Materials Science

Distinguished Speaker Talks

Session Chair	**Benigno Rodríguez Díaz,** *Universidad de la República, Uruguay*
Session Chair	**Suresh G.S.,** *The National Institute of Engineering (Retd.), India*
10:50-11:10	Title: Has Knowledge Economy a Role to Play in Transfusion Medicine? **Cees Th. Smit Sibinga,** *University of Groningen and IQM Consulting, Netherlands*
11:10-11:30	Title: Design of Accessible Educational Tools for Independent Learning by Persons with Blindness **Richa Gupta,** *Indraprastha Institute of Information Technology Delhi, India*
11:30-11:50	Title: Structural and Optoelectronic Properties of Newly Designed Lead Halides PbXY (X, Y = F, Cl, Br, I) Janus Layers: DFT Study **Anjana E. Sudheer,** *Indian Institute of Information Technology Design and Manufacturing, India*
11:50-12:10	Title: Update on Nasopharyngolaryngoscopy in Head and Neck Surgery **Hugo Galera-Ruiz,** *University of Seville, Spain*
12:10-12:25	Title: Role of Pesticide Degrading Bacterium, *Rhodococcus Biphenylivorans*, in Breaking Down Crystal Violet Dye **Sirajunnisa Abdul Razack,** *Chulalongkorn University, Thailand*
12:25-12:40	Title: On Analytical Solutions of a System of Nonlinear Partial Differential Equations **Kholiknazar Kuchakshoev,** *University of Central Asia, Tajikistan*
GROUP PHOTO 12:40-12:50	
LUNCH BREAK 12:50-13:30	
13:30-13:50	Title: An Interplay of Artificial Intelligence-Based Customer Analysis on the Performance of Customer Relationship Management in Organized Retail Outlets: Serial Mediation Approach **R. Swaranalatha,** *PSG College of Arts & Science, Coimbatore, India*

13:50-14:10	Title: D.A Pospelov Identified in 1996 Ten “Hot Spots” in the Field of AI **Alexey Averkin,** *Federal Research Center “Computer Science and Control” of the Russian Academy of Sciences, Russia*
14:10-14:30	Title: Insight into the Dynamics of NiO-Nanoparticle Induced Methylation Changes and Cell Death Mechanisms in Plant **Indrani Manna,** *Presidency University, India*
14:30-14:50	Title: Applications of Machine Learning and Deep Learning in Pavement Crack Detection and Characterisation: A Comparative Approach **Harris Khan,** *Near East University, Turkey*
14:50-15:10	Title: Degradation of Energetic Material 2,4,6, Trinitro Toluene using Integrated Approach **Garima Upreti,** *Delhi Technological University, India*
15:10-15:30	Title: 2D Materials Defects Characterization using AI/ML **Farhan Mahbub,** *World University of Bangladesh, Bangladesh*
15:30-15:50	Title: *In-situ* Bioremediation of 1,3,5-Trinitroperhydro-1,3,5-Triazine Contaminated Sediments using Endemic Microbial Formulation **Avantika Shukla,** *Indira Gandhi Delhi Technical University for Women, India*
REFRESHMENT BREAK 15:50-16:10	
16:10-16:30	Title: Iron-Tannic Acid Nano Coating: A Promising Treatment Approach for Enhancing Lactococcus Lactis Antibiotic Resistance **Marwa M. Elmaghrabi,** *King Saud University, Saudi Arabia*
16:30 -16:50	Title: Simultaneous Removal of Toxic Cationic Water Pollutants using ZnO-Curcumin Decorated Graphene Oxide Composite **Nabanita Chakraborty,** *Indian Institute of Technology Hyderabad, India*
16:50-17:10	TItle: Resonating Particle Dynamics in Laser Irradiated Matter with Nano-Antenna Dopes **Konstantin ZSUKOVSZKI,** *Wigner Research Centre for Physics, Hungary*
17:10-17:30	Title: A Novel Multifunctional Theranostic Platform for Chemo-Photothermal Co-Therapy of Hepatocellular Carcinoma **Uzma Azeem Awan,** *National University of Medical Sciences (NUMS), Pakistan*

17:30-17:50	Title: Additive Manufacturing of Mo-SiC Multimaterial Component **Marina Aghayan,** *A.B. Nalbandyan Institute of Chemical Physics, Armenia*
Video Presentations	
V1	Title: A Biogenic Approach to Develop Guava Derived Edible Copper and Zinc Oxide Nanocoating to Extend Shelf Life and Efficiency for Food Preservation **Susmita Dey Sadhu,** *University of Delhi, India*
V2	Title: Electrosynthesis of Organic 2D Conducting Polymer Films **Luiza Aguiar do Nascimento,** *La Trobe University, Australia*
NETWORKING	

End of Day 2

ADV. MATERIALS SCIENCE 2025

DAY 01

7th EDITION OF

ADVANCED MATERIALS SCIENCE WORLD CONGRESS

LONDON, UK

MARCH 24-25, 2025

SPEAKER TALKS

Learning and Performance in the Age of Artificial Intelligence

Gary J. Dickelman

EPSScentral LLC, USA

Educators, scientists, and engineers increasingly focus on how artificial intelligence (AI) impacts lifelong learning and performance across education and workplace contexts. This inquiry identifies how AI applications enhance cognitive and behavioral outcomes, starting from early childhood education and extending through professional development and workplace performance. It examines how AI influences human cognition and performance over time, including neuroscientific implications. The study evaluates generative AI (genAI) tools, which enable rapid, high-quality outputs—text, images, audio, and video—through simple natural language prompts. It investigates whether these tools deliver on their promises to reduce cognitive load and lower skill barriers across disciplines. Despite the potential, many organizations fail to realize AI's benefits, highlighting the need for optimized protocols that support human-AI collaboration and integration. The inquiry addresses key challenges, including the "Alignment Problem" between human and machine, the limitations of artificial general intelligence (AGI), ethical issues like cheating, fears of autonomous machine dominance, and marketing hype that confounds responsible adoption. By analyzing expert insights, the study proposes actionable recommendations to align AI with human and organizational performance goals. It aims to equip educators, scientists, engineers, and practitioners with a framework to integrate AI as a constructive element of human cognition and organizational performance. It provides a foundational resource for leveraging AI's transformative potential while navigating its complexities across the learning and performance continuum.

Biography

Gary J. Dickelman is a thought leader, researcher, strategist, and solution provider for the knowledge ecosystem, which includes education, technology-based learning, performance support, predictive analytics, knowledge management, and artificial intelligence. He has developed global human-centered knowledge solutions while directing cross-functional teams of online learning professionals, knowledge and case managers, and technical communication specialists. Solutions include global eLearning, software simulations, learning and knowledge analytics, just-in-time reference for enterprise systems, emergency management, business continuity, pandemic response, customer support, and digital transformation. Dickelman has author scores of peer-reviewed articles, contributed to industry books, and has served as author/editor of industry journals. He has served as adjunct faculty for university graduate programs in the education/learning technologies and human performance engineering. Dickelman has worked across a plethora of industries, including nuclear power, career development, finance, insurance, publishing, travel, hospitality, education, sales/marketing, defense, security, and the performing arts.

Neural Network Method for Solving Parabolic Two-Temperature Micro/ Nanoscale Heat Conduction in Thin Films Exposed to Ultrashort-Pulsed Lasers

Weizhong Dai

Louisiana Tech University, USA

Ultrashort-pulsed lasers have been widely applied in biology, chemistry, medicine, physics, and optical technology. Simulation of the micro/nanoscale heat conduction induced by ultrashort-pulsed laser heating has been attracting great attention. In this talk, I will present some recently obtained research results in my group, which have been mainly published in International Journal of Heat and Mass Transfer. We have obtained an artificial neural network (ANN) method for solving the parabolic/nonlocal two-temperature heat conduction equations in thin films exposed to ultrashort-pulsed lasers. The ANN method is developed based on the PINN method. Note that the laser pulse duration is very short, only in the sub-picosecond/femtosecond domain and the non-equilibrium heating stage is usually in picoseconds. Thus, randomly sampling the learning points in the entire domain for the ANN method will not quickly capture the behavior during the pulse, which may cause the ANN solution to be inaccurate. To overcome this trouble, we start at a small-time interval to obtain the ANN solution and then use the solution at the end of that small-time interval as the initial condition for the next small-time interval to obtain the next ANN solution. We continue this procedure from one small time interval to another small-time interval until the entire desired time interval is completed. Convergence of the ANN solution to the analytical solution is theoretically analyzed. Finally, the ANN method is used to predict the electron and lattice temperatures in a gold film or padding on a chromium film when exposed to ultrashort-pulsed lasers.

Biography

Dr. Weizhong Dai is McDermott International Professor of Mathematics and Chair of Ph.D. Program in Computational Analysis and Modelling at Louisiana Tech University, USA. He received his Ph.D. degree in Applied Mathematical and Computational Sciences from the University of Iowa, USA, in 1994. His research interests are numerical methods including artificial neural network method for solving partial differential equations, and simulations for micro/nano scale heat transfer, bio-heat transfer. He has been involved in many research grants and has developed many numerical schemes for solving partial differential equations. He has published more than 177 peer-reviewed journal papers such as in International Journal of Heat and Mass Transfer and Journal of Computational Physics, 31 conference proceedings, one co-author book, one textbook, four book chapters, and two entrees in encyclopedia. He was ranked #4 Highly Ranked Scholar in Finite Difference Method (Lifetime and top 0.05% of all scholars worldwide) by ScholarGPS (2024).

New Insights on Molecular Cooperativity in Amorphous Condensed Matter

J. J. C. Cruz Pinto[1] and **J. R. S. André**[2]

[1]University of Aveiro (Retd.), Portugal
[2]Guarda Polytechnic Institute, Portugal

Despite so many recent advances in the most challenging field of the thermal and other physical behavior of amorphous condensed matter, there appears (and is generally recognized) to be no common opinion on what theoretical developments might be necessary to solve the general problems of such behavior. Statements and labels about "*unresolved problems*" and even "*mysteries*" involved in fully understanding the *glass transition, super-Arrhenius behavior* and *corresponding relaxation maps, cooperativity, dynamic heterogeneity, behavior universality, temperature and molecular packing effects, WLF and VTF behavior, time-extended responses, fragilities, etc.* continue to appear in the literature year after year and volume after volume .

From a listing of 11 universal characteristics of amorphous condensed matter thermal and other physical response behavior, a fresh look and abductive reasoning strategy is sketched and shown to be possible, such as to yield new quantitative insights into all those characteristics, *via a cooperative theory of materials dynamics (CTMD)*[2], based on thermal activation at constant volume, but still compatible with thermal packing effects, involving a limited and specific set of basic physical properties (mainly, *a crossover temperature and frequency, minimum activation energy* and total, occupied plus free, *volume of primitive relaxors*) allowing very fast calculations, definite predictions, and viable paths for necessary future updates and extensions to different systems and different physical excitations.

Among the predictions of the theory, stand and will be illustrated relevant trial proposals and conclusions on all the above italicized unresolved problems, in addition to glimpsing prospects of future application to the equilibrium and non-equilibrium thermal response.

[1]P. W. Anderson, *Science*, 267, 1615 (1995); E-J- Donth, *The GlassTransition – Relaxation Dynamics in Liquids and Disordered Solids*, Springer Ser. Mat. Sci. 48 (2001); L. Berthier *et al*. (eds.), Dynamical Heterogeneities in Glasses, Colloids and Granular Media, Oxford (2011).

[2]J. J. C. Cruz Pinto, J. R. S. André, *Analytical Molecular Dynamics of Amorphous Condensed Matter – Thermal and Non-equilibrium Response Behavior*, Springer Ser. Mat. Sci. 342 (2024).

Biography

José Joaquim C. Cruz Pinto, born in Lisbon, Portugal, in 1948, holds a 5-year degree in Chemical Engineering from IST, University of Lisbon (1971) and 1-year Diploma ("Section Spéciale") from ENSIC, University of Nancy, France (1972), a Ph.D. in the same field from UMIST, University of Manchester, U. K. (1979), and an "Agregado" title and Full Professorship in Polymer Materials Science from the University of Minho in 1992 and 1994, respectively. Taught and conducted research at the Universities of Mozambique (1972-75), Minho (1978-97), and Aveiro (1997-2011) both in Chemical Engineering (since 1972) and Polymer Materials Science (since 1979). In the Materials Science field, his activity concentrated on Polymer Thermal and Viscoelastic Behavior, having directed the Thermal Analyses Laboratory of the University of Aveiro within its CICECO Research Center. Since his retirement in 2011, he keeps his interest in the most challenging subject of the cooperative dynamics of amorphous condensed matter.

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March 24-25, 2025 | London, UK

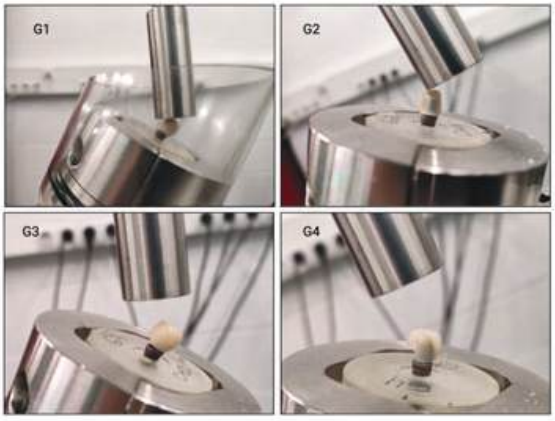
In vitro Assessment of a New Block Design for Implant Crowns with Functional Gradient Fabricated with Resin Composite and Zirconia Insert

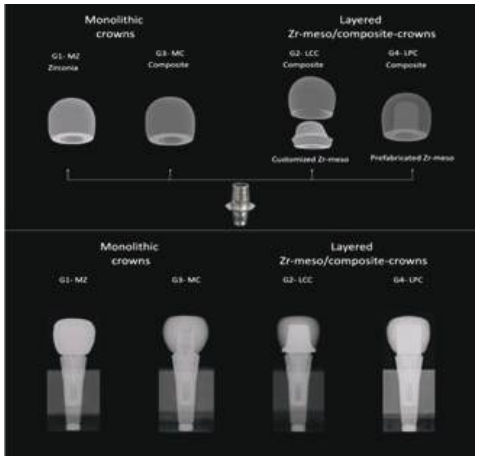
Nicolás Gutiérrez Robledo[1,2], Miquel Punset Fuste[3,4,5,6], Alejandra Rodríguez-Contreras[3,5,6], Fernando García Marro[5,7], José María Manero Planella[3,5,6], Oscar Figueras-Álvarez[1] and **Miguel Roig Cayón[1]**

[1]School of Dentistry, Universitat Internacional de Catalunya (UIC), Spain
[2]Independent Research, Spain
[3]Biomaterials, Biomechanics and Tissue Engineering Group (BBT), Universitat Politècnica de Catalunya (UPC), Spain
[4]UPC Innovation and Technology Center (CIT-UPC), Universitat Politècnica de Catalunya (UPC), Spain
[5]Barcelona Research Centre in Multiscale Science and Engineering, Universitat Politècnica de Catalunya (UPC), Spain
[6]Reserach Institute San Joan de Déu (IRSJD), Spain
[7]Center for Structural Integrity, Reliability and Micromechanics of Materials Research Group (CIEFMA), Universitat Politècnica de Catalunya (UPC), Spain

This study aims to evaluate and compare the mechanical resistance, fatigue and fracture behavior of different CAD/CAM materials for implant crowns. Eighty-eight implant crowns cemented-screwed with four sample groups: two monolithic G1 Zirconia (control) and G3 composite and two bi-layered G2 customized zirconia/composite and G4 prefabricated zirconia/composite. All static and dynamic mechanical tests were conducted at 37 °C under wet conditions. The fractographic evaluation of deformed and/or fractured samples was evaluated *via* electron microscopy. Statistical analysis was conducted using Wallis tests, which were performed depending on the variables, with a confidence interval of 95%, ($p < 0.05$). The Maximum Fracture Strength values displayed by the four groups of samples showed no statistically significant differences. The crown–abutment material combination influenced the failure mode of the restoration, transitioning from a fatigue fracture type located at the abutment–analog connection for monolithic materials (G1 and G3) to a brittle fracture located in the crown for bi-layered materials (G2 and G4). The use of layered crown materials with functional gradients appears to pro-

tect the crown/abutment connection area by partially absorbing the applied mechanical loads. This prevents catastrophic mechanical failures, avoiding long chairside time to solve these kinds of complications.





Group of Samples	% Fmax	Fmax (N)	Fmin (N)	N° cycles to break	Failure mode
G1	80	1301	130	16314	T2
	80	1301	130	30475	T4
	70	1139	114	105522	T6
	70	1139	114	75315	T5
	60	976	98	470741	T7
	60	976	98	805596	Run out
	50	813	81	2000000	Run out
	50	813	81	2000000	Run out
G2	80	1208	121	16028	T5
	80	1208	121	16930	T5
	70	1057	106	109106	T5
	70	1057	106	148110	T6
	60	906	91	1631627	T5
	60	906	91	273531	T6
	50	755	76	2000000	Run out
	50	755	76	2000000	Run out
G3	80	1337	134	3797	T5
	80	1337	134	9108	T6
	60	1003	100	43309	T5
	60	1003	100	140250	T6
	50	836	84	1197943	T5
	50	836	84	1864478	T6
	40	668	67	2000000	Run out
	40	668	67	2000000	Run out
G4	80	1243	124	1724	T1
	80	1243	124	1396	T5
	70	1087	109	2063	T3
	70	1087	109	4518	T2
	60	932	93	265460	T1
	60	932	93	328837	T4
	50	777	78	2000000	Run out
	50	777	78	2000000	Run out

Where: T1: (Partial fracture of the crown), T2: (Partial fracture of the crown and fracture of screw, with deformation of both implant and abutment), T3: (Total fracture of the crown, without deformation of either the implant or the abutment), T4: (Total fracture of the crown, with deformation of both implant and abutment), T5: (Fracture of the screw, with deformation of both implant and abutment), T6: (Fracture of the screw, with deformation of the abutment and partial fracture of the implant), T7: (Fracture of the screw, with deformation of the abutment and total fracture of the implant). T8: (Run out).

Biography

Dr. Nicolas Gutiérrez obtained his DDS degree at Pontificia Javeriana University, Bogota- Colombia, in 1993. He received the associated fellow at the American Academy of Implant Dentistry (AAID) in Washington DC., 2012. He is an associated professor at the International University of Catalunya in Barcelona (UIC) in the field of digital dentistry and cad/cam materials. And owns his own training center “DOA ACADEMY” and practice in Madrid, Spain focus on digital aesthetic and implant dentistry.

"Double Dovetail Tenon": A New Connector for Multi-Storey Timber Construction A Case Study on Fire Protection with this Connection

Anton Kraler, Martin Saltuari and **DI Andreas Pomaroli**

University of Innsbruck, Timber Engineering Unit, Austria

There are no wood-wood connectors on the market for connecting cross-laminated timber (CLT). The Institute of Timber Construction at the University of Innsbruck has therefore developed the 'double dovetail tenon', a system connector designed of Laminated Veneer Lumber (LVL) made of spruce. It consists of two dovetail tenons that are rotated 180 degrees on their overlapping surface. This system connector allows varying the orientation of the veneers and the slope of the flank surfaces. In addition to the static tests in the laboratory, fire tests are also carried out to prove that the double dovetail tenon can also be used in large-volume, multi-storey timber constructions with CLT. The fire tests are carried out analytically based on existing literature research and on analysed fire tests of metal and timber joints of similar size and joint shape. The analysis is carried out in two stages: Examination of the components of the system joint (connector, CLT) and the combination in the installed condition. In contrast to conventional wall-ceiling-wall connections the ceiling does not rest on the wall, but is inserted vertically into the wall element. The system connector is fully integrated into the components that are to be connected. The fire safety analysis is based on a six-storey timber building with different installation variants of the system connection. The results show that, unlike metal system connectors, the connector is not heated up in its entirety, but only the parts of the connector directly exposed to the flames. Another finding is that the standard designs for multi-storey timber buildings already largely meet fire safety requirements.

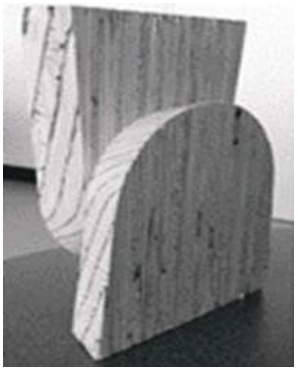


Fig. 1: Double dovetail tenon – Connector

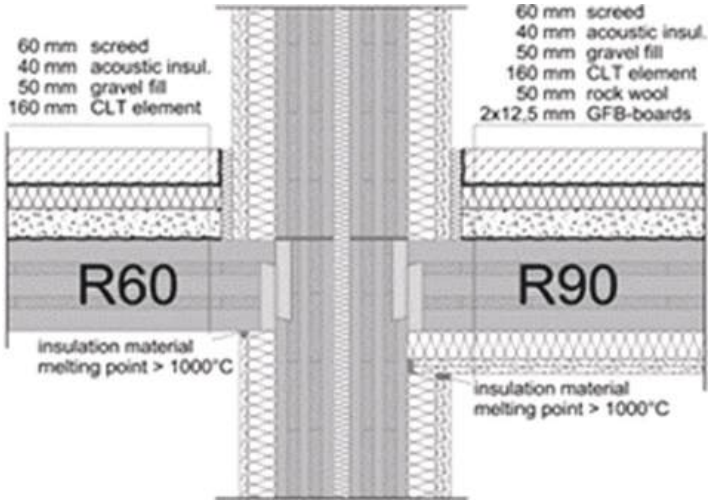


Fig. 2: Fire protection measure - wall-side and ceiling-side with or with not facing shells

Biography

Assoc. Prof. Dr. Anton Kraler has been researching and teaching at the Institute of Timber Construction at the University of Innsbruck since 2002. He has been an Associate Professor since 2016 and Head of the Department of Timber Construction since 2024. His research focuses on component development, building acoustics and quality assurance in timber construction - with special consideration of constructional, building physical, environmentally friendly and quality-enhancing aspects. He has successfully completed a large number of projects with national and international participation and has extensive experience in the innovative management of scientific challenges. In addition, he was the responsible key researcher for novel CLT connection systems and for the novel radius panel technology of curved cross laminated timber. He is also active in quality assurance and external training (timber construction, building physics) in the timber construction industry. At the university he teaches timber construction, calculation, detail planning and building physics.

Solution Conductivity and Solution Layer Thickness as Factors Determining the Rate of the Photocatalytic Reaction Rate

Emil Lilov, Vanya Lilova and **Svetlozar Nedev**

Department of Physics, University of Chemical Technology and Metallurgy, Bulgaria

Two factors determining the rate of photocatalytic reactions are investigated from a theoretical and experimental point of view. A simple model is based on the following assumptions:

(i) The photocatalytic reaction involves only one type of charge generated during the absorption of photons by the photocatalyst;

(ii) The field created by the electric surface charge will facilitate the expulsion of this type of charge;

(iii) The higher the medium conductivity, the greater the number of charges that will leave the photocatalyst particles;

(iv) Decreasing the number of charges decreases the rate of reaction, which is proportional to the charge;

The model predicted a hyperbolic relation between the photocatalytic reaction rate and solution conductivity. Experimental validation was performed using methyl orange as a model pollutant and titanium dioxide as a photocatalyst. The experiments, with three different salts, confirm the hyperbolic correlation between the photocatalytic degradation rate and solution conductivity.

Another simple model was based on the Langmuir-Hinshelwood equation and the Beer-Lambert law. This model applied to photocatalyst in nanopowder form gives the following formula:

$$r = \frac{kKnC\left(1+e^{-(lC+\mu n)d}\right)}{(1+KC)(lC+\mu n)d}$$

where r is the reaction rate, k is the reaction rate constant, C is the concentration of the degradation compound, K is the adsorption equilibrium constant, I is the light absorption coefficient of the contaminant, d is the depth of the solution, n is the amount of the photocatalyst powder, and μ is the coefficient of absorption/scattering of light by the powder.

The applicability of this formula was proved on methylene blue discoloration by zinc oxide in a reactor illuminated from above. Preliminary theoretical calculations show that for a cylindrical reactor illuminated from the outside, the reaction rate will depend on the radius of the cylinder.

Funding acknowledgment: The authors thank the Bulgarian National Science Fund, contract КП-06-Н59/13 for the financial support.

Biography

- Born on May 11 1959 in Dimitrovgrad, Bulgaria
- Graduated from Sofia University Faculty of Physics in 1983.

Work experience:

- 1983 – 1985 Institute of Optics-Sofia, Physicist.
- 1985 – 1988 Institute of Chemical Technology and Metallurgy-Sofia, Postgraduate Student.
- 1988 – Laboratory of Radiochemistry-Sofia, Physicist.
- 1989 – nowadays – University of Chemical Technology and Metallurgy-Sofia, Assistant Professor, Associated Professor.

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Synergetics Principles of the Regularity of the Development of Microcracks in Elements of the Friction Units

A. Janahmadov[1], K. Nabizade[2] and **M. Javadov[2]**

[1]Azerbaijan National Academy of Aviation, Azerbaijan
[2]Azerbaijan Engineering Academy, Azerbaijan

In the study of tribological processes the highly nonequilibrium states of crystal lattice arise inside the frictional contact. It is no longer described by Hooke's law, and undergoes a local structural transformation, besides its movement toward the equilibrium occurs as a synergetic process. However, the application of purely synergetics within the framework of continuum mechanics, by itself leads to the conflicting conclusions.

The synergetic principles and the fractal approach of physical mesomechanics allow to describe kinetics of the plastic deformation and fatigue of various materials under different loading conditions from a single point of view, including the cyclic loading of tribocoupling, controlling of points of the bifurcation.

In this paper, the stress-strain state of brake disks of transportation vehicles is analyzed to prevent the occurrence of microcracks on their working surfaces and the model is developed for studying nonstationary friction modes and fracture of contacting elements. The concept of metal fatigue is developed within the framework of physical mesomechanics.

The proposed model explains the change in the mechanism of crack propagation under conditions of low-cycle fatigue of metal-polymer friction pairs when air enters the crack, and leads to the oxidation of fracture surfaces with the formation of a film. Perhaps, in this case, the formation of surfaces with a subgrain structure occurs.

Biography

Ahad Khanahmad Janahmadov is a world-famous Azerbaijani scientist, mechanic-philosopher, doctor of technical sciences, professor, Head of the Department of Transport Mechanics of the Azerbaijan National Aviation Academy, Vice-President of the Azerbaijan Engineering Academy, and Deputy Editor-in-Chief of the journal “Herald of the Azerbaijan Engineering Academy”.

He is the founder of engineering philosophy. Active member of a number of foreign academies, author of more than 40 monographs, 3 scientific discoveries and about 500 scientific articles and patents. Honored Engineer of Russia. He was international awarded the knighthood "Knight of Science". He is a laureate of several international competitions in science and education. His fundamental monographs are translated into English, published in the USA, Germany and other countries and received international recognition. He is a member of the Azerbaijan Writers Union.

The author's scientific achievements are praised by many international awards, orders and medals

Three-Dimensional Elasticity Analysis of Sandwich Cylindrical Shell by Numerical Integration Approach

Yogesh M. Desai[2], Yashaswini T. LomtePatil[1] and **Tarun Kant[2]**

[1]Department of Civil Engineering, COEP Technological University, India
[2]Department of Civil Engineering, Indian Institute of Technology Bombay, India

Sandwich panels are used in a variety of engineering applications such as aircraft, construction and transportation where strong, stiff and light structures are required. The major concern in case of sandwich panels is the delamination between core and face-sheets arising from the mismatch of properties between the core and the face sheets. Research in the field has indicated that the resistance of sandwich panels to this type of failure can be increased by varying the material properties of the core. Hence the concept of a functionally graded (FG) material is being actively explored in sandwich panel construction.

Accurate assessment of stresses acting on the transverse planes is very important in investigation of delamination. Only three dimensional (3-D) elasticity theories are capable of accurate estimates of stresses. Therefore, a 3-D elasticity solution is presented in the present work by using a numerical integration approach for a sandwich laminated circular cylindrical finite shell with FG core.

A novel solution approach has been proposed by making use of all the equations of 3-D elasticity without making any simplifying assumptions in the formulation. Solution is obtained by using a computationally efficient numerical integration technique. The proposed approach is based on mixed formulation technique to evaluate the displacements as well as stresses simultaneously with the same degree of accuracy. Illustrative examples are presented to demonstrate applicability, accuracy and superiority of the proposed approach.

Biography

Prof. Yogesh M. Desai is an academician and active researcher in the broad areas of Computational Mechanics with emphasis on Finite Element Analysis, Composite Mechanics and Fatigue of structures. His research team has developed a state of the art hybrid finite element for static and dynamic analyses of laminated composite plates and sandwiches. He has received several awards and accolades for his teaching and research. He has over two hundred research papers in international journals and reputed conferences. He has published two text books on Finite Element Method and has one edited volume to his credit. He has guided twenty research scholars. He has one patent to his credit and has also been involved in entrepreneurship activity and technology development. He has been serving as an advisor to several government organizations for over last twenty years.

Copper Oxide Nanostructures with Nanoneedles Shape Obtained by Direct Reaction with Nitrogen-Doped Carbon Quantum Dots: Development of an Electrochemical Sensor to Glyphosate

Thiago C Canevari and **Daniel Y TIBA**

LabNaHm: Multifunctional Hybrid Nanomaterials Laboratory, Engineering School, Mackenzie Presbyterian University, Brazil

This work describes the synthesis, characterization, and application of nanoneedle-shaped CuONPS/Cdot(N) nanostructures obtained by direct reaction between $Cu(NO_3)_2$ and nitrogen-doped carbon quantum dots (Cdot(N)). The CDot(N) obtained from oleylamine using the electrochemical technique of chronoamperometry was used as catalysts and directing agents in synthesizing CuONPS/Cdot(N) nanostructures. The CuONPS/Cdot(N) nanostructures were characterized using transmission electron microscopy (HR-TEM), X-ray photoelectron spectroscopy (XPS), ultraviolet spectroscopy (UV–Vis), infrared spectroscopy (FTIR), and electrochemical techniques. HR-TEM and XPS analysis has shown that CuONPS/Cdot(N) nanostructures are constituted for both CuO and Cu_2O nanospecies. The printed carbon electrode was modified with CuONPS/Cdot(N) nanostructures. It was used to determine the pesticide glyphosate in PBS, pH 5.5, at a potential of E = - 0.02 V, using the differential pulse voltammetry technique with a detection limit of 11.6 nMol L-1. The printed carbon electrode was modified with CuNPS/Cdot(N) nanostructures and was also used to determine pesticides in real water samples with good performance.

Biography

CNPq fellow productivity in technological development and innovation. He graduated with a bachelor's degree in Technological options from the State University of Londrina, a Master's in Inorganic Chemistry, and a Doctorate in Materials Chemistry from the State University of Campinas. He has two postdoctoral internships at the University of São Paulo in nanotechnology. Leader of the research group, consolidated by CNPq, called Multifunctional Hybrid Nanomaterials (NaHM). He works mainly on the following topics: electrocatalysis, (Bio) electrochemical sensors, multifunctional hybrid nanomaterials, filtering nanomembranes, and the sol-gel process. He is currently a professor in the chemistry course and the Materials and Nanotechnology Engineering postgraduate program at Universidade Presbiteriana Mackenzie.

Testing Cut-Resistance of Protective Textiles

Nandan Kumar[1], Shubham Srivastava[2] and **Chandra Shekhar Malvi[3]**

[1]High Performance Textiles Pvt Ltd., India
[2]Institute of Technical Textiles Pvt Ltd., India
[3]Madhav Institute of Technology & Science (Deemed University), India

Injuries caused by sharp-edged objects are common in many industries. To protect workers from such injuries, cut-resistant materials like para-aramid and high-performance polyethylene (HPPE), sometimes reinforced with steel or glass strands, are used. Before these materials can be commercialized, rigorous testing is essential to confirm they meet established standards for cut resistance. These tests are conducted using either static or dynamic methods. Static testing is governed by standards such as BS EN 388:2016 + A1:2018, ISO 13997, and ASTM F2992/F2992M-15, while dynamic testing is addressed in standards like ISO 13998 and ISO 13999. Despite lab results, real-world performance may differ due to factors such as exposure to oil, grease, chemicals, or elevated working temperatures. Although coatings can mitigate the effects of oils and chemicals, the decline in cut resistance at high temperatures remains an unresolved challenge. This study investigates the cut resistance of HPPE and para-aramid fabrics under such conditions. The findings reveal that HPPE's cut resistance reduces at higher temperatures, whereas para-aramid retains its protective properties especially when these yarns are reinforced with metals in core. A 'modified' TDM tester (Figure 1) was designed, incorporating a heated sample mandrel to enable cut tests at elevated temperatures.

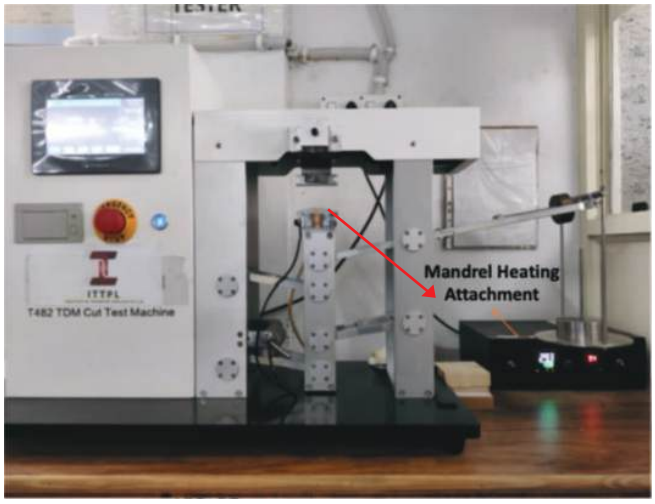

Figure 1 Modified TDM Cut Testing Machine

Biography

Dr. Nandan Kumar (PhD) has over fifteen years of experience in the field of Protective Textiles. He did his MSc and PhD from the University of Leeds, U.K. His company High Performance Textiles Pvt Ltd (HPT) specializes in the spinning of technical composite yarns using p-aramid, m-aramid, modacrylic, UHMWPE, FR Nylon, FR viscose, stainless steel and other high-performance fibers using innovative spinning technologies. He has also established the Institute of Technical Textiles Pvt. Ltd for supporting 'commercial' testing, training & development in the field of protective & automotive textiles.

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Influence of Gauges in the Numerical Simulation of the Time-Dependent Ginzburg-Landau Model

Cyril Tain[1,2], **Jean-Guy Caputo**[2] and **Ionut Danaila**[1]

[1]Univ Rouen Normandie, CNRS, Normandie Univ, France
[2]Laboratoire de Mathématiques de l'INSA Rouen Normandie, De l'Université, Saint-Etienne-du-Rouvray, France

The time-dependent Ginzburg-Landau (TDGL) model requires the choice of a gauge for the problem to be mathematically well-posed. In the literature, three gauges are commonly used: the Coulomb gauge, the Lorenz gauge and the temporal gauge. It has been noticed [J. Fleckinger-Pellé et al., Technical report, Argonne National Lab. (1997)] that these gauges can be continuously related by a single parameter considering the more general ω-gauge, where ω is a non-negative real parameter. In this article, we study the influence of the gauge parameter ω on the convergence of numerical simulations of the TDGL model using mixed finite element schemes. A classical benchmark is first analysed for different values of ω and artefacts are observed for lower values of ω. Then, we relate these observations with a systematic study of convergence orders in the unified ω-gauge framework. In particular, we show the existence of a tipping point value for ω, separating optimal convergence behaviour and a degenerate one. We find that numerical artefacts are correlated to the degeneracy of the convergence order of the method and we suggest strategies to avoid such undesirable effects. New 3D configurations are also investigated (the sphere with or without geometrical defect).

Biography

Cyril Tain began as a teacher in secondary and high schools in France from 2012 to 2020. He graduated with honors from Rouen University in 2020 with a master degree in applied mathematics. He got a PhD in mathematics in 2023 from the Institut National des Sciences Appliquées de Rouen entitled: "Modelling Type II Superconductors: implementation with FreeFem". He is working on numerical methods for modelling superconductors, especially finite elements.

Characterization of Varnish Adhesion on Polyamide Monofibers: An Innovative Approach

Meriem Benzarti[1,2] and **Pascal Henry**[1,2]

[1]Laboratoire de Physique et Mécanique Textiles (LPMT- EA4365), Université de Haute Alsace, France
[2]Physics and Mechanics Textile Laboratory, Université de Haute Alsace - IUT de Mulhouse, France

The adhesion of varnish to different types of materials has caught significant attentions in recent years. Varnish is widely used in various fields, including medical, textile, mechanical, electronic and electrical applications.

To characterize toughness of thin coatings on flat surfaces, a critical parameter for tribological behavior, the standard method employed is the scratch test. However, for curved surfaces, tensile tests are often preferred. The results for this method mainly depend on the strain differences between the fiber and the applied coating. The scratch test is a mechanical process where a controlled increasing force or displacement is applied using a hard-spherical tip to indent the substrate and move across its surface at a prescribed speed. This experimental procedure enables the determination of toughness criteria of the coating even if deposited onto curved surfaces submitted to radial compressive strain.

In this study, we investigated the adhesion of varnish on a polyamide monofiber using the conventional scratch test method. A specific device was conceived to facilitate this procedure. We examined the adhesion between varnish and nylon monofiber through several series of scratch tests conducted on fibers coated with two types of varnish and several polymerization times. Cohesion and adhesion toughness of the coatings were discussed in terms of the coating composition and thermal treatment. Comparisons were drawn between different samples to characterize the effect of varnish type on scratch resistance and to identify parameters influencing adhesion through scratch testing.

The results highlighted the impact of thermal treatment on the fibers' mechanical behavior. Additionally, tensile tests were conducted on the three types to establish a correlation

between a well-known characterization method and the presented scratch test. Beyond investigating the adhesion of varnish to nylon fibers, this study primarily aims at validating an innovative process for characterizing coatings deposited on curved surfaces, such as fibers.

Biography

Dr. Meriem Benzarti is an Associate Professor at the Physics and Mechanics Textile Laboratory (LPMT). Graduated from École des Mines de Saint-Étienne and École Centrale de Lyon, Dr. Benzarti joined the University of Haute-Alsace in September 2017 as an Assistant Professor in Mechanics. Their research spans three key domains: the characterization and optimization of natural fibers, the adhesion of coatings on fibers, and the integration of optical fibers into smart textiles.

Dr. Benzarti's research focuses on understanding the mechanical behavior of natural and synthetic fibers, employing tensile testing methods. In parallel, Dr. Benzarti has explored innovative approaches to characterize coating adhesion on curved fiber surfaces through scratch testing, contributing to advancements in coating technology and fiber surface engineering.

A significant aspect of Dr. Benzarti's recent work involves smart textiles and the development of optical sensors for body-monitoring applications. This research integrates tribological, mechanical and signal processing methods.

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Proof that Minority Current Carriers Produce Superconducting Current in Superconductors

Y.O. Uhryn

Ivan Franko Drohobych State Pedagogical University, Ukraine

Minority current carriers in a solid are those current carriers whose concentration is much lower than the concentration of other types of carriers, which we call majority carriers. In general, minority carriers do not contribute significantly to electrical conductivity, but this can be different if their mobility is significantly higher than that of the majority carriers. Based on this condition and on the analysis of magnetoresistivity, we obtained a formula for calculating the mobility of minority current carriers

$$\mu = \frac{\sqrt{3}}{B_f}\left(\frac{4\rho_f}{3\rho_0} - 1\right)$$

where B_f is flex point of magnetoresistivity, ρ_0 and ρ_f is zero field and flex point magnetoresistivity respectively.

Calculations by this formula for conventional as well as high-temperature superconductors shows that by cooling them in a small temperature range 0.5 – 1K near the critical temperature, the mobility of minority current carriers sharply increases, for example in $YBa_2Cu_3O_7$ superconductor with critical temperature 92K, when the temperature decreases from 92.7 to 92.1 K, this mobility increases from $8*10^5$ to $60*10^5$ $cm^2/(V\ s)$. From this we conclude that when a superconductor approaches a critical temperature, a rapid drop in resistance occurs due to a rapid increase in the mobility of minority current carriers. Further, it becomes obvious that after the transition to the superconducting state, it is the minority current carriers that become the carriers of superconducting current. The analysis of experimental data for another galvanomagnetic effect, the Hall effect, leads to the same result: when approaching the critical temperature (when lowering) by 1 - 2 K, the mobility of minority current carriers begins to increase sharply and reaches enormous values at a temperature

0.1 - 0.2 K above the critical temperature. With this rapid increase in mobility we also explain the mysterious change in the sign of the superconducting onset Hall effect observed in many experiments and the so-called "ghost critical field" observed in some experiments.

Biography

Yurii Uhryn was born on April 12, 1961 in Drohobych, Ukraine. He graduated from high school in 1978 and immediately entered the Faculty of Physics and Mathematics at the Ivan Franko Pedagogical Institute in Drohobych (now a university), graduating with honors in 1983. After graduation, he worked as a school teacher and in 1986 returned to his alma mater as a researcher. In 1991, he defended his PhD thesis on "Quantum oscillations of magnetoresistance in narrow-gap semiconductors". In the same year, he started working as a lecturer and then as a senior lecturer and associate professor at the Department of Physics, where he still works. He is the author or co-author of about 100 scientific papers and textbooks. He consider his greatest scientific achievement to be the proof that minority current carriers are responsible for the superconducting state in superconductors.

He has two children and three granddaughters. His son left Ukraine for the UK earlier in search of a better life, and his daughter and granddaughter left for Ireland in February 2022 when the muscovites began their aggression against our country.

Studies on the Behaviour of Steel Fibre Reinforced Concrete under Monotonic and Repeated Cyclic Stress in Tension

G S Suresh[2], Jayanth K[1] and **M N Shesha Prakash[3]**

[1]Department of Civil Engineering, The National Institute of Engineering, India
[2]Department of Civil Engineering, The National Institute of Engineering (Retd.), India
[3]Department of Civil Engineering, Vidya Vikas Institute of Engineering and Technology(Retd.), India

In the present study, the tensile behaviour of SFRC under monotonically applied load was investigated using Double Punch Test (DPT). Concrete of grade M25, with hooked end steel fibres of aspect ratio 50 (50 mm length and 1 mm diameter), comprising fibre volumetric proportions of 1.0, 1.25, 1.50, and 1.75 percent were considered. The stress-strain characteristics were compared using the theoretical equations proposed in the literature. For the case of 1.5 and 1.75 % SF, the theoretical peak stress was found to be lower bound compared to that arrived experimentally. Specimens with steel fibres under monotonic loading indicated planes of failure, without the specimens being broken into segments as observed in the case of no-fibre concrete. There was difficulty in capturing the response under cyclic loading, basically due to random distribution of steel fibres and this affected the tensile stress-strain characteristics. The fibre distribution, being random, predominantly affected the tensile stress-strain characteristics. The testing methods available for studying the tensile characteristics of steel fibre-reinforced concrete, in the form of direct and indirect tests, does not provide a true stress-strain behaviour due to random fibre distribution, thereby influencing the behaviour of specimens during unloading cycle. DPT, an indirect tensile testing method, provided reliable results with lesser coefficient of variation. The simplicity of the testing method in the case of DPT, makes it a suitable testing technique to study the tensile characteristics of SFRC.

Table: Peak stress and strain of plain and fibrous concrete under monotonic loading

		Fibre volume fraction (%)				
		0.00	**1.00**	**1.25**	**1.5**	**1.75**
ft (N/mm²)		2.302	NA	NA	NA	NA
ε_f		0.000040461	NA	NA	NA	NA
f_{tf}	**Experimental**	NA	2.544	3.09	3.312	3.554
(N/mm2)	**Theoretical**	NA	2.946	3.108	3.269	3.43
ε_{ft}	**Experimental**	NA	0.000062247	0.000280111	0.000352828	0.000433466
	Theoretical	NA	0.000052801	0.000057449	0.000058971	0.000062056

Fig: Double punch test setup

Biography

Education:

- Under Graduation (BE): 1982, NIE (Mysore University), Mysore
- Post Graduation (M.Tech): 1988, IIT Bomby, Mumbai
- Ph.D: 1995, IISC, Bangalore

Teaching Experience @ The National Institute of Engineering, Mysore (37)

- Lecturer: 8 years
- Senior Lecturer: 8 year
- Professor: 21 years

Administrative Positions Held:

- Dean (Academic Affairs)
- Head, Civil Engineering Department

· Project Consultant, NIE, Group of Institution

Research Guidance:

· Master's: 15

· MSc: 1

· Ph.D: 4+1 (Registered)

No. of Papers Published (102)

Sponsored Research Projects Carried Out: 7

Patents :- Arches in foundation for residential buildings

Books Published: (3)

Awards: (8)

Professional Institutions:

- Ferrocement Society of India
- Institute of Engineers India
- Indian Society of Technical Education
- Indian Concrete Institute
- Association of Consulting Civil Engineers (India)

Chairman for Mysore center during 2013-15. introduced many new activities for professionals and students, *viz*., Engineer's day, Design Safe, RAGI, Ultratech-ACCE Awards, M.Tech Thesis award, Quiz for PG students and for UG Students (CATALYST)

Professional Experience as Structural consultant: 34 Years

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Study on Mechanical Properties of Fiber Metal Laminates and its Application in Automobile Body

Wenbin Hou[1] and **Hongzhe Zhang**[2]

[1]School of Mechanical Engineering, State Key Laboratory of Structural Analysis for Industrial Equipment, Dalian University of Technology, China
[2]School of Mechanical Engineering, Dalian University of Technology, China

Fiber metal laminates can combine the characteristics of metal materials and traditional fiber composites, and have high specific strength, high specific stiffness and other excellent properties. It is an important research direction of lightweight materials. In recent years, the research on the impact resistance of fiber metal laminates is mainly focused on the flat plate structure, and the specific application research is less. In this paper, the low-speed impact performance of fiber metal cap structure is tested and simulated, the low-speed impact performance of fiber metal laminate cap structure applied to the body anti-collision beam is analyzed, and the body anti-collision beam is optimized.

Firstly, the dynamic and static parameters of carbon fiber and aluminum alloy materials are experimentally studied, including the preparation of experimental samples, the analysis of experimental principles, the calculation of experimental parameters and the analysis of experimental results. By analyzing the difference between dynamic and static parameters, it is found that the strength changes greatly. The functional relationship between strain rate and strength is established. The effect of strain rate on material strength is analyzed from the perspective of strain rate affecting stress, and the change law of material strength is predicted.

Secondly, the fiber metal laminate is applied to the body anti-collision beam with corrugated sandwich structure. By studying the impact on the low-speed collision performance of the body anti-collision beam when different material distribution schemes are adopted for the upper panel, core panel and lower panel of the anti-collision beam, and comprehensively considering the cost and feasibility, the initial design scheme of aluminum alloy for the

upper panel, fiber metal laminate for the core panel and carbon fiber for the lower panel is determined Carbon fiber anti-collision beams are compared and analyzed.

Thirdly, the initial design scheme of the anti-collision beam is optimized. Taking the mass, peak impact force and energy absorption as the optimization objectives, the optimal Latin hypercube test design method is used to generate sample points, and the response surface proxy model is established to improve the calculation speed. The NSGA-II algorithm is used to solve the optimization model, the final optimization design results are selected according to preferences, and the optimization design effect is analyzed and verified.

Biography

Dr. Wenbin Hou is a professor of School of Mechanical Engineering in Dalian University of Technology of China. He is now director of Liaoning Advanced Vehicle Design and Manufacturing Engineering Technology Center. He is also a council member of The China Society of Automotive Engineering and a member of the Science and Technology Award Committee of the China Society of Automotive Engineering. He has served as the evaluation expert of national Science and Technology Award and China Automobile Industry science and technology Award. He has presided over more than 30 projects including national natural Science Foundation of China key and general projects. He has published more than 100 papers. He has won the second prize of National Science and Technology Progress award, the first, second and third prizes of China Automobile Industry Science and Technology Progress Award and the second prize of Liaoning Province Teaching Achievement Award.

Synthesis of Pure Hydroxyapatite (HA) from Indian Clam Seashells and Deposition of the same by Atmospheric Plasma Spray (APS) Technique on Ti-Alloy Substrate for Biomedical Applications

Kazi Sabiruddin[1], Shahid Huissain[2] and **Mirza S. Baig[1]**

[1]Indian Institute of Technology Indore (IIT Indore), India
[2]Indian Institute of Technology Kharagpur, India

The pure hydroxyapatite (HA) powders were synthesized from the Indian clam seashells by the hydrothermal reaction method with varying heating temperatures (700–1000 ℃). Further, the spray-dried HA powders were sprayed on Ti-6Al-4 V (ELI) alloy to deposit different HA coatings through the atmospheric plasma spraying (APS) technique. Various bio-mechanical tests were employed on the coatings to obtain the suitable HA powder for implant applications. The surface roughness (R_a), microhardness, porosity, adhesion strength, and wear resistance of the as-sprayed coatings were evaluated by standard methods. The highest adhesion strength was noticed in the case of the 900 ℃ coating sample which is due to the high compatibility of such coating material with Ti-alloy substrate in terms of thermal properties. The 900 ℃ coating sample has also shown the highest microhardness and wear-resistance properties due to its maximum crystallinity among all the HA coatings. The in-vitro bioactivity properties of the HA coatings were examined by the SBF test. The biocompatibility of the HA coatings was examined through MTT (3-(4,5-dimethylthiazol-2-yl)- 2,5- diphenyltetrazolium bromide) assay analysis by using human osteosarcoma cell line (MG-63 cell). With an increase in incubation time, the cell density is increased for all. Seashell-derived HA coatings are found to be both bioactive and biocompatible in nature. The variation in biological properties observed among the HA coatings is due to their different microstructural features resulting from the melting and solidification behavior of the HA feedstocks. As the deposition parameters are kept constant, the synthesis condition of HA powders, such as the reaction temperature, has played a key role in varying the phases and stoichiometry of the resulting coating. With the highest amount of metastable and near stoichiometric HA phase content, the HA-1000 coating has shown the maximum amount of cell proliferation and apatite growth among all.

Biography

Dr. Kazi Sabiruddin is a Professor in the Department of Mechanical Engineering at the Indian Institute of Technology Indore (IIT Indore), India. He holds a doctoral degree in Mechanical Engineering from the Indian Institute of Technology Kharagpur (2009). Before this, he achieved M. Tech and B. Tech degrees in Production (2006) and Mechanical Engineering (2003) respectively. He teaches courses like Machining Science and Metrology, Technology of Surface Coatings, etc. His area of research is surface engineering which includes the application and characterization of various coatings applied by different techniques on metallic components for tribological, thermal barrier, and bio-medical applications. He has published more than forty journal papers, some book chapters, and a patent in his name. many PhD and master's students have completed their thesis work under his guidance. Presently he is working on the synthesis of Hydroxyapatite powders from bio-waste materials and the deposition of the same on metals by various deposition techniques for bio-medical applications.

CO_2 Capture with Activated Carbon from Hydrothermal Treatment of Synthetic Urban Wastes

Alejandro AMAYA, Carmina REYES and **Nestor TANCREDI**

Facultad de Química, Universidad de la República, Uruguay

Urban waste management in development countries has become a relevant issue. The increase in generation of wastes has resulted in the adequation of policies and programs that include proper waste disposal and valorization. The production of activated carbon has been explored as a valorization alternative. The high moisture content of some residues could represent a disadvantage if classical physical or chemical activation processes are chosen, so hydrothermal treatment (HTT) followed by physical activation were chosen as activated carbon obtention method. HTT is a thermo-chemical process that uses sub-critical water as a reaction medium for converting organic raw materials into valorized products that include a solid (hydrochar), and liquid and gas fuels.

In this work, a synthetic solid that resembles typical urban wastes composition was treated by HTT at 270°C and 50 bar during 30 min. The liquid phase was separated as biooil and hydrochar was used as activated carbon (AC) source. The activation temperature was obtained through thermogravimetry and set at 900°C. Different activation times were employed and ACs obtained presented BET areas close to 800 m^2g^{-1}. The ACs were assessed in carbon dioxide capture giving adsorption capacities near 250 mg g^{-1} at 4 bar. Raw materials, HTT and ACs were characterized by infrared spectroscopy, elemental analysis and SEM.

Biography

Doctor in Chemistry. Associate Professor in the Physical Chemistry Area of the Faculty of Chemistry and the Renewable Energy Laboratory of the Polo Tecnológico de Pando Institute. Head of the Teaching Unit at the Faculty of Chemistry. Researcher in the National Research System and the Basic Sciences Development Project. Specialist in surface physical chemistry, carbon materials and thermochemical energy conversion.

Superaustenitic Stainless Steels: Characteristics, Properties and Applications

Alessio Malandruccolo

Department of Industrial Engineering – DII, University of Trento, Italy

Superaustenitic stainless steels are one of the families of high-performance stainless steels, the so-called “super” grades. Although they share the face-centered cubic lattice with standard austenitics, these alloys have a more complex chemical composition and are able to provide a unique combination of outstanding corrosion resistance and high mechanical properties. Complex compositions rich in certain alloying elements such those of the superaustenitics necessarily have to deal with the phenomenon of segregation and related consequences. The study of the thermodynamics and kinetics associated with these materials becomes critical for understanding the types of secondary phases that can form. Finally, understanding the nature of secondary phases is critical to address the consequences of their presence and strategies for their elimination, as well as the possibilities for preventing their formation. Of course, in addition to the knowledge of the chemistry behind them, materials are characterized by other properties, including physical, mechanical, and corrosion resistance-related ones. In-depth knowledge of superaustenitic stainless steels also comes through analysis of such characteristics. Material properties represent a key information for designers because in the design process, the product features, its use, and its expected useful lifetime are affected by material attitudes. The characteristics of the material certainly influence its usability, but the reverse is also true in that constraints related to service conditions may force the choice to a specific material because others do not possess the appropriate combination of properties for effective use. Last, but not least, to complete the understanding of superaustenitic stainless steels, the techniques by which these materials can be produced, manufactured, processed and brought to market have to be analyzed. In this context, the knowledge of the properties of the material is as fundamental and important as knowing the aspects of each technological process to be employed in the production cycle. Manufacturing and processing possibilities strongly influence the type of prod-

uct that can be realized and, in combination with material characteristics and associated cost, contribute to the determination of the reference markets.

Biography

Alessio Malandruccolo is a PhD student at the Department of Industrial Engineering, University of Trento, with research focus on metallic materials. He previously worked as an industrial consultant across Italy and Europe. His career began in the steel industry with a prestigious Italian company specialized in stainless steels and nickel alloys; focusing on R&D and quality improvement. He later coordinated product development projects for a German company in the sheet metal working sector and established a new site in Italy of a mechanical design consulting company. Holding a Master's in Materials Science and Engineering, he expanded his expertise at ESRF (Grenoble) and Diamond Light Source (UK) in X-ray diffraction for inorganic materials. He has served as a lecturer and teaching assistant in materials and manufacturing technologies at multiple institutions. Together with Stefano Gialanella is the author of *Aerospace Alloys* and recently published *Superaustenitic Stainless Steels: A Comprehensive Overview*.

The Role of Digital Twins Concept in Old Tbilisi Superblocks Model Development

Nino Chachava[1,2], Nikoloz Lekveishvili[2,3] and **Nutsa Kandelaki[2,3]**

[1]Georgian Technical University, Georgia
[2]NINCLP Engineering Idea, Georgia
[3]TIMM Architects Ltd., Georgia

In the context of the rapid development of artificial intelligence and its increasing integration into everyday life, the need for obtaining accurate information, converting it into digital formats, creating large databases, and effectively utilizing this data has become more important than ever, particularly in the field of cultural heritage digitalization. The preservation of Georgia's historical heritage requires comprehensive research, thorough documentation, and the creation of smart platforms to support reconstruction and urban development efforts in historical cities.

While working on the Tbilisi Superblocks project, part of the Livable City program and based on core mobility principles was approached differently extended the task of mobility with layout of buildings, their multifunctional characteristics, influencing the lifelines of streets in terms of cultural heritage, functionality, demographics, and environmental impact.

The big scale of studied area, the vast amount of data, the complexity of expert evaluations, made necessary to develop a special approach, concept of digital Twins. The registered point cloud, developed using 3D laser scanning and photogrammetry methodologies, played a crucial role in enabling experts to study the streets and buildings within a limited time, assess their current condition, and organize the results into databases, including Excel and ArcGIS knowledge bases. This data was used to develop drawings in the XYZ coordinate system and 3D models on CAD and other vector-based platforms. This unified system obtained and linked various digital platforms.

Transforming physical building stock into virtual models, and subsequently into regenerated conceptual models, highlights the importance of the Digital Twins concept in adapting

the Universal Superblock model to the historical fabric of Old Tbilisi districts. This process facilitates urban planning decisions and design, urban scenarios development, and transport simulations.

As a result of the research, recommendations were developed for the implementation of the Digital Twins concept in urban planning and design, cultural heritage preservation, and the documentation and reconstruction of historical districts, including seismic risk reduction tasks.

Biography

Nino Chachava graduated from the Georgian Polytechnic Institute in 1989 and received her PhD in Architecture in 2006 in Tbilisi, Georgia. She is the Head of the Department of Science, Education, and Tourism at Non-Entrepreneurial Non-Commercial Legal Entity- Engineering Idea. she is a Professor at the Faculty of Architecture, Urban Planning, and Design at Georgian Technical University, served as the national coordinator of the Tempus RETHINKe, CoE Dumas Cultural Route and other international projects. Her areas of interest include cultural heritage documentation, utilizing 3D laser scanning, photogrammetry techniques, CAD platforms, landscape architecture, urban planning, seismic risk reduction, cultural heritage protection tasks, New utilizing techniques 3D laser scanning, photogrammetry, and CAD, GIS platforms. She is a Board Member of the Scientific and Technical *Magazine Modern Problems of Architecture and Town Planning* at Georgian Technical University.

Nikoloz Lekveishvili Biography

Nikoloz Lekveishvili is a Tbilisi-born architect and the founder of the architectural studio TIMM Architecture. He received his architectural education in Istanbul at Mimar Sinan Fine Arts Academy and later completed his master's degree at Politecnico di Milano in Italy, where his thesis supervisor was the renowned Italian architect Stefano Boeri. He has gained working experience in various countries, including Italy, Turkey, Germany, Georgia, and India. Currently, he serves as an invited lecturer at Tbilisi State Academy of Art and Ilia State University.

Nikoloz's projects are predominantly situated in historical areas, showcasing a harmonious blend of heritage and contemporary architecture. TIMM Architecture's portfolio encompasses a wide range of projects spanning different scales and functions, from public space transformations and mixed-use cultural centers to private hotels and urban furniture. The practice fosters international collaboration among architects based in cities such as Tbilisi, Istanbul, and Milan.

Since 2021, Nikoloz has been curating a conceptual gallery project called Steal Art Gallery (SAG). SAG features an interactive physical vitrine in a historical area of Tbilisi where A5-sized art pieces are exhibited and can be taken by visitors or passersby. Notable artists showcased at SAG include Ninuka Sakandelidze and Luka Akimidze. In collaboration with CM-2 and TIMM, Nikoloz won a nationwide competition organized by Futura for the Future Schools of Italy in Matelica.

Among Nikoloz's recent public projects are the Museum and Information Center of the National Botanical Garden of Tbilisi, transforming three major city center areas into pedestrian Superblocks, the design of the Light-Sound system at Tbilisi Rustaveli Metro Station for the Tbilisi Public Art Fund, and the transformation of the Apollo Cinema into a Cultural Center, among others.

Stimuli Responsive Hydrocolloid Encased Bioactives: Release Behaviour and Kinetics

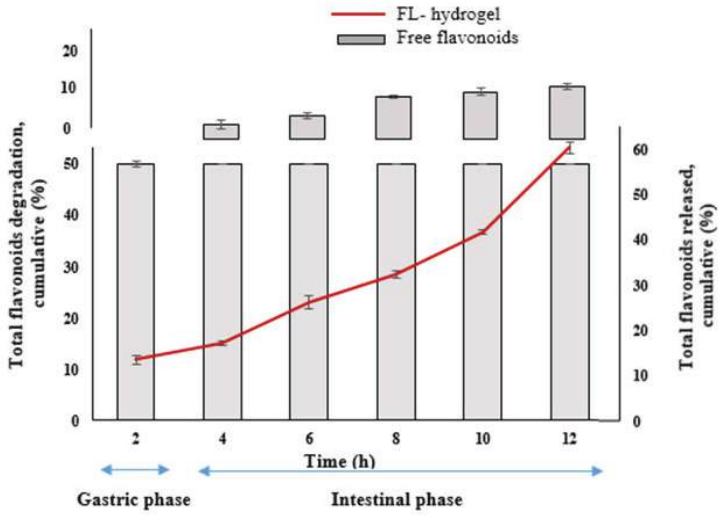
Minni Singh, Parmveer Singh and **Niharika Kaushal**

Functional Foods and Nanotechnology Group, Department of Biotechnology and Food Technology, Punjabi University, India

Pre-systemic metabolism of bioactive compounds remains a concern. Moreso, since many of these offer potential benefits such as anticancer, anticholesterolemic, hepatoprotective and the likes. To harness their potential, it becomes imperative to develop carriers as delivery systems that have the ability to protect these bioactives through the highly acidic gastric surroundings, and deliver them into intestinal surroundings for absorption thereof. This work studies the ability of a biocompatible hydrocolloid, alginate hydrogel, for its ability to encase a class of bioactive compounds, the flavonoids derived from mandarin peels, and the extent of protection it could provide. Also, the manner of release of flavonoids from the hydrogel, and the mechanisms involved have been explored, with the objective to develop functional biomaterials for new product development.

For this, alginate hydrogel was fabricated by ionic cross linking, within which the flavonoids were encased. *In vitro* cell free gastrointestinal (GI) model was used to study the release profile of flavonoids, and kinetic modelling was done to predict the release mechanism. Rheological parameters suggested that the hydrogel offered an appreciable tensile strength and could resist compression. SEM image confirmed a compact and dense network essential to secure bioactive compounds. GI studies revealed that unprotected flavonoids underwent degradation of up to 50% within 2h of gastric exposure, whereas flavonoids encased within the hydrocolloidal network remained guarded, with only 10% being released, thereby offering significant protection to the bioactives. In addition, the hydrogel supported a sustained release of flavonoids in the intestinal environment, as seen in the Figure.

Kinetic modelling showed Korsmeyer-Peppas model as the best fit, thereby suggesting the non-Fickian combination of diffusion and polymer erosion as the mechanism of release of compounds from alginates. This work lays a foundation to propel further investigation into utilizing these matrices in main stream products.



Biography

Dr. Minni Singh is currently serving as a Professor at the Department of Biotechnology and Food Technology, Punjabi University, Patiala, India. Her research interests include exploring bioactives from food biomass, and developing biocarriers for compounds, particularly nutraceuticals derived from food processing wastes, with an objective towards sustainable utilization of these. Her research group works at developing various types of nanoformulations for new product development. Recently, she was recognized by the International Association of Advanced Materials for her contribution to the advancement of materials and technology. She impresses on translational research and two of her technologies have been transferred, and commercialized.

Unlocking the Key Factors, Mechanisms and Solutions of OCTG Material Failure for China Oil & Gas Industries

Lihong Han

CNPC Tubular Goods Research Institute, China

The statistical data on the Oil-Country-Tubular-Goods failure in China shows that there are three types dominantly including of stress-corrosion-crack under H_2S-containing environment, cyclic alternative temperature in thermal wells and formation movement in shale gas well. For high H_2S-contained gas wells, the original regulation to control mechanic properties of OCTG material is insufficient and the key factor is the micro stress-corrosion-crack sensitivity showed in material's microstructure features such as residual martensitic lath, chemical segregation, second-phase particle morphology and so on. These new micro-parameters has been proposed and adopted by ISO 11961 standard as a new product type, which was widely adopted in global drilling industry, to prevent H_2S-induced stress corrosion crack. For heavy oil recovery, the cyclic-steam-stimulation process was widely used for more than 40 years in china but lots of casing failure has happened because of unavoidable thermal-plastic deformation due to large temperature alternation usually about 250-300℃. So traditional strength-based casing design method is unsuitable for thermal well and a new strain-based casing design method was proposed and applied successfully for more than 13 years accompanying 38 steam-cycles up to now, which has been adopted to form a new china national standard. For the casing deformation in shale gas well the formation movement was recognized as a new controlling factor transferring to casing strings through stiff and dense cement annular. So the casing design was considered together with the cement annulus, which was modified to be compressible and able to accommodate some moving formation, and then decrease and even remove the casing deformation. This solution has been applied in 60 shale gas wells successfully and formed a new china national standard.

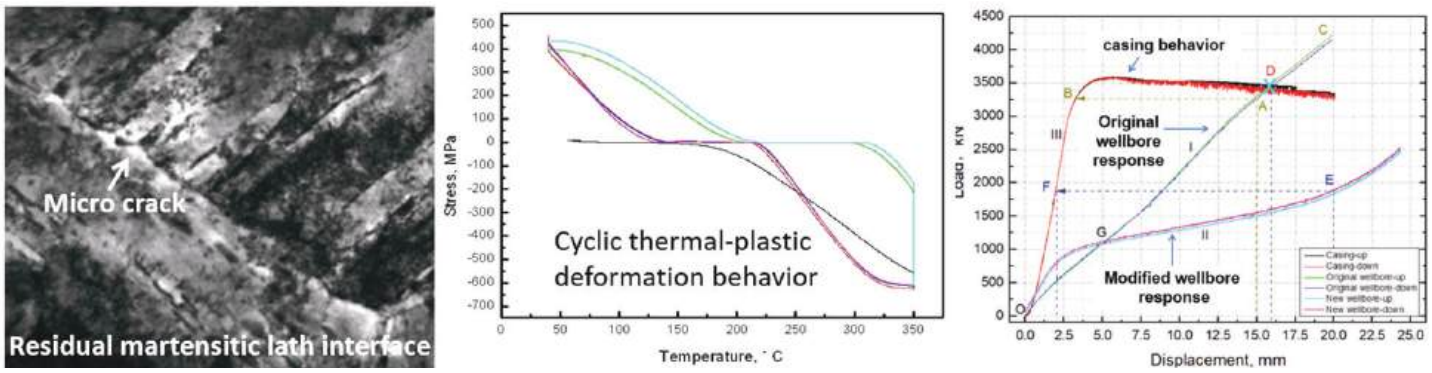


Figure 1: Typical failure factors and mechanisms for OCTG materials

Biography

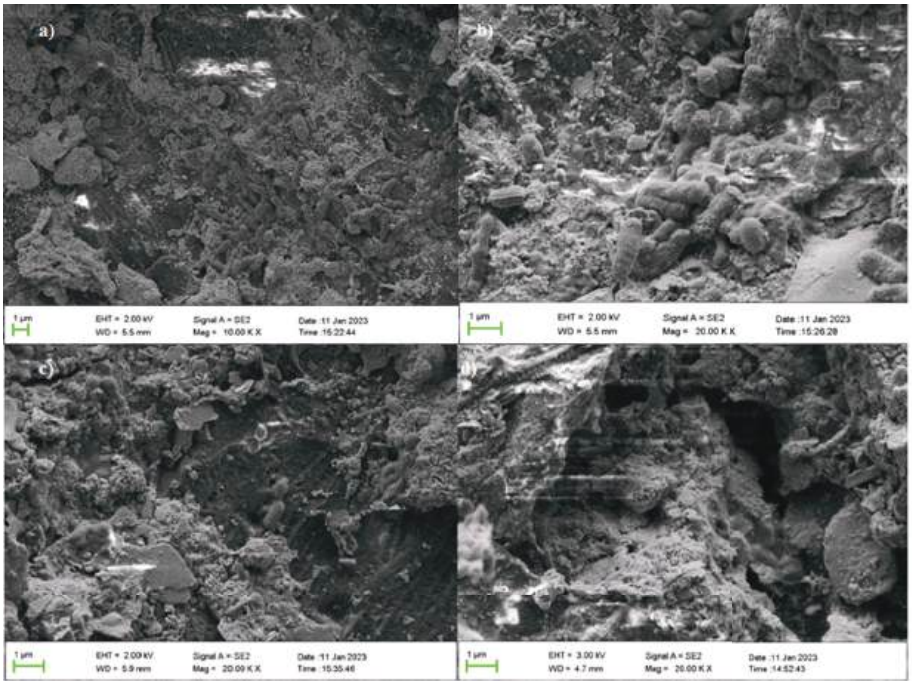
Dr. Lihong Han has conducted OCTG material research for more than 20 years. In 2013 he found the micro origin of H_2S stress corrosion crack for petroleum drill pipe and proposed new control parameters about materials, which has been adopted by ISO 11961 standard and greatly improved OCTG material qualification control capability. For heavy oil recovery he proposed a new strain based casing design method, which has been successfully applied in industry wells and the casing life was improved greatly. For shale gas he found the casing deformation comes from the external formation movement, which is usually neglected in casing design. So he considered the casing design together with the cement annular modification. This creative design can make the cement annular accommodate external formation movement efficiently and reduce the casing deformation greatly, which has been widely used in china's shale gas industry.

A New Concern of Plastic Waste-Fostering Antimicrobial Resistant (AMR) Biofilms in Water Bodies

Preethy Chandran and **Sneha Suresh**

School of Environmental Studies, Cochin University of Science and Technology, India

In recent years, plastic pollution has been quadrupled and become a global concern. The current study examined the possibility that plastic waste in aquatic environments could serve as a substrate for the formation of biofilms by antimicrobial-resistant (AMR) bacteria in order to survive. We have collected 32 different types of plastic waste from six sites along the Periyar River, which serves as the city's drinking water supply and sadly, the Kerala's most contaminated rivers (India)surrounded by chemical factories. FT-IR analysis was used to screen the chemical makeup of plastics and discovered that they were divided into two types: polyethylene and polypropylene. Eight distinct classes of antibiotics were used to screen bacteria isolated from the samples for AMR characteristics. All isolates exhibited significant resistance to colistin and showed MAR index value in the range of 0.1 to 0.4. Using 16sRNA sequencing, six typical bacterial isolates with high multiple antibiotic resistance (MAR) indices were selected and identified as *Lysinibacillus mangiferihumi*, *Bacillus pumilus*, *Bacillus safensis*, *Bacillus cereus*, *Bacillus altitudins*, and *Bacillus pumilus*. *In vitro* biofilm development was examined on the purchased plastic samples in artificial media and river water by using *Bacillus pumilus* and *Bacillus cereus*. Significant variations were observed in biofilm growth in different media ($P < 0.05$) regardless of plastic types ($P > 0.05$). SEM investigation revealed the extracellular polymeric substances (EPS) and the distinctive pores on the surface morphology, demonstrating how the isolates conditioned the plastics for the formation of biofilms.



Scanning electron microscopy (SEM) images. Biofilm and the surface morphology on the plastic samples-WNT (a &b) and MSK (c &d). Individual bacteria and the biofilm structure are formed on sample WNT, on sample plastic surface MSK, the individual bacterial structure was less visible.

Biography

Dr. Preethy Chandran is a visionary and seasoned Microbiologist with exciting experience of 16 +Years which include the dynamic combination of Research, Project Direction, Guidance and Teaching. She has published more than 20 research papers in international peer reviewed journals and H-index of 18. Her aim is to transform and transcend the students dedicated to environmental microbiology in to competent professionals and responsible citizens through state of art research and mold for independent entrepreneur themselves and their organization. Finally inculcate discipline, impart positive attitude and ability to work in heterogeneous groups.

EDUCATION

- PhD in Environmental Microbiology (2008-2011)
- Master of Science in Applied Microbiology (2006-2008)
- Bachelor of Science in Micobiology (2003-2006)

TEACHING EXPERIENCE 15 YEARS

RESEARCH GUIDANCE

- PhD STUDENT - 5
- Project students: 20+

PUBLICATIONS IN INTERNATIONAL REFEREED JOURNALS:

- International peer reviewed journals- 26
- H- Index 18
- Cumulative Impact Factor- 65

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7th Edition of

ADVANCED MATERIALS SCIENCE WORLD CONGRESS

March 24-25, 2025 | London, UK

The Development of Recycled Oyster Shell Waste in Polymer-Modified Green Concrete Towards Enhanced Mechanical Properties and Environmental Benefits

W.F. Tang[1], S.L. Mak[2], K.M. Ma[1] and **Chan Tze Him[1]**

[1]Hong Kong Metropolitan University, Hong Kong
[2]Youth College (Kwai Chung), Vocational Training Council, Hong Kong

Due to the extensive usage in large-scale buildings, highways, bridges, dams, and marine engineering constructions, worldwide use of concrete has expanded dramatically. During the manufacture of cement, significant volumes of greenhouse gases are generated. Excessive dredging, extraction, and processing of natural aggregates has already disrupted local eco- systems and harmed the environment. The conventional concrete production has a substantial adverse effect on the environment. This has initiated a drive towards more sustainable concrete production, in order to decrease the greenhouse gas emission. Some researchers have made attempts to look for alternative materials to substitute conventional materials in concrete. The most economical and sustainable ways is to replace cement by using waste- based materials for the substitution. One of the feasible solutions is the recycling of oyster shell waste. The microstructure analysis revealed that the composition of oyster shell is Calcium Carbonate which is the primary composition in concrete (Table 1 and Figure 1).

Table 1. Chemical composition of oyster-shell

$CaCO_3$	SiO_2	MgO	Al_2O_3	SrO	P_2O_5	Na_2O	SO_3
95.994%	0.696%	0.649%	0.419%	0.330%	0.204%	0.984%	0.724

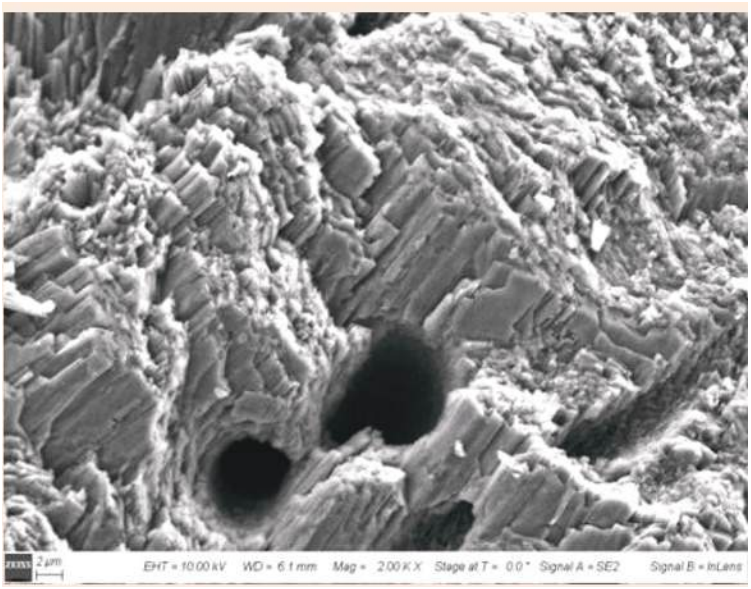

Figure 1. SEM images showing the surface microstructure of the surface of oyster shell

As such, the objectives of the research study is to determine the composition and weight percentage of oyster shell waste, aggregates, cement and polymer resin to provide optimum strength enhancement in concrete. Second, a comprehensive supply chain, beginning from the collection of oyster shell waste and pre-treatment to adaption of concrete with reused oyster shell will be examined. The result indicated that the substitution ratio of oyster shells (10-20%), polymer binders as aggregate (10-20%) could provide a positive enhancement to compressive strength, split tensile strength and permeability on the properties of green concrete.

Biography

Ir. Dr. Fanny Tang, Wai-fan is currently the Assistant Professor and the Programme Leader in the Department of Construction and Quality Management, School of Science and Technology, Hong Kong Metropolitan University.

Ir. Dr. Tang Fanny Wai-fan (PI) is the experienced engineer and metallurgist in material science. She is the technical member of National Asphalt Research Consortium, the Nottingham Transportation Engineering Centre (NTEC) in the University of Nottingham. She is currently a Technical Assessor for the Hong Kong Laboratory Accreditation Scheme (HOKAS) in Physical and Mechanical Testing. She is appointed as the member of Hong Kong Council for Testing and Certification by the Innovation and Technology Commission, technical Assessor of the Hong Kong Accreditation Service (HKAS) and the fellow of the Hong Kong Institution for Certified Auditors (HKICA). Her research interests include material properties and failure analysis, reliability engineering and higher education curriculum development.

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March 24-25, 2025 | London, UK

Mechanical and Microstructure Properties of Eco-Friendly Sand Concrete Incorporating Cane Ash

Razika Charime[1], Assia. Abdelouahed[2], Houria. Hebhoub[3], Mouloud. Belachia[4] and **Karima. Messaoudi[5]**

[1,2,3,5]LMGHU Laboratory, University 20 August 1955, Skikda, Algeria
[4]LMGHU Laboratory, University 8 May 1945, Guelma, Algeria

This study focuses on developing sustainable sand concrete (SC) using cane ash (CA) as a cement replacement material. The CA is an agricultural waste consisting of parts of cane plant stems and leaves, collected from local fields in Skikda, Algeria, which was previously discarded or burned, as an alternative to environmental concerns. Different proportions of CA (0 %, 8 %, 16 %, and 24 %) were blended with ordinary portland cement (OPC) to produce the SC mixtures. The properties of these mixtures were then compared to a control mixture. The performance of the SC mixtures was evaluated in both fresh and hardened states, in terms of their compressive and flexural strength, hardened density. The microstructure was examined using X-ray diffraction (XRD) and scanning electron microscopy (SEM), complemented by energy-dispersive X-ray analysis (EDAX). The findings of the study indicate that the addition of 8–16 % CA improves workability, which is a real interest in easy casting, especially into narrow formworks. The best mechanical strength performance can be achieved at a rate of 8 % CA, while the proportion of 0–24 % CA may be employed for structural applications. The addition of 8 % CA also contributes to microstructure development. Correlation formulas between different parameters can be used to predict or estimate their values. Thus, CA can be used as a cementitious addition in many applications, and the positive effect of the 8 % content can be exploited to produce a cost-effective and durable sand concrete.

Biography

Razika Charime is a PhD in civil engineering materials at the University 20 August 1955 in Skikda, Algeria. She obtained a Master's degree in civil engineering materials from the same University of Skikda, and a civil engineering degree from the University of Constantine in Algeria. Her thesis explored an ash-based sand concrete, emphasizing its characterization, formulation, performance and durability. Her research interests include building materials, blended cement and concrete durability. Since 2019, she has been involved in the collaborative PRFU Project (Research project university training) (Valorization of biomass ash in the composition of different types of concrete). She has published in scientific journals, given presentation at national and international congresses. Her extensive background in project management comprises: tendering processes, contract management and quality control (QA/QC) in civil engineering for Sonatrach, a company specializing in oil and gas.

Development and Applications of Textile Nanocoatings using Cellulosic Nanowhiskers

Kunal Singha[1], Anjali Agrawal[1] and **Abhijit Mukherjee[2]**

[1]Department of Textile Design, National Institute of Fashion Technology, India
[2]Department of Fashion Technology, National Institute of Fashion Technology, India

Nanotechnology has been used extensively in the textile industry recently, particularly in textiles. This work examines how nanocoatings by nanowhiskers can improve these materials' sustainable and practical qualities. The current work is divided into two parts; in the first part we have discussed the overall process and challenges of regular nanocoating methods, materials, and their effects on the environment by incorporating knowledge from materials science, sustainability, and cosmetic technology. Additionally, it included methods for creating environmentally friendly nanocoatings and carrying out lifetime studies, as well as a critical evaluation of the opportunities and problems associated with applying sustainable nanocoatings in textiles. Nanocoatings are therefore crucial for enhancing effective, environmentally friendly textiles and present opportunities for further study and industrial application.

While, in the second part, we have examined the usefulness of nanowhisker in nanocoating application by using selective and sustainable cellulosic nanoshel nanowhiskers (microcrystralline cellulose nanopowder) on textile materials. This paper discusses a variety of chitin nanowhisker, their applications, chemical modification, and methods for extraction and processing. These developed textile products are very useful to care wound dressings, as well as in the manufacturing of adsorbents, water purification, protein immobilization, bacterial transformation by exogenous genes, and carbon precursors.

This chapter's precise objectives are as follows:

1. To offer a thorough comprehension of the many kinds of nanocoatings by cellulosic nanowhiskers utilized in textiles. This involves emphasizing their functional advantages.

2. To investigate and weigh the advantages and disadvantages of various approaches for putting nanocoatings by cellulosic nanowhiskers to textiles.

3. To investigate how nanocoatings by cellulosic nanowhiskers in textiles affect the environment and sustainability issues. The usage of biodegradable materials, lifespan assessments, and possible environmental hazards will all be discussed.

4. To evaluate the possible dangers to one's health and safety that come with using to textiles coated with nanotechnology by cellulosic nanowhiskers.

Biography

Kunal Singha, is currently working as Assistant Professor in Department of Textile Design at National Institute of Fashion Technology, Kolkata, India and published over 230 Papers in national/international journals/books chapter/conferences and co-edited/co-authored 9 books in Wiley, Elsevier, Apple academic publishing (AAP)-Taylor & Francis, Springer, Textile Institute-CRC-Woodhead, Apple Academic Press and Lambert Pub.

Anjali Agrawal, is an Assistant Professor in Department of Textile Design at National Institute of Fashion Technology, Kolkata, India. She published a number of research papers in the journals of national and international repute and also coediting 4 books in Apple Academic Publishing (AAP)-Taylor & Francis, Fiber Society Conference, Switzerland and also has been supervisor to a number of PhD scholars.

Abhijit Mukherjee, is currently working as Associate Professor in the in Department of Fashion Technology at National Institute of Fashion Technology, Kolkata, India. He has published several research papers along with several years of research experiences.

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Properties and Dynamics of Long-Range Topological Objects in Heterogeneous Media: Applications in Advanced Materials Science and Technology

Jorge A. Gonzalez

Department of Physics, Florida International University, USA

Introduction: Topological solitons are the charge carriers in many systems and materials.

Objectives: We will investigate the dynamics of long-range topological objects in heterogeneous materials. We will use the results in the design of new technologies.

Methods: We solve inhomogeneous nonlinear Klein-Gordon equations, both theoretically and numerically. We analyze the data from real experiments.

Results: We have discovered a new kind of soliton-like object: long-range topological objects. We show that long-range topological objects can pass freely through a randomly disordered medium. Real experiments confirm our theoretical predictions. We have proved that a new kind of fluxon created with long-range topological objects can be used to produce qubits protected against noise.

Discussion: Using a new kind of doping, we have been able to increase the extent of the created long-range topological objects in charge-density-wave materials. Thus, we can transform a charge-density-wave material into a superconductor at room temperature and ambient pressure. Our next result is the following. A multinary super-hydride with a potential free energy that supports the existence of our long-range topological charged objects can lead to the development of a room-temperature-ambient-pressure superconductor. Our quantum computing systems constructed with protected superconducting qubits can spread entanglement super-ballistically.

Conclusions: Long-range topological quantum objects can play an important role in the development of quantum artificial intelligence and energy devices (including superconducting batteries). A superconductor at ambient thermodynamic conditions can pave the way for economic electric power transmission.

Biography

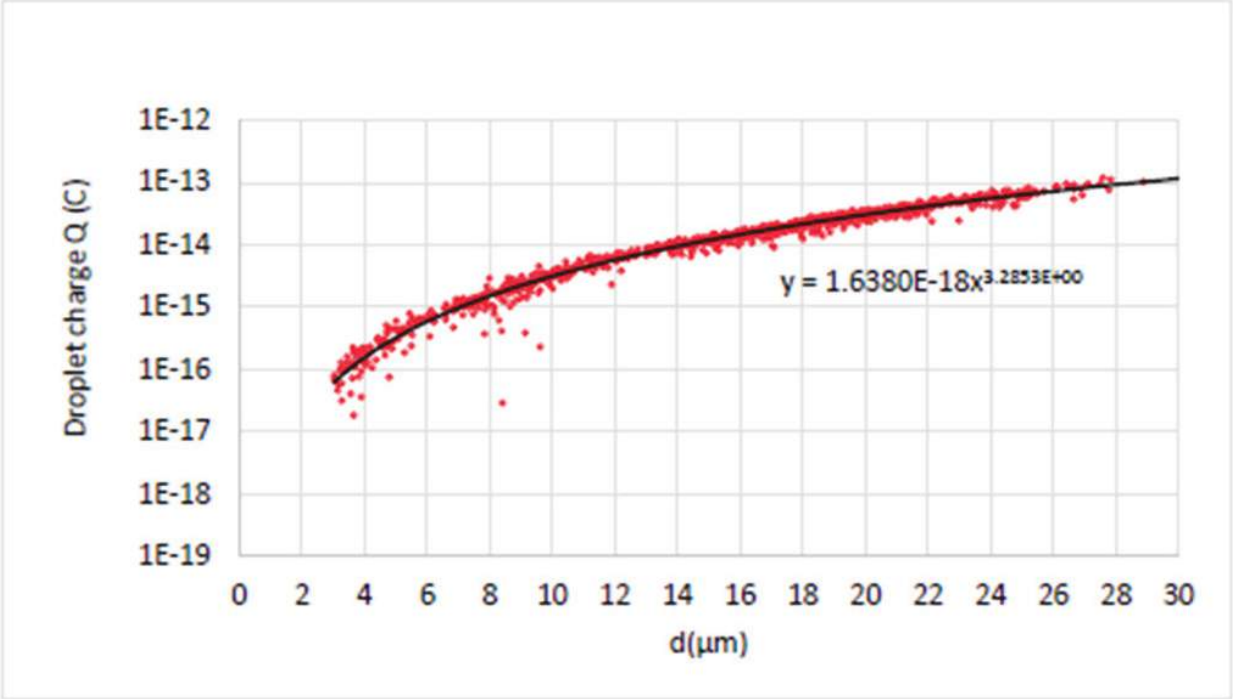
Prof. Dr. Jorge A. Gonzalez (PhD) has published more than 100 papers in journals like Physical Review Letters, Physical Review B, Physical Review E, Applied Physics Letters, New Journal of Physics, Physics Letters A, Europhysics Letters, Physics Letters B, CHAOS: An interdisciplinary Journal of Nonlinear Science, Physica A, Physica D, Chaos, Solitons, and Fractals, Journal of High-Energy Physics, etc. He has received several national and international prizes and awards: KBN Award, Scientific-Technological Merit Prize (three times), IMU Grant-Award, CONICIT National Prize to the best scientific work in Physical Sciences, Vanguard of Science Prize, Royal Society Award, Andres Bello Prize to the best scientific work in fundamental sciences, Named "International Expert" by United Nations Industrial Development Organization. Recent Professional Experience: Head of Laboratory of Nonlinear Dynamics and Complex Systems. Visiting Professor, Department of Applied Mathematics, Madrid University of Technology. Visiting Professor, Lancaster University, (UK). Visiting Professor, Department of Applied Mathematics, Carlos III University of Madrid. Associate Professor and Researcher, International Centre for Theoretical Physics, Trieste, Italy. Associate Professor and Researcher, International Center for Condensed Matter Physics, Brasilia. Prof. Gonzalez has mentored and advised 14 students to get a master's degree and PhD. He has supervised 2 post-Docs.

Numerical Simulation of Electrostatically Supported Painting Processes using a High-Speed Rotary Bell from Liquid Charging, Break-Up to Spray Propagation

Qiaoyan Ye[1], Oliver Tiedje[1] and **Joachim Domnick[2]**

[1]Fraunhofer Institute for Manufacturing Engineering and Automation, Germany
[2]University of Applied Sciences, Germany

The present contribution deals with numerical studies of painting processes using an electrostatically supported high-speed rotary bell. Simulation results are summarized into two parts. The first one is the investigation that focuses on the disintegration process of the paint liquid in the near-bell region at the paint atomizer. The commercial CFD software Ansys Fluent with user-defined equations/functions was used to study the EHD-atomization process (i.e. the atomization under fluid dynamic and electrostatic forces). This includes calculation of the two-phase flow field, in which the charge migration from electrode to leaky dielectric film and droplets. we introduced an apparent ion mobility coefficient, to solve the charge conservation equation. The obtained simulation results, namely the droplet charge-diameter relationship and the initial droplet velocity near the bell edge were further applied to the simulation of full spray propagation that is the second parts of the presentation. Experimental results were applied to model development and validations. A quite good agreement between the experiment and the simulation was obtained, concerning to the film thickness distribution and the transfer efficiency on the substrate.



Biography

Dr.-Ing. Qiaoyan Ye: Female, born in 1960 in China. Dr. Ye is the project leader of spray painting and simulations in Fraunhofer Institute for Manufacturing Engineering and Automation, Stuttgart, Germany. Dr. Ye received her Ph.D. degree from Institute of Fluid Mechanics, LSTM, at the University of Erlangen, Germany in 1996. In 1996 as guest scientist, she worked in the Institute für Reaktorsicherheit Forschungszentrum Karlsruhe (FZK), Germany. Her research work concerns with Turbulence modelling and computation of buoyant turbulent flows. Since 1998 she has been a researcher in Fraunhofer Institute Produktionstechnik and Automatisierung in Stuttgart and engaged in numerical simulation in coating applications and with adjunct appointment in the institute of Industrial Manufacturing and Management (IFF), University of Stuttgart, Germany. She has undertaken several German national and EU projects, German AIF scientific research projects, Fraunhofer Association Fund projects (Industry 4.0 projects), German BMBF scientific research projects. Her research interests are Spray painting simulations using electrostatic high-speed rotary bell atomizers, airless and air assisted spray guns; Simulation of electrostatic powder coating; Study of paint droplet impact on dry and wet surfaces; Simulation of flow and heat transfer in dryer for car industry and Optimization of spray-painting processes.

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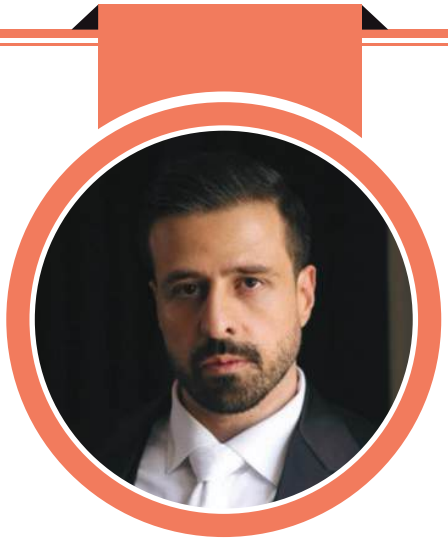


A Mathematical Model for Aerospace Product MRO Scheduling with Remanufacturing

Yasser Ghamary and **Mingyuan Chen**

Concordia University, Canada

The aerospace industry is essential for global transportation and technological growth, with Maintenance, Repair, and Overhaul (MRO) operations playing a critical role in ensuring the safety and reliability of aircraft. Ensuring the integrity of aircraft products and components through effective MRO operations is vital to the sector's success. This paper presents a comprehensive linear programming model designed to optimize the scheduling of aircraft C-check and D-check maintenance operations. The model incorporates multiple component treatment options, including replacement, repair, and remanufacturing, to address various maintenance needs.

A significant feature of the model is its integration of risk assessment for component failure before the next maintenance interval. This risk-based approach allows for more informed decision-making, ensuring that maintenance actions are not only cost-effective but also adhere to stringent safety standards. The model also considers the allocation of essential maintenance resources, such as labor and machinery capacities, ensuring that these resources are utilized efficiently.

To evaluate the effectiveness of the proposed model, scenario analyses are conducted. These scenarios assess the impact of varying parameters such as resource availability, unplanned maintenance costs, and penalties on the overall maintenance strategy. One of the key findings is the potential for remanufacturing to significantly reduce maintenance expenses in MRO operations, making it a viable option for cost savings and sustainability.

The primary contribution of this research lies in its novel approach to integrating risk assessment with resource optimization in MRO scheduling. By providing a comprehensive framework that enhances decision-making for MRO maintenance operations, this study

offers valuable insights for improving the efficiency and cost-effectiveness of maintenance strategies in the aerospace industry. The model's ability to adapt to different operational circumstances and its focus on minimizing maintenance costs while maintaining safety standards make it an advancement in the field of aerospace MRO.

Biography

Yasser Ghamary is an Enterprise Project Manager at MaintainX, leading various initiatives and managing stakeholder relations. Currently, he is a Ph.D. candidate in Industrial Engineering at Concordia University, specializing in aircraft Maintenance, Repair, and Overhaul (MRO) scheduling with a focus on remanufacturing. His research aims to optimize aerospace manufacturing systems and develop new forecasting methods for parts demand.

He holds a Master's degree in Industrial Engineering from Concordia University, where his master's thesis focused on multi-project scheduling with resource constraints. He has over eight years of research and teaching experience, including lecturing on simulation, and assisting in courses such as Applied Optimization and Advanced Quality Control.

Previously, he served as an Assistant Project Manager at Seatply Products and a Technical Consultant at Ontario Northland. He is a certified Project Management Professional (PMP) and was awarded the best oral presentation at the ICITM conference at Cambridge University.

Integrating Sensory Modalities and Technologies in Artistic Contexts

Piper Hutson and **James Hutson**

Lindenwood University, USA

This research explores the integration of sensory modalities and advanced technologies in artistic contexts, aiming to create personalized, immersive experiences that boost emotional and neurological engagement. Utilizing Augmentative and Alternative Communication (AAC) systems, haptic feedback, virtual and augmented reality (VR/AR), and generative AI, the study investigates tailored art experiences based on individual sensory profiles and aesthetic preferences. Drawing on neuroaesthetics and neurodiversity studies, the methodology includes interviews with individuals with synesthetic and sensory processing conditions and applies AI to interpret feedback. Technologies such as real-time text-to-image generation and AR glasses facilitate dynamic environments that adapt to user needs. The findings suggest AI-driven virtual Wunderkammers, or digital 'cabinets of curiosities', can evolve with interactions, using neural feedback to align content closely with personal sensory and emotional profiles, enhancing user engagement. Additionally, the study considers ethical issues, emphasizing informed consent and data privacy, and integrates salutogenic principles to promote well-being through art. This work suggests that merging sensory technologies with artistic expression can enhance therapeutic interventions and provide a framework for future research in healthcare and education, highlighting the transformative potential of tech-enhanced art experiences.

Biography

Piper A. Hutson, EdD, is distinguished in neurodiversity, art history, and education, blending these disciplines to promote inclusivity in art and urban spaces. Holding a Doctor of Education, focusing on adult learning and art history, she previously spent 13 years as a Corporate Art Curator and continues as an Adjunct Professor at Lindenwood University. Her scholarly contributions include co-authoring several influential publications in peer-reviewed journals, while addressing critical intersections between NeuroHealth, digital inclusivity, and learning styles. Her accomplishments include curating over 30 exhibitions across the country and co-author

to two books under Palgrave-McMillian including *Sensemaking and Neuroaesthetics: Neuroarts and the Spectrum of Neurodiverse Experiences*.

Dr. James Hutson is an administrator, innovator and researcher in higher education, with a diverse range of subject-matter expertise in research, emerging technology, inclusivity, and accessibility. He holds degrees in Art, Art History and Archaeology, Leadership, Artificial Intelligence, and Game Design. He has held a variety of positions at Lindenwood University over the past 14 years, including chair of Art History, program manager of Pre-Art Therapy and Pre-Art Conservation, and Assistant Dean of Graduate and Online Programs for the School of Arts, Media, and Communication. Currently, Dr. Hutson serves as Lead XR Disruptor and Department Head of Art History and Visual Culture for the College of Arts and Humanities. His scholarship focuses on digital cultural heritage and neurodiversity in the metaverse. He actively researches the potential educational and social benefits of emerging technologies, such as immersive realities and gamification of education, and has used his expertise to explore new avenues for making cultural heritage accessible to all individuals.

Water as a Material for Sustainable and Biocompatible Antennas

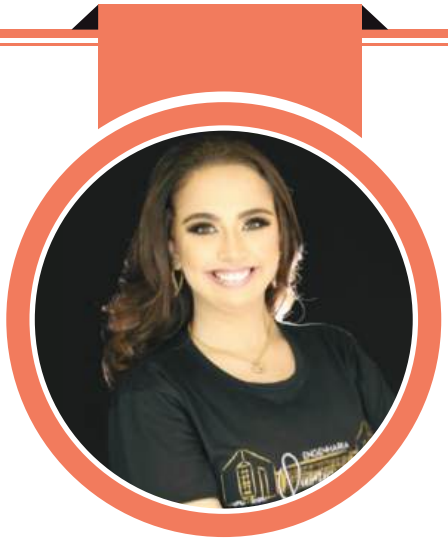
Benigno Rodríguez Díaz

Universidad de la República, Uruguay

Water is an excellent material for the development of sustainable and biocompatible antennas. This presentation highlights the potential of water as a material for the development of new antennas. Antennas are key pieces in the development of any wireless system. Improving antenna performance is one of the areas with the greatest room for improvement to obtain more efficient wireless systems. For several years, the international scientific community has been considering water as a material with great potential for the development of antennas with new features. The use of distilled water as an excellent dielectric and seawater or saltwater as a conductor allows the development of antennas with particular capabilities, such as reconfigurability, reduced size, use of the lens effect, harmlessness (which makes it an excellent material for implantable or ingestible antennas), etc. Even water mixed with other substances, such as antifreeze liquid, has been studied to achieve extended temperature ranges for the correct operation of these antennas. Considering the large number of existing wireless systems and their continuous expansion, improving the energy efficiency of wireless systems is a clear key objective that can significantly contribute to mitigating climate change. The use of many materials, such as graphene, goldene and custom-made compounds is considered a way to expand antenna capabilities, among which water and all its variants deserve a special chapter whose potential is still being discovered. This presentation reviews key works that show the potential of water in the development of innovative antennas.

Biography

Benigno Rodríguez Díaz has an electrical engineer and a master's degree in electrical engineering (telecommunications option) from UdelaR, Uruguay, in 1997 and 2004 respectively. Since 2007 he has a PhD in electrical engineering and telecommunications, from the Technische Universität Hamburg-Harburg, Germany. Since 1993 he has held various positions in the Academy and in industry. Since 2009 he has been part of the National Research System. Since 2016 he has held the position of Full-time Associate Professor at the IIE, FING, UdelaR. His research interests focus on the areas of: OFDM-based wireless systems, free space lasers, millimeter waves, wireless sensor networks and antenna development.



Bacterial Nanocellulose Produced as a By-Product of the Brewing Industry and used as an Adsorbent for Synthetic Solutions for Co (II), Cu (II), Ni (II) and Fe (III)

Gabriela Martins de Paiva[1], Fernanda Palladino Pedroso[1], Edson Romano Nucci[1], Alan Rodrigues Teixeira Machado[2], Carlos Augusto Rosa[3] and **Igor José Boggione Santos[1]**

[1]Department of Chemistry, Biotechnology and Bioprocess Engineering, Federal University of São João del-Rei, Brazil
[2]Department of Exact Sciences, University of Minas Gerais State, Brazil
[3]Department of Microbiology, Institute of Biological Sciences, Federal University of Minas Gerais, Brazil

Bacterial nanocellulose (BNC) has gained increased interest due to its versatile structure and high resistance properties. Due to its biocompatibility and biodegradability properties, BNC has been shown to be an environmentally friendly alternative for the treatment of iron ore production waste in Brazil as an adsorbent for the metals present in the waste composition. However, in order to reduce production costs, it is necessary to study alternative substrates, such as waste from the brewing industry, which are nutrient rich and therefore excellent candidates for substrate for bacteria that produce bacterial nanocellulose. Therefore, the present work aims at the static production of BNC from brewery waste and the use of BNC as an adsorbent for the treatment of mining industry waste. Approximately 1532 mg of bacterial nanocellulose was obtained by the batch system using the residual brewer's yeast hydrolysate at pH 7 and 5 days of incubation. When used as an adsorbent, the material obtained a maximum adsorption capacity for the metals Co (II), Ni (II), Cu (II) and Fe (III) of 0.0739, 0.2504, 0.3945 and 0.02841 $mg \cdot g^{-1}$, respectively. For the same metals, the removal rate of the synthetic solutions studied was 62.56, 39.13, 61.64 and 24.42%, respectively. For the analysis of the isotherms, the Freundlich model proved to be the most effective in describing the system. In terms of adsorption kinetics, the Elovich model was more effective. These data show that nanocellulose produced by bacteria and using agro-industrial by-products becomes a good alternative for remediation processes in a sustainable way.

Biography

Chemical Engineer from the Federal University of São João Del Rei, postgraduate in MBA - Process Management and MSc. in Chemical Engineering from the Federal University of São João Del Rei. Developed Scientific Initiation projects about catalysis, working on the synthesis and characterization of solids based on alumina/niobium/coal and Mining Waste Treatment through Electrocoagulation. Research project about hard water treatment, using adsorption and bovine bone char as an adsorbent, not yet identified in the literature for this purpose. Experience with the biosynthesis of bacterial nanocellulose carried out through experimental design as well as the study of the material used as an adsorbent to evaluate the removal of Cu(II), Co(II), Ni(II) and Fe(III). Solid experience in adsorption as well as the characterizations that such an operation demands. Currently, works in Mining Industry, with iron ore beneficiation.

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Coupling X-Ray Beam Induced Current ToF-XBIC with High Time Resolution to Characterize Semiconductor-Based Detectors

T-N. Tran Caliste, P. Everaere, S. Benichou and **J. Baruchel**

European Synchrotron Radiation Facility, France

Recently the demand for accurate characterization of the electronic properties of semiconductor-based detectors is steadily increasing. In this context, at the beamline BM05 of the EU synchrotron, we have developed an X-Ray Beam Induced Current (XBIC) [1] and a Time of Flight X-Ray Beam Induced Current (ToF XBIC) experiment setup. These two methods involve recording two-dimensional current maps (XBIC) and/or time resolution (ToF-XBIC) to assess the homogeneity of the crystal's response of local electrical property. Furthermore, by leveraging Bragg diffraction imaging technique [3] on the same beamline, we have demonstrated correlations between these techniques, revealing insights into charge collection attenuation, intrinsic time resolution, and structural defects at a percent level accuracy [1].

Achieving precise mapping of the crystal's intrinsic temporal resolution with local precision necessitates superior electronics to minimize measurement interference, along with high-intensity X-ray beams to enhance the signal-to-noise ratio and enable large-scale resolution (30 um). This beam intensity can be attained using a multilayer monochromator which can gain 10^2 time the flux of a Si(111) monochromatic. Control over the amount of signal generated within the semiconductor is crucial to have a good signal to noise ratio. Slits placed just in front of the sample can select the fraction of the transmitted beam down to 10 um^2, although this approach also dictates the resolution of the map. Alternatively, adjusting the beam energy within the range of 5 to 60 keV can influence the fraction of absorbed radiation. This provides sufficient signal for straightforward reading electronics comprising a preamplifier and an oscilloscope. Synchronizing measurements with the synchrotron frequency can compensate for smaller signals in large-gap semiconductors.

Our studies with XBIC and ToF-XBIC have shown the effects of the irradiation on single crystal diamond (sCVD) with a 68 MeV proton beam at ARRONAX, resulting in a notable decrease in charge collection and an increase in intrinsic time resolution dependent on the received fluence, as depicted in Figure 1.

These integrated quantitative imaging techniques (XBIC, ToF XBIC, and X-ray diffraction imaging) offer valuable insights for optimizing not only for diamond crystals but also for all semiconductor: from bulk materials, thin overgrown layer to final devices in the order to understand better the success or failure of the electronic devices.

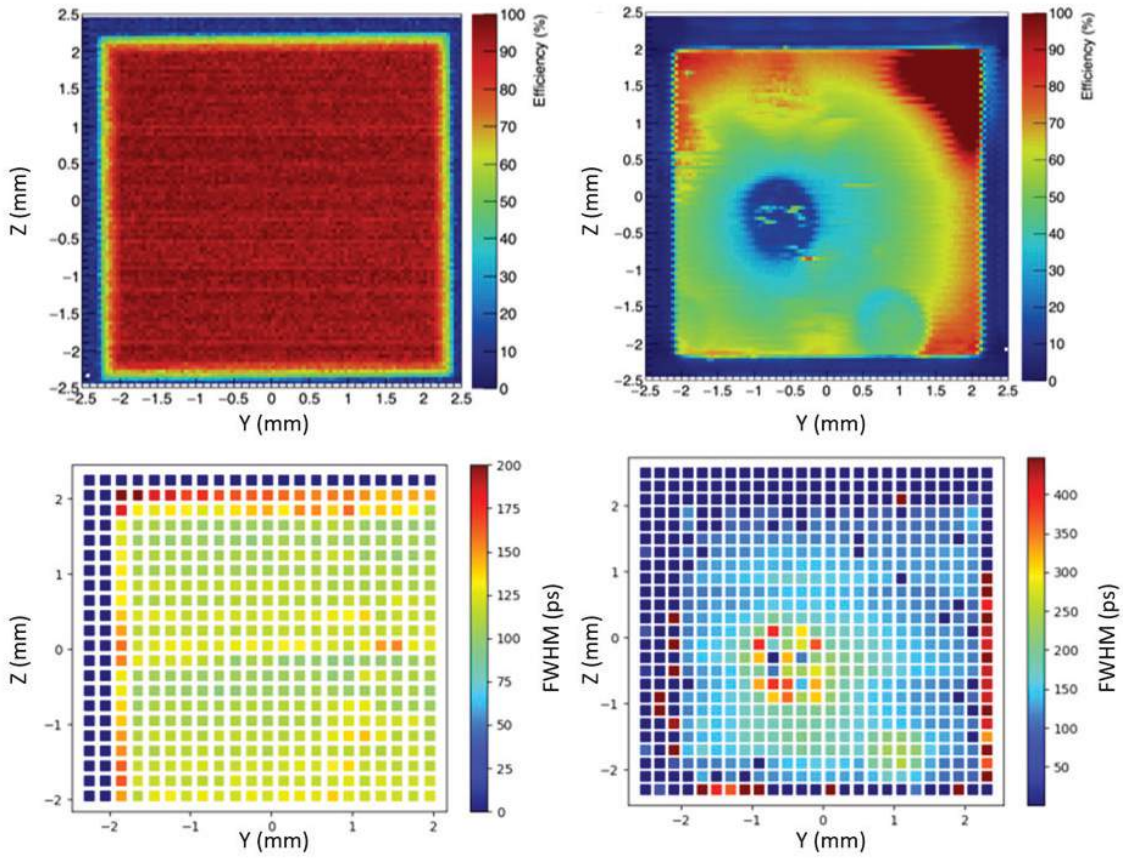


Figure 1: *XBIC (up) and ToF-XBIC (down) map obtained on signle crystal diamond before (left) and after (right) an irradiation of 68 MeV protons beam.*

Evolution of LDL Research: New Technologies and New Discoveries

Chu-Huang (Mendel) Chen

Vascular and Medicinal Research, The Texas Heart Institute, USA

Traditionally labeled as "bad cholesterol" due to its role in atherogenesis, low-density lipoprotein (LDL) has emerged as a far more complex and multifaceted molecule than initially understood. This review delves into the evolution of LDL research, tracing its journey from early discoveries to current insights driven by advanced omics technologies and molecular biology. We explore the comprehensive history, structure, metabolism, and function of LDL in both cardiovascular health and disease.

Key developments in LDL research are outlined, from the elucidation of its structure to the application of modern imaging and analytical techniques that reveal the intricate heterogeneity of its three-dimensional architecture. Understanding LDL's metabolic pathways, from synthesis to clearance, provides critical insight into its physiological roles and clinical implications. Beyond cholesterol transport, LDL plays pivotal roles in inflammatory responses, immune modulation, and cellular signaling, reflecting its functional diversity and impact on cardiovascular health.

This lecture also addresses evolving clinical perspectives on LDL, discussing how these insights impact cardiovascular risk assessment, patient management, and potential therapeutic interventions. We emphasize the need for a more nuanced approach to understanding LDL biology, one that acknowledges its broader implications beyond cholesterol metabolism.

Furthermore, our research team has made significant strides in the study of electronegative lipoproteins, particularly LDL (L5), VLDL (V5), and HDL (H5). These subfractions are identified as highly atherogenic entities within their respective classes, representing critical factors in cardiovascular pathology. This groundbreaking work has expanded the hori-

zons of lipoprotein research, paving the way for innovative treatment strategies. To support these advancements, we have developed new technologies for L5/V5/H5 assays to enhance research capabilities and translate findings into practical clinical applications.

In conclusion, this lecture highlights the dynamic and evolving nature of LDL research and its far-reaching implications for understanding cardiovascular health, offering new perspectives and directions for future research and therapeutic approaches.

Biography

Prof. Chu-Huang (Mendel) Chen, MD, PhD, serves as the Director of Vascular and Medicinal Research at The Texas Heart Institute, and as a Distinguished Visiting Professor at Shinshu University in Japan. Previously, Dr. Chen held positions as Chair Professor of Medicine at Kaohsiung Medical University and Visiting Professor at China Medical University in Taiwan.

Dr. Chen is a pioneer in the research of electronegative lipoproteins, specifically LDL (L5), VLDL (V5), and HDL (H5), which represent the most atherogenic entities in their respective classes. His work has significantly advanced the field of lipoprotein research, including the establishment of HEART (Health Resource Technology, LLC) to enhance lipoprotein assays.

Dr. Chen's contributions span in two major areas:

1. Characterization of Electronegative Lipoproteins for their Clinical Relevance
2. Defining L5/V5/H5 as Novel Causative Biomarkers in CAD for Risk Stratification

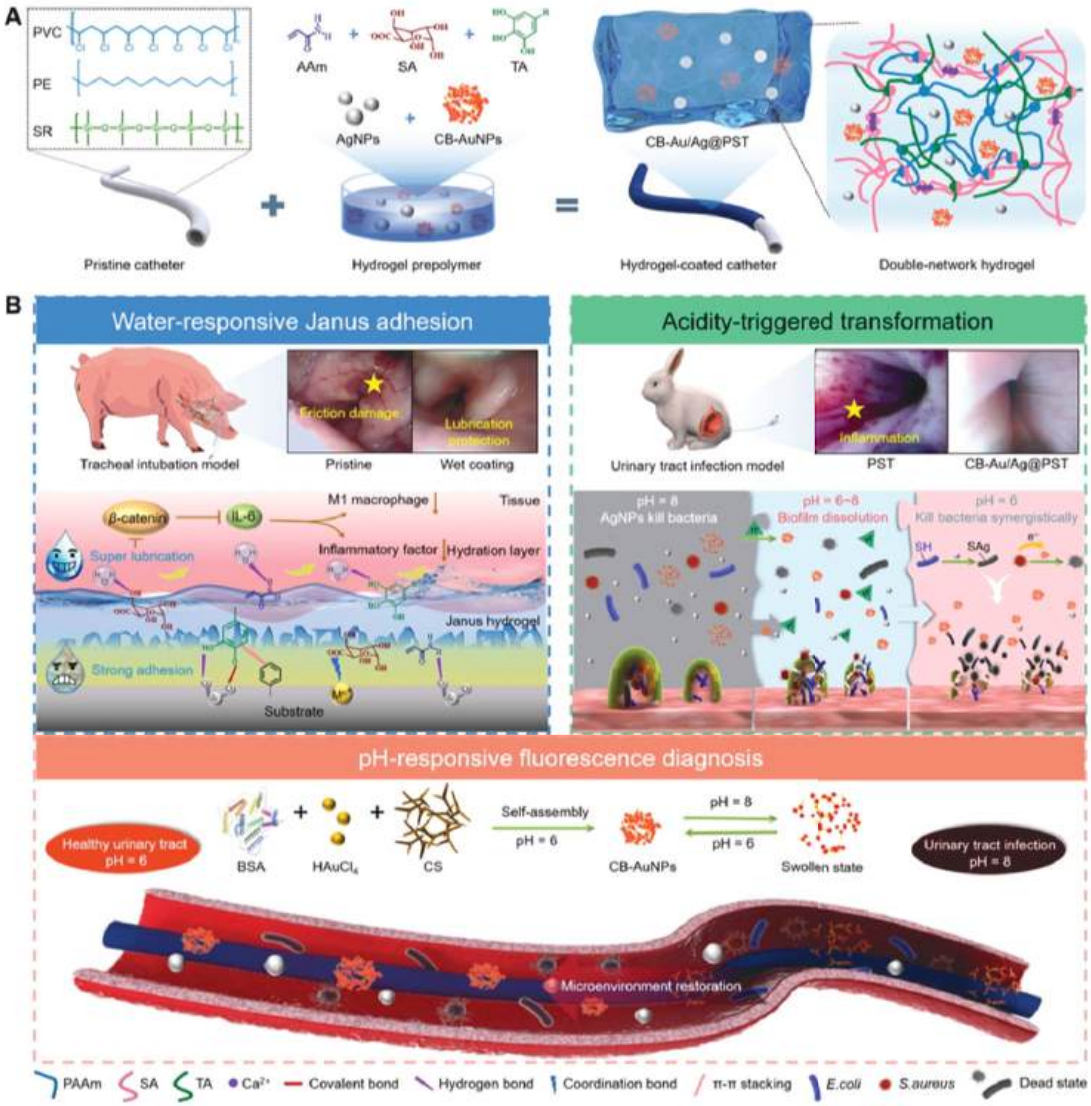
Prof. Chen has mentored numerous physician-scientists, established an international collaborative network, and welcomes future partnerships.

Hydrogel Coatings on Universal Medical Devices with Water-Responsive Janus Adhesion and Acidity-Triggered Transformation for Adaptive Antibacterial Treatment and Fluorescence Diagnosis

Ming Li[2], Yanyun Liu[1] and **Ying Zheng[3]**

[1]Qingyuan Innovation Laboratory, China
[2]Trauma Medicine Center, National Center for Trauma Medicine, Key Laboratory of Trauma and Neural Regeneration (Peking University, Ministry of Education), Peking University People's Hospital, China
[3]Department of Obstetrics, Fuzhou Second Hospital, China

Hydrogel coatings of catheters have attracted extensive attention in the field of medical devices due to its hydrophilicity and softness, while scarcities of Janus adhesion, adaptive antibacterial property, and real-time disease monitoring restricted their clinical translational applications. Herein, a novel hydrogel coating with water-responsive Janus adhesion and acidity-triggered transformation was fabricated for antibacterial treatment and fluorescence diagnosis of catheters-associated infections. First, a sufficient adhesion strength of 44.6 ± 1.9 kPa effectively prevented shedding of the hydrogel coating during catheterization, and meanwhile a superlubricated layer with an extremely-low coefficient of friction of about 0.03 was formed to reduce friction pain in an aqueous microenvironment. Furthermore, size and fluorescence intensity of chitosan/bovine serum albumin-gold nanoparticles within the hydrogel were varied with pH due to acidity-triggered transformation, where an adaptive release of antibacterial nanoparticles was achieved to reduce biofilms formation and alleviate inflammation degree synergistically. More importantly, such antibacterial treatment was monitored in real-time dependent on an on–off variation of fluorescence intensity. Overall, amounts of *in-vitro* and *in-vivo* results performed in rabbit urinary tract infection model and porcine tracheal intubation model fully suggested our newly synthesized hydrogel coating on universal medical devices showed a promising potential for integrated diagnosis and treatment of catheters-associated infections.



Scheme. Schematic illustration of hydrogel coating for reducing friction, adaptive antibacterial treatment, and fluorescence diagnosis. (A) Preparation process of hydrogel coating. (B) Unique characteristics including water-responsive Janus adhesion, acidity-triggered transformation, and fluorescence monitoring.

Biography

Dr. Li Ming, PhD, is an attending physician at Peking University People's Hospital. His main areas of interest are severe trauma treatment, complex wound repair, and biological tissue engineering.

Low Cost Materials for Several Applications, Obtained by the Simple Spray Pyrolysis

Beya Ouertani[1,2]

[1]Photovolaic Laboratory (LPV), Research and Technology Center of Energy (CRTEn), Tunisia
[2]University of Carthage, Higher Institute of Environmental Sciences and Technology of Borj Cedria, Borj-Cedria, (ISSTE), Tunisia

Most transition metal chalcogenides TX2 (T: transition metal; X=S, Se, Te) exhibit layered structure. Pyrite is probably the largest structure family found for these compounds in the VIIIB periodic group. In contrast to the layered materials, this structure is isotropic in its 3 dimensions. Among the semiconducting transition metal dichalcogenides, the sulfides and the selenides have widespread importance that ranges from catalysis and geochemistry to solar energy conversion. In this context, iron chalcogenides have been widely investigated for several applications such as, hydrogen evolution, light energy conversion devices, batteries, storage devices, etc Moreover, they are built up by non-toxic and abundant elements. So, we are interested in the fabrication and characterisations of these low cost materials. It is obvious that preparation processes must play an important part in films behaviour. Many techniques of preparation were investigated in order to obtain pyrite thin films. In the present book, we will describe an inexpensive, non toxic, and easy to manipulate method to prepare pyrite thin films that consists, in a first step, of spraying $FeCl_3.6H_2O$ (0.03M)-based aqueous solution onto glass substrates pre-heated at 350°C. The obtained iron oxide films are amorphous. In a second step, they were heat treated under sulphur or selenium atmosphere (10^{-4} Pa) at different temperatures for six hours in the aim to obtain respectively FeS_2 or $FeSe_2$ thin films. Optical analyses of the obtained pyrite films showed high absorption coefficients, but insufficient band gap energy values for the estimated applications. Infact, at a sulfuration temperature of 450°C and duration of 6 hours, single FeS_2-phase layers having granular structure, high absorption coefficient (~5.10^4 cm^{-1}) and direct band gap energy of about 0.98 eV were obtained. Also, single $FeSe_2$-phase films having good crystallinity were obtained. Optical analyses of the obtained $FeSe_2$

films enabled us to deduce a large absorption coefficient (α~105cm-1, λ < 800 nm) and direct band gap energy of about 1.03eV. However, the as obtained band gap energy values are less than the desired value, for the photovoltaic application; which is of 1.5 eV. So, we thought about the improvement of their optical properties using the alloying technique. After a deep study, in the aim of increasing the band gap value of FeS_2-pyrite thin films obtained according to the pre-described procedure, we chose the ruthenium for alloying them. The effect of alloying on atomic structure, as well as optical properties of Ru-alloyed FeS_2-pyrite films were examined by XRD, optical and MEB characterizations. Our results showed that the band gap value of $Fe_{(1-x)}RuxS_2$ layers increased versus the alloy percentage. An optimum band gap value was obtained of about 1.48 eV; which is considered as a very interesting result for the photovoltaic applications of our films. According the same procedure and in the aim of improving the $FeSe_2$ thin films properties (structural, optical, and electrical), the ruthenium was incorporated into their composition by the same technique. Indeed, the aqueous solution of $FeCl_3.6H_2O$ (0.03 M) was sprayed on pre-heated glass substrates (at 350°C) for 4 min, on which immediately, the aqueous solution of $RuCl_3.3H_2O$ with different molar ratios $[RuCl_3.3H_2O]/[FeCl_3.6H_{2O}]$. The as obtained amorphous films are heated under selenium atmosphere (~10^{-4} Pa) in sealed tubes at different temperatures (400°C, 450°C, 500°C, and 550°C) for 3 hours into RTP oven and submitted to X-ray diffraction analysis. The optical measurements showed a high absorption coefficient (α > 4×10^4 cm^{-1}) and an amelioration of the corresponding direct band gap value from 1.03 eV (for 0% of ruthenium) to, respectively, 1.50 eV and 1.64 eV, desired values for photovoltaic applications. Electrical properties are determined using the Hall Effect measurements. All the obtained Ru-alloyed films showed N-type conductivity. The noted improvement of the FeS_2 and $FeSe_2$ thin films optical and electrical behaviors, confirmed that ruthenium is one of the best candidates for alloying potential photovoltaic materials. Furthermore, all the obtained Ru-alloyed FeX_2 (X=S, Se) films are able to be used for several applications, especially in the photovoltaic domain.

Furthermore, since thin films of transition metal dichalcogenide (TMD) materials, such as $RuSe_2$, are promising alternatives to platinum (Pt) for the hydrogen evolution reaction (HER). Herein, growth of $RuSe_2$ thin films, having desired properties for several applications, using the simple and non-cost technique, spray pyrolysis, makes the main object of the work. In a first step, an aqueous solution of $RuC_{l3}.3H_2O$ (0.03M) was sprayed for 5 min onto ordinary glass substrates pre-heated at 350°C. The as obtained amorphous thin films were heat treated under selenium atmosphere (~10-4 Pa) at various temperatures for 3hours in RTP oven. A single hexagonal $RuSe_2$-phase (h-$RuSe_2$) was picked up by the XRD analysis. The obtained layers presented a high absorption coefficient (α > $6x10^4cm^{-1}$). The plots of $(\alpha.h.v)^2$ vs (h.v) showed direct band gaps corresponding to the photon energies of about 1.56 eV, 1.75 eV, and 1.86 eV of the layers selenized at 450, 500, and 550°C, simultaneously. The interesting obtained results provide for improving more the domain of low cost materials having encouraging properties for several applications domains (photovoltaic, hydrogen evolution, electrocatalysis and photocatalysis) using the spay pyrolysis technique.

Biography

Beya OUERTANI is an Associate Professor at the Higher Institute of Environmental Sciences and Technologies of Borj Cédria, University of Carthage, Tunisia. She obtained her Bachelor's Degrees in physical sciences, her "DEA" in quantum physics, her PhD, and her habilitation, in physics, about thin films for low cost solar cells, at the Faculty of Sciences of Tunis, University of Tunis El Manar. She had been researcher at the Photovoltaic and Semiconductor Materials Laboratory, ENIT, Tunisia. Then, researcher at the Laboratory of Semiconductors, Nanostructures and Advanced Technology (LSNTA). She is being researcher at the Laboratory of Phototovolaîc (LPV) at the Research and Technology Center of Energy (CRTEn), Science and Technology Park of Borj Cedria.

Advancing Fit Technologies: Key Trends and Requirements for Clothing Element Assessment

Olga Paraska[1], Tomasz Buratowski[2], Michal Manka[2], Piotr Kohut[2], Lucjan Miekina[2], Bartosz Bartkowiak[3] and **Tomasz Klorek[3]**

[1]Department of Chemistry and Chemical Engineering, Khmelnytskyi National University, Ukraine
[2]Department of Robotics and Mechatronics, AGH University of Krakow, Poland
[3]VISBROKER Sp. z o.o., Poland

The article presents current trends related to comprehensive systems that allow for checking the fit of selected clothing items. Particular attention was paid to systems implemented using a mechatronic mannequin model. A system structure was proposed that was designed and manufactured as a prototype solution. The design process took into account suggestions from end users representing large chains of new and used clothing stores. The use of the developed system allows for collecting data in the form of basic human dimensions and providing data for the correct setting of mannequin modules so that the fit of the selected clothing item can be assessed. The developed data is then transferred to a potential buyer in order to make an informed decision about the purchase. Mechatronic mannequin model are changing the approach to clothing creation, making it more technological, cost-effective and customer-oriented. Fit accuracy minimizes errors that cause material waste, reduces the need for redundant samples, reduces logistics costs, which contributes to sustainable development in clothing production.

Biography

Prof. Olga Paraska PhD in engineering (2009), DSc (2021) Head of the Department of the Chemistry and Chemical Engineering Khmelnytskyi National University, Leading Researcher in Scientific-research centre, R&D, CEO start-up project Up To Furture. Academic and pedagogic experience – 20 years. Advises and directs students' research, start-up projects. Author of about 100 published works and 8 patents of Ukraine for invention. Reviewer of scientific journals "Tekstilec", "Journal of Industrial Textiles", "Fibres and textiles". Active participant of cooperation with international Universities and Industry in the fields of chemical engineering, resource and energy saving technologies of cleaning industry and ecological safety. Olga Paraska is to teach

the courses dealing with the issues of European experience in the sphere of functioning textile industry enterprises, ecological, technological and chemical safety.

Tomasz Buratowski

Tomasz Buratowski has over 25 years of experience in academia and industry. He received PhD (2003) and DSc (2014) degrees in Automatics and Robotics from Faculty of Mechanical Engineering and Robotics AGH University of Krakow, Poland. Since 2003 has been working at AGH University at the Faculty of Mechanical Engineering and Robotics in the Department of Robotics and Mechatronics. In 1999 he worked as a programmer in HTS-COMARCH. Currently, he cooperates with many Companies in the area of Automatics (mechatronic systems design and control), Robotics (industrial and service robots design and maintenance) and Informatics (design applications and administration of databases for industry).

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Cause-Effect Analysis for Process Parameters in the Formation of the Shell Zone during DCC Process of Al Alloys

Alessio Malandruccolo[1], Cinzia Menapace[1] and **Federica Canevari[2]**

[1]Department of Industrial Engineering – DII, University of Trento, Italy
[2]Almec Tech Srl, Italy

In modern manufacturing, the semi-continuous casting process named direct-chill casting (DCC) occupies a dominant position in the production of aluminum alloys, especially with regard to billets intended for extrusion and forging processes. Amont the types of casting molds used, hot-top molds are characterized by high performance and enable qualitatively superior results. Among the phenomena related to the DCC process being studied for continuous improvement are the formation mechanisms and extension of the so-called shell zone, the part of the material near the surface in contact with the casting mold during the solidification process. The shell zone is characterized by a fine-grained microstructure, segregation of alloying elements and high risk of gas inclusions and micro-shrinkage formation. In recent years, the market has started to require shell zone minimization from casting equipment manufacturers. Shell zone reduction has become a goal to be pursued to improve the performance of extrusion and forging processes, and also to improve the quality of the final product. The most influential parameters affecting shell zone formation turn out to be; alloy chemical composition, liquid alloy temperature, casting speed, secondary cooling parameters and casting mold design, metal flow, and casting mold contact surface. This study is part of a multi-year innovation project for the development of innovative hot-top molds that enable shell zone minimization. In this first part, the effects of the variation of some of the process parameters were evaluated in order to minimize the shell zone thickness for billets obtained by semi-continuous casting for one of the most popular aluminum alloys on the market: AW 6082.

Biography

Alessio Malandruccolo is a PhD student at the Department of Industrial Engineering, University of Trento, with research focus on metallic materials. He previously worked as an industrial consultant across Italy and Europe. His career began in the steel industry with a prestigious Italian company specialized in stainless steels and nickel alloys; focusing on R&D and quality improvement. He later coordinated product development projects for a German company in the sheet metal working sector and established a new site in Italy of a mechanical design consulting company. Holding a Master's in Materials Science and Engineering, he expanded his expertise at ESRF (Grenoble) and Diamond Light Source (UK) in X-ray diffraction for inorganic materials. He has served as a lecturer and teaching assistant in materials and manufacturing technologies at multiple institutions. Together with Stefano Gialanella is the author of *Aerospace Alloys* and recently published *Superaustenitic Stainless Steels: A Comprehensive Overview*.

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Irradiation Damage Mechanism and *In-situ* Micro-Mechanical Properties of Advanced First-Wall W-Y_2O_3 Material

Jun Huang[1], Tong Zuo[2] and **Yucheng Wu[3]**

[1]School of Materials Science and Engineering, Hefei University of Technology, China
[2]China International S&T Cooperation Base for Advanced Energy and Environmental Materials, Hefei University of Technology, China
[3]Engineering Research Center of High Performance Copper Alloy Materials and Processing, Ministry of Education, China

Tungsten with 0.5% Y_2O_3 was chosen for the first wall material in this study. After exposure to helium plasma, thick fuzz tendrils were observed on the surface. The tendril dispersion was obtained using ultrasonic dispersion and examined through TEM. The fuzz tendrils were found to have a tungsten crystal structure with bubbles of varying sizes. The outer layer of the tendrils consisted of an amorphous material, likely a result of damage from helium plasma exposure. Fuzz tendrils were only found on the W matrix, while Y_2O_3 particles caused nano-protrusions and small cracks on the surface. The lack of Y in fuzz tendrils, along with the nano-protrusion morphology and EDS analysis, suggests that Y_2O_3 particles could not form a fuzzy structure. Helium plasma exposure altered the distribution of defects in the W matrix and Y_2O_3 particles. Fewer but larger bubbles were observed near the surface of Y_2O_3 particles, while smaller but denser bubbles were seen further away. The formation of bubbles in the W matrix was deeper and larger than in the Y_2O_3 particles, likely due to lower migration energy. The response of W matrix and Y_2O_3 particles to helium plasma exposure reveals the potential to increase plasma exposure resistance in tungsten-based materials. Stress-induced amorphization in the alloy matrix at the interface with the second phase leads to a different distribution of helium bubbles compared to those inside the crystal. This suggests the formation of potential barriers due to lattice distortion at the interface, allowing for self-trapping of defects. Nano-sized pillar compression samples of the matrix and second phase prepared using FIB before and after irradiation showed distinct irradiation characteristics. Unlike bulk tungsten-based specimens, the nano-sized pillar specimens

did not demonstrate irradiation hardening but instead exhibited irradiation softening. The distribution of defects on crystal planes and within the crystal directly influences the *in-situ* micro-mechanical properties of tungsten-based materials.

Biography

Assoc. Prof. Jun Huang works at Hefei University of Technology and is a visiting scholar at the University of Toronto in Canada. She holds a PhD in Materials Science and is a prominent figure in Anhui Province's education sector. Jun Huang is a senior member of the Chinese Society of Mechanical Engineering, a member of the Chinese Nuclear Society, and a director of the Materials and Strength Youth Alliance of the Society of Mechanical Engineering. Over the past five years, she has led multiple research projects funded by various organizations including the National Key Research and Development Program of the Ministry of Science and Technology, the National Natural Science Foundation of China, the China Postdoctoral Science Foundation, as well as the Ministry of Education's Doctoral Fund. Jun Huang's research areas include tungsten-based materials for nuclear fusion plasma facing, aluminum-based and titanium-based materials for lightweight vehicles, high-temperature alloys, material failure and fracture, and metal phase transformation and deformation behavior. To date, Jun Huang has published over 20 papers in reputable journals such as Materials Science and Engineering A (IF= 6.0445), Metallurgical and Materials Transactions A (IF=2.7258), Surface & Coatings Technology (IF= 4.9373), Fusion Engineering and Design (IF=1.904), Journal of Rare Earths (IF=4.6324), and others.

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Mathematical Modeling of the Change of Electric Potential Energy during the Formation of Covalent Polar and Ionic Chemical Bonds in a Two-Atomic Molecule

Lyakishev Vladislav[1] and **Perfileev Mikhail**[2]

[1]Irkutsk State University, Russia
[2]International Academy of Natural History, Russia

This work belongs to the field of physical chemistry and is devoted to the mathematical description of the process of reduction of electric potential energy of a molecule during its formation. The purpose of the work is mathematical modeling of the formation of covalent polar and ionic chemical bonds in a molecule in the context of the potential energy of the Coulomb interaction. The principle of potential energy minimum and the concept of electronegativity equalization to the geometric mean, which is widely used on the basis of the Malliken electronegativity scale, are taken as the physical basis of the work. As a mathematical basis, the theorem on the speed of alignment of electronegativities of atoms in the process of formation of a chemical bond in a binary molecule and a two-dimensional generalization of the Gauss function (the Supergaussian function can also be used) are used. For the case of formation of a covalent polar and ionic chemical bond in a binary molecule, the expression of the dependence of the potential energy of the formed molecule on the current electronegativities of its constituent atoms and on time is written down. It is shown that this function is decreasing and upon completion of the process of chemical bond formation the electrical potential energy of the molecule takes the lowest value. The results obtained in this work are of interest for molecular physics, thermodynamics of nonequilibrium processes and physical chemistry.

Biography

Lyakishev Vladislav Konstantinovich was born on November 14, 2002 in Irkutsk. Studied at high school (lyceum №47) in Irkutsk from 2008 to 2020. From 2020 to 2021 studied at MSTUCA. From 2021 to 2025 he study at the Department of Chemistry at ISU. Since 10th grade he started writing scientific articles with Mikhail Sergeevich Perfiliev, doctor of the International Academy of Natural Sciences, phd in mathematics. He is one of the top 150 living mathematicians according to Clay State University. He has been awarded 2 Euler

and Lomonosov medals for his achievements in mathematics. In 2016 he solved the Millennium Problem (Riemann Hypothesis) and in 2024 he solved the Brocard Problem.

Below are all the articles (there are 10 so far, including this one):

1. Software for calculating the degree of ionicity and polarity of chemical bonding in binary compounds.
2. Estimation of the maximum ionic strength of a solution.
3. Resonant wave contribution to chemical kinetics.
4. Calculation of the diameter of a hydrogen molecule within the framework of classical electrodynamics.
5. Improvement of the model of the hydrogen molecule as a spherical capacitor.
6. Positronium molecule geometric model in the context of the Hopf link.
7. Computer verification of the positronium molecule model as a two tori Hopf link.
8. Quantum model of anharmonic vibrations of a diatomic molecule with a variable force constant and a small value of the anharmonicity coefficient.
9. Theorem on rates of alignment of electronegativities of atoms in the process of formation of a chemical bond in a binary molecule.
10. Mathematical modeling of changes in electrical potential energy during the formation of covalent polar and ionic chemical bonds in a two-atomic molecule.

Life Cycle Cost Analysis Comparison Between Structural Steel and Light Gauge Steel Structures

Lama Aly, Ahmed El-Tair and **Ayman Nassar**

German University in Cairo, Egypt

Life cycle cost analysis plays a vital role in evaluating both the economic viability and sustainability of building construction systems. This study compares the life cycle costs between structural steel (SS) and light gauge steel (LGS) framing systems by considering the construction costs, usage costs, and end-of-life costs for each system. Although SS has been widely used in construction, LGS has gained popularity as a lightweight and cost-effective alternative. The current literature mainly focuses on the life cycle cost analysis comparisons between traditional systems while neglecting the specific comparison between SS and LGS. Moreover, the comparisons done between the systems only consider the construction costs. This study aims to fill this gap by conducting a comprehensive life cycle cost analysis comparison of two steel structural systems in Egypt, namely: SS moment-resisting frame combined with reinforced concrete slabs and brick walls, and a LGS frame supported on a SS moment-resisting frame and Ferrocement Boards were used for floors and walls. Life cycle cost (LCC) was calculated for each system, which included construction costs, usage costs, and end-of-life costs in addition to the potential for future reuse/recycling. The calculations showed that the CFS system had a lower life cycle cost than the SS system by 46.4% and as for the recycle and reuse values, the SS system was more than the LGS system by around 33.5% and 31.6% respectively as the SS system's overall weight of steel members was higher.

Biography

Lama Mohamed Ashraf Aly is a recent graduate with a Bachelor's degree in Civil Engineering, specializing in Structural Engineering from the German University in Cairo (GUC). Although a fresh graduate, Lama has already made a notable impact by publishing a research paper titled "Life Cycle Cost Analysis Comparison Between Structural Steel and Light Gauge Steel Structures", showcasing her commitment to advancing the field of structural engineering. Passionate about sustainable construction practices, she aims to contribute innovative solutions that optimize both cost and environmental impact. Lama is enthusiastic about sharing her insights and learning from industry leaders as she embarks on her professional journey.

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A Novel Polymer Nanoparticle for Drug Delivery System

O. Al-Jaf, Yaseen G. Kareem and **Shwan Rachidd**

Charmo University, Iraq

Polymer nanoparticles (PNPs) have significantly advanced the field of biomedicine, showcasing the remarkable potential for precise drug delivery, administration of nutraceuticals, diagnostics/imaging applications, and the fabrication of biocompatible materials, among other uses. Despite these promising developments, the invention faces notable challenges related to biodegradability, bioactivity, target-site specificity, particle size, carrier efficiency, and controlled release. Addressing these concerns is essential for optimizing the functionality and impact of PNPs in biomedical applications. Here, new poly cysteine methacrylate nanoparticles (PCMANPs), ca. (200 nm) in size have been synthesized from the cysteine methacrylate (CysMA) monomer using different strategies, including emulsion and inverse emulsion polymerization techniques. The monomer was synthesized using the Michael addition reaction, involving the addition of 3-(acryloyloxy)-2-hydroxypropyl methacrylate to the sulfhydryl group (–SH) of the cysteine (Cys) active site, with the aid of dimethyl phenyl phosphine (DMPP) as a nucleophilic agent as previously reported. To enhance nano-polymerization, a thorough exploration of various initiators, including ammonium persulfate (APS) and 4,40 -azobis (4-cyanovaleric acid) (ACVA), alongside surfactants, such as polyvinyl alcohol (PVA), polyvinyl pyrrolidone (PVP), and sodium dodecyl sulfate (SDS), was conducted. Additionally, critical parameters, such as reaction time, temperature, and solvents, were systematically investigated due to their substantial influence on the shape, size, stability, and morphology of the synthesized polymer nanoparticles. This comprehensive approach aims to optimize the synthesis process, ensuring precise control over the key characteristics of the resulting nanoparticles for enhanced performance in diverse applications. Various characterization techniques, including field emission scanning electron microscopy (FE-SEM), transmission electron microscopy (TEM), nuclear magnetic resonance (NMR), Raman spectroscopy, Fourier-transform infrared spectroscopy (FTIR), zeta potential, and zeta sizer

dynamic light scattering (DLS) analysis, were utilized to investigate purity, morphology, and particle size of the PNPs. As a result, a spherical, monodispersed (homogenized), and stable PCMANP with defined size and morphology was achieved. This may exhibit a remarkable achievement in the future of drug delivery systems and therapeutic index.

Biography

Dr. Omed Al-Jaf, Lecturer and researcher at Charmo University and Komar University of Science and Technology. He received BSc and MSc form the University of Suliamni Kurdistan-Iraq, and a PhD degree in Nanotechnology form the University of Sheffield, Sheffield, UK, 2016. His main areas of research interest are Nanotechnology, Polymer nanoparticles, Drug delivery system, AFM, Bio-antifouling Polymer brush, Nano-patterning, Self-assembled monolayer, etc.

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Interconnecting Internet of Things Devices to a Mobility-Supporting Lora Network using HWMP for Energy-Efficient B.A.T.M.A.N

M. Archana[1], Vikram Narayandas[2], M. Arivukarasi[3] and **Tiruvayipati Sujanavan[4]**

[1]Department of Information Technology, Faculty of Engineering and Technology, Annamalai University, India
[2]Maturi Venkata Subba Rao Engineering College, India
[3]Department of Computer Science and Engineering, Kongunadu College of Engineering and Technology, India
[4]Maturi Venkata Subba Rao Engineering College, India

The Internet of Things is a rapidly increasing field of research. Web-connected sensors help manage and collect large amounts of data and gadgets. The study emphasizes the need of an integrated strategy to managing MANET-IoT networks, which ensures effective node capacity utilisation and increases system lifespan. In any case, they scattered Sensors must be able to work in situations with limited to no internet access, which may severely limit their viability. These sensors may also be installed on something unusual stages, further confounding relationships Information flow. Utilizing the energy-efficient B.A.T.M.A.N using HWMP. Low-power long-range RF convention for routing sensor data. Hubs link devices to the cloud, bypassing the need for direct connections. The goal of this research is to increase our capacity to predict route quality. Several improvements to the algorithm will be investigated. In terms of throughput, access delay, CPU burden, and routing overhead, the results show that BATMAN outperforms OLSR. Additionally, efforts were attempted to use the unencrypted 802.11s, Open80211s, and Hybrid Wireless Mesh Protocol (HWMP) routing protocols with BATMAN.

Biography

Dr. M. Archana, an Assistant Professor in the Department of Information Technology at the Faculty of Engineering and Technology, Annamalai University, India. With 16 years of dedicated teaching experience, she has played a vital role in shaping future technologists and advancing research in information technology.

She completed her Bachelor's degree in Information Technology at Annamalai University in 2007, graduating as the top student. She then earned her Master's degree in Computer Engineering in 2011 and a Ph.D. in Image and Video Processing from the Department of Computer Science and Engineering in 2016, also at Annamalai University.

As an accomplished researcher and mentor, she has successfully guided four Ph.D. students in fields including networking, cloud computing, video processing, and IoT. She has published over 40 research papers in prestigious journals indexed by SCI and Web of Science, contributing significantly to these areas. Her work continues to make an impact in both academia and industry, reflecting her commitment to innovation and excellence in information technology education.

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Electrochemical-Piezoelectric Detection of Heavy Metal Ions in Potable Water using Ultrathin-Film of Functionalized Nanotubes and its Machine Learning Analysis

Parul Taneja[1,2,3], Raj Kumar Gupta[3] and **V. Majuladevi[3]**

[1]Department of Mechatronics Engineering, Symbiosis University of Applied Science, India
[2]Department of Water Resources Development & Management, Indian Institute of Technology Roorkee, India
[3]Department of Physics, Birla Institute of Technology and Science (BITS), Pilani, India

Water is an essential element that is fundamental to the existence of life on earth, thus making living impossible without it. Therefore, water quality analysis has been an intriguing area, where various types of sensors are utilized to monitor the water quality parameters such as pH, TDS, dissolved oxygen, etc. While, inorganic pollutants such as heavy metals are particularly of interest because they are mostly stable and non- biodegradable occurring in the environment, including the water. Therefore, they are not easily removed from water. The proposed work explores the development of a sensing platform by integrating piezoelectric and electrochemical-based two different techniques. In such a way, an electrochemical quartz crystal microbalance (EQCM) sensing platform was utilized to study the signature characteristics peaks of various metal ions such as cadmium (Cd), lead (Pb), and mercury (Hg) in aquatic medium. The ultrathin film of octadecyl amine functionalized carbon nanotubes was fabricated using the Langmuir Schaefer (LS) technique and implemented as a working electrode of an electrochemical cell for the detection of dissolved metal ions in aqueous medium. The ultrathin film of functionalized carbon nanotubes was fabricated at the air-water interface as well as studied its molecular orientation at air-water interface using Brewster angle microscopy (BAM). The cyclic voltammetry technique was chosen under the electrochemical cell for probing the redox characteristics of metal ions in the presence of electrolyte. The presence of electrolyte changes the pH of water to 4. The results obtained from the EQCM platform are utilized to train the machine learning model for the prediction of metal ions in the unknown water samples from their characteristic peaks.

Biography

Dr. Parul Taneja is a distinguished researcher specializing in sensor technology, IoT-enabled devices, and machine learning. She is currently an Assistant Professor at Symbiosis University of Applied Sciences, Indore. Previously, she held Postdoctoral Fellowships, 2022-2024 at IIT Roorkee, where she worked on two different IoT-based projects, including a smart irrigation system at Department of WRD&M of IIT Roorkee and a DST-funded smart device for brain kinematics monitoring, at Department of MIED of IIT Roorkee resulting in a patent published.

Dr. Taneja earned her Ph.D. in Physics from BITS Pilani, focusing on ultrathin nanomaterial- based electrochemical sensors for water quality assessment. She holds a Master's in Nanoscience & Technology and a Bachelor's in Electronics and Communication Engineering. Her expertise spans wearable sensors, electrochemical sensors, IoT integration, and machine learning, with proficiency in advanced techniques like Quartz Crystal Microbalance (QCM), Atomic Force Microscopy (AFM), and Electrochemical QCM.

Dr. Taneja is an active researcher, reviewer, and conference participant dedicated to advancing environmental monitoring and healthcare innovation

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Foam- Surfactant Template Synthesis of Nanomaterials for Boosting the Electrochemical Energy and Sensor Reactions

Mohamed A. Ghanem and **Abdullah M. Al-Mayouf**

Department of Chemistry, College of Science, King Saud University, Saudi Arabia

Engineering the electrocatalysts' nanoarchitecture, particularly the transition metal compounds with manometer size, shape, facets, and composition, significantly boosts the electrocatalytic activity of the electrochemical energy and sensor reactions [1-5]. This work demonstrates a novel chemical approach for the synthesis of mesoporous nanoarchitectures (nanoflakes, nanosheets) of transition metal (nickel, cobalt, copper) hydroxides (Figure 1) using double templates of surfactant self-assembled thin-film and foam of hydrogen bubbles (FST) concurrently produced by sodium borohydride reducing agent. The physicochemical characterizations show the nanomaterials exhibit high specific surface area and mesoporosity, various nanoarchitecture morphologies (nanoflakes and nanosheets), and compositions that can be varied in a controllable way through changes in the template compositions and deposition conditions. The electrocatalytic activity and stability of the new transition metal nanomaterials have shown significantly enhanced performance for the electrochemical energy and sensing reactions of methanol, urea, glycerol, and glucose oxidation as well as the water-splitting reactions of hydrogen and oxygen evolution. The electroactivity high-performance of the mesoporous transition metals nanoarchitectures is mainly derived from the high specific surface area and mesoporosity framework that provide efficient charge transfer, as well as mass transport of the electroactive species. The Foam- Surfactant Template (FST) synthesis approach has the advantages of a one-pot template applicable to the synthesis of a wide range of nanomaterials with various compositions and nanoarchitectures at room temperature for application in electrochemical catalysis, sensing and energy production and storage.

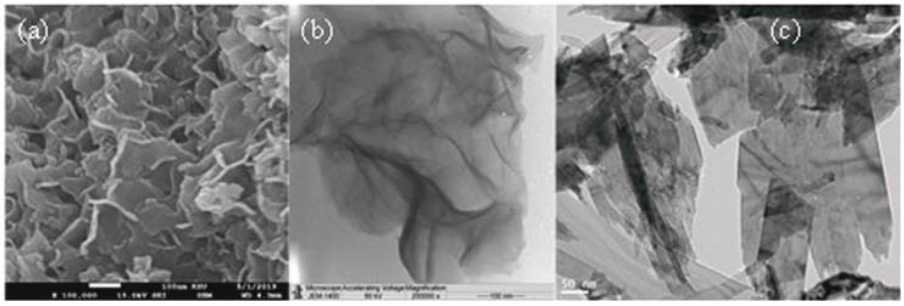

Figure 1 Scanning and transmission electron microscope images of nanoarchitectures of (a) and (b) Ni/$Ni(OH)_2$ nanoflakes and (c) CuO nanosheets

Biography

Prof. Mohamed A. Ghanem obtained his PhD in Chemistry in 2002 from the University of Southampton (UK) in the field of synthesis, characterizations, and applications of nanostructured materials. He works as a postdoctoral researcher at Southampton and Bath University (2003-2008). He joined King Saud University in 2012 as an associate professor. of physical chemistry and was promoted to full professor in 2017. His research interests focus on nanomaterials, fabrication, characterization, and applications for electrochemical sensors and energy production and storage. He acts as editor for the Journal of Saudi Chemical Society and was awarded the IAAM Medal in 2018 for notable and outstanding research in the field of New Age Energy Materials & Technology. He published about 150 papers, and five patents and his i10-index are 80 with 4800 citations. He has been included in the list of the top 2% of Scientists of Stanford University scientific index 2021-24 (chemical science) and awarded the IAAM Fellow title in 2022.

Study of Photocatalytic, Photodetection as well as Photovoltaic Studies Based on $Cd_x Zn_{1-x} S$ Nanoparticles

Satyajit Saha

Department of Physics, Vidyasagar University, Midnapore, India

Effective engineering of nanostructured $Cd_x Zn_{1-x}S$ materials provides scope to explore photoelectric phenomenon like Photocatalytic and Photudetection properties. In the present study CdS, $Cd_{0.7}Zn_{0.3}S$, $Cd_{0.5}Zn_{0.5}S$, $Cd_{0.3}Zn_{0.7}S$, ZnS nanoparticles are grown by chemical reduction route using THF as capping agent. The grown nanoparticles are charatcrerized through structurally (XRD, FESEM, EDX) and optically (Optical absorption, PL,TCSPC, Raman). X-ray diffraction peaks show that the transition from hexagonal phase to cubic phase as Zn content increases. Composition is specified through EDAX analysis. FESEM images show that surface morphology changes with change of composition. Optical absorption study shows that nanoparticles are formed and the band gap varies from 2.49 ev for CdS to 3.97 ev for ZnS. TCSPC study shows that PL lifetime decreases from 8.31 ns to 1.67 ns as the composition change from CdS to ZnS. Raman peak shift changes with change of composition.

Degradation of pollutant dyes like methylene blue is important for the need of fresh water. Semiconductor photocatalysis offers the potential for complete elimination of toxic chemicals through its efficiency and potentially broad applicability. We present a photocatalytic degrdation technique of Methyl Blue Dye using the grown nanoparticles $Cd_xZn_{1-x}S$ with varying x.We have shown how the photocatalytic activity changes 86%-25% with change of compositions in $Cd_xZn_{1-x}S$ .The results are explained how the change of nanostructures, band gap, PL life time in these nanomaterials play important role in photocatalytic degradation of Methyl Blue Dye.

$Cd_xZn_{1-x}S$ nanomaterials on n-type bulk silicon (Si) were deposited using spin coating method to fabricate hetero-junction photodetectors. The heterojunction is found to be highly sensitive to visible light irradiation with good I_{light}/I_{dark} ratio, quick response time (40ms

to 1005ms) and good reproducibility. The performance of the grown photodetectors with change of nanomaterial composition $Cd_xZn_{1-x}S$ are compared considering the properties like Responsivity, Detectivity, Response Time. Our aim is to grow good photodetectors out of these grown heterojunctions which can be useful in communication technology as well as sensors for safety monitoring.

Biography

Prof. Satyajit Saha joined in the Physics Department of physics Vidyasagar University in June 16th 1998. He was acting as a full-time faculty for 26 years. 13 scholars have completed PhD under his guidance. 8 scholars are working under his guidance. He has published more than 100 research papers in reputed journals. He acted as Head of Physics Department of Vidyasagar University from 2012-2014 and 2018-2020 in two phases. He acted as a Dean (Faculty of Science) of Vidyasagar University from 2020 (November) to 2024(January) he came among the best 2% scientists of the world by the list prepared by Stanford University this year.

He completed his Schooling from Midnapore Collegiate School with Pure Science in 1976. He completed his graduation with Honours in Physics from St. Xavier's College Kolkata in 1981. He completed MSc with Solid State Physics from IIT Kharagpur in 1984. He worked on CdTe Thin films and CdTe single crystals under the guidance of Prof. A.K. Chaudhury and completed PhD from IIT Kharagpur in1991. He also worked as a project officer.

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Development of Novel Spin-Controlled Optoelectronic Eco-Friendly and Energy Efficient *hybrid* Inorganic-Organic Heterostructure

Puja Dey[1,2], Apurba Pal[1] and **Nitish Ghosh[1]**

[1]Department of Physics, Kazi Nazrul University, India
[2]Centre for Organic Spintronics and Optoelectronics Devices, Kazi Nazrul University, India

Organic Opto-Spintronics is a promising field of research that explore the integration of high-speed operation of Optoelectronics and data storage capability of Spintronics in a single device to achieve futuristic *Multifunctional, fast* and *Energy Efficient* integrated memory-logic devices. Incorporation of organic-based materials addresses the problem of spin relaxation and poor spin injection, and promises *Eco-friendly* and *Energy efficient* devices.

Organic-based Opto-Spintronics combines the effect of light with the spins of charge carriers. Coupling of spintronics and optoelectronics has been carried out adopting two approaches, *i.e.*, *Magnetic field tuning of photo current and Optical tuning of spin valve effect to obtain Optospintronic effect*. In the first approach, in an attempt to obtain magneto-tunability of photocurrent, we have successfully deposited ZnO-Reduced graphene oxide (rGO) photodetector on ferromagnetic substrates. The heterostructures, thus formed are Si/$Zn_{0.3}Ni_{0.7}Fe_2O_4$/ZnO-rGO and Si/$NiFe_2O_4$/C_{60}/ZnO-rGO. We have studied tuning of photocurrent, generated in ZnO-rGO photodetector overlayer by the magnetization of the underlayer $Zn_{0.3}Ni_{0.7}Fe_2O_4$ and $La_{0.7}Sr_{0.3}MnO_3$ ferromagnetic substrate through magnetic field and light dependent A.C and D.C transport property. Both the heterostructures exhibit reasonably good opto-spintronic effect.

In the second approach, we have fabricated a coupled organic photodetector and organic spin valve, *i.e.*, a single Magnetic Organic Photodetector (MOPD) heterostructure, ITO/V[TCNE]x/(C_{60}/Rubrene)/Co/Au that exhibited both the photodetection and spin-valve effect, at room temperature. According to our experimental evidences, this MOPD shows photocurrent generation with 40% photocurrent to dark current ratio under illumination

of 660 nm red laser light. Also, it exhibits negative magnetoresistance as high as -25.85% under dark. Moreover, spin valve effect with peak up to 3% spin valve magnetoresistance is shown. Thus, this device can operate as an individual spin valve, and a photodetector. Significantly, coupling between spin valve and photodetector characteristics is observed for the first time in one of this MOPD device. Such “cross-talk” between optical response and spin valve property in a single device are highly significant for future development of novel optically controlled integrated memory logic devices, such as LiFi and *Electro-Optical Hybrid Computing* technologies.

Biography

Dr. Puja Dey is an Associate Professor in the Department of Physics and *Joint-Coordinator of Centre for Organic Spintronics and Optoelectronic Devices* at Kazi Nazrul University, Asansol, India. Dr. Dey received Ph D degree in Physics from Indian Institute of Technology Kharagpur, India. She has also received CNRS Post-Doctoral Fellowship from CNRS, Strasbourg, France. She has already published more than *70 research papers* and *three books*. Dr. Dey received three research grants from (i) *Department of Science and Technology India*; (ii) *Board of Research in Nuclear Sciences, Department of Atomic Energy, India and (iii) UGC-DAE CSR, Govt. of India. Dr. Dey has active International Collaboration with Virginia Microelectronics Center, ECE Department, Virginia Commonwealth University, Richmond, Virginia, United States* and *Centre National de la Recherche Scientifique (CNRS), Strasbourg, France.* Dr. Dey is involved in research activities in 2D materials like Topological Insulators, Multifunctional Materials, hybrid Inorganic-Organic heterostructure devices and Opto-Spintronics.

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Nanotechnology: An Emerging Field for Enhancing Micronutrient Enrichment in Millets *via* Biofortification Strategies-Present Knowledge and Prospects for the Future

Anbu Malar. M and **J. Sonya**

Stella Maris College (Autonomous) Chennai, India

Pharmaceutical supplementation and dietary fortification are the most common approaches to reducing vitamin deficits. To improve the health and nutritional value of crops, agronomic biofortification necessitates the direct application of nutrients. Producers using micronutrient fertilizers to increase the fortification of crops are essential to the success of biofortification. Overthrow malnutrition using biofortified millets notwithstanding their challenges. Millets stressors have been demonstrated to be reduced by artificial nanoparticles recently. Engineered nanoparticles (ENPs) have had their properties and functions has been reported recently. Several genes that are involved in maintaining an equilibrium of iron and zinc are genetically regulated in millet with nanoparticle formulations, resulting in even greater nutrient-by-default and stress-resilience. Millet, according to the study, is a micronutrient powerhouse because priming controls cereal iron and zinc absorption and enrichment even in the face of nutritional deficiency. This review examines millet, its health advantages, nano fertilizers, and initiatives to improve the crop production.

Biography

Dr. Anbu Malar. M is Head and Assistant Professor, Department of Food Processing and Quality Control, Stella Maris College (Autonomous), Chennai, India.

Her research interest is Nanotechnology in food, Fortification and enrichment of micronutrient in foods, Nutrient Bioavailability (*In vitro*) study, Antioxidant content of foods, Anticancer activity of foods, Bio film for food packaging, new food product development.

She has guided under graduate students in their research work focussing on "Food chemistry and analytical techniques for food".

She has published papers and articles in the area of research interest. She has presented and awarded as best poster/paper in various conferences and seminars. Academic audit member in various colleges.

Her poster was awarded as 'Best Poster' and received "Senior Scientist Award" in 2nd international workshop on micronutrients and child health held at All India Institute of Medical Sciences, New Delhi, Human Nutrition Unit, India.

Currently working with two different sanctioned projects one by MRF for the amount of 9,20,000/- to initiate incubation centre in the department. The other project was sanctioned by TNSCST for 2,40,000/-. Received SEED grant for 05 projects. Organised several programs the world record event on millet day which was organised for the students and faculty of Food Processing and Quality Control, Stella Maris College, Chennai preparing 752 millet recipes with 99 students and 04 faculty.

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Optimization of Process Parameters in Friction Stir Processing for the Development of Polymer-Derived Aluminium Matrix Composite

Sujith Kumar Kavanur Ramesh, Jagathram S[1] and Govind Kumar[2]

[1]PES University, India
[2]Indian Institute of Science, India

Friction stir processing (FSP) is a solid-state process to develop metal matrix composite. It is a severe plastic deformation process which is well capable of fracturing the reinforced particles and distributing them into the matrix material. But the process parameter in FSP is always a critical part to get a defect free sample. In this work, effort has been made to optimize the process parameters for different volume fractions of reinforcement. For the development of the Aluminium based composite, a special kind of reinforcement called PMHS (polymethylhydrosiloxane) was used. PMHS comes under the category of polymer-derived ceramic (PDC) materials which on heating at a particular temperature for a certain time converts into ceramic. For the current investigation, different amounts of reinforcement were being incorporated into the commercially pure (CP) Aluminium metal. First the processing was done keeping the parameters unchanged for different volume fractions of reinforcement and then the processed samples were characterized. It was found that the compatibility of mixing was not satisfactory for all the experiments with varying volume fractions. This is also well understood from the torque data obtained from the machine. It is inferred that the processing parameters should be different and need to be optimized separately for varying volume fraction experiments.

Biography

Sujith Kumar Kavanur Ramesh is a postgraduate Mechanical Engineer specializing in advanced materials and manufacturing techniques. With research experience at the Indian Institute of Science, he has explored Friction Stir Processing and Polymer-Derived Ceramics (PDCs) for lightweight aluminum composites. His work on optimizing process parameters for polymer-derived aluminum matrix composites has been recognized by the Indian Society of Mechanical Engineers and published in "Recent Advances in Materials and Manufacturing." Sujith is passionate about sustainable material solutions and innovative engineering design.

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Methods of Application of Nanoscale Coatings on Textiles

Anjali Agrawal[1], Kunal Singha[1] and **Abhijit Mukherjee[2]**

[1]Department of Textile Design, National Institute of Fashion Technology, India
[2]Department of Fashion Technology, National Institute of Fashion Technology, India

Nanotechnology, which is over many years old, is no longer cutting-edge. Nanotechnology is expected to impact material science, materials processing technology, mechanics, electronics, optics, medicine, energy and aerospace, polymers, and textiles. This young technique is improving textile performance and drawing global interest. Revolutionary nanotechnologies in textiles enable a wider range of attributes with new and enhanced usage. Nanotechnology can improve or create new functionality.

In its many uses, nanotechnology benefits the textile industry. Nanocomposites, nanofibers, and smart polymeric coatings are being used in high-performance applications and conventional textiles to add functionality and improve performance. Nanotechnology in textiles improves reproducibility, dependability, and toughness. Functionalization of nanoparticles during textile production phases including dyeing, finishing, and coating improves product performance and provides unattainable functionality.

Due of its diverse applications across a variety of fields, nanotechnology is still the study area with the fastest growth. The textile industry has also taken use of this opportunity to provide new functionalities and improved performances in place of conventional fabrics. A hybrid approach to textile engineering, nanotechnology-based textile coatings rely primarily on the use of innovative techniques and materials at the nanoscale level to generate smart finishing. Nanoscale textile coatings have been used regularly to create variety of textile coating techniques such as plasma treatment, conformal inorganic nanoscale coating, zinc oxide anno particle based antimicrobial textile finishing, nanoscale silver coating, TiO_2 based UV protective nanoscale coating, ZnO/epoxy resin based superhydrophobic coating with a rapid healing ability etc. A thorough examination of applications has been discussed

in chapter. Additionally, emerging ideas for novel textile coatings at the nanoscale are also explained

This chapter's precise objectives are as follows:

1. To investigate various conventional and latest methods of nanoscale coatings on textiles.

2. To research and identify diverse applications of nanoscale coatings in the field of textiles.

Biography

Anjali Agrawal, is an Assistant Professor in Department of Textile Design at National Institute of Fashion Technology, Kolkata, India. She published a number of research papers in the journals of national and international repute. She is also co-editing 4 books in Apple Academic Publishing (AAP), Taylor & Francis and has been a supervisor to a number of PhD scholars.

Kunal Singha, is currently working as Assistant Professor in Department of Textile Design at National Institute of Fashion Technology, Kolkata, India and published over 230 Papers in national/international journals/books chapter/conferences and co-edited/co-authored 9 books in Wiley, Elsevier, Apple academic publishing (AAP), Taylor & Francis, Springer, Textile Institute-CRC-Woodhead, Apple Academic Press and Lambert Pub.

Abhijit Mukherjee, is currently working as Associate Professor in the Department of Fashion Technology at National Institute of Fashion Technology, Kolkata, India. He has published several research papers along with several years of research experience.

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Research about Silicon Based GaN Devices and the Related System

Hongyu Yu[1,2]

[1]Southern University of Science and Technology, China
[2]Shenzhen Polytechnic University, China

Owing to the exceptional material properties, third-generation semiconductors like GaN and SiC are recognized as the linchpin of new-generation technology, energy efficiency, and smart manufacturing. Dr. Yu shall report the following research achievements of his group in the area of "GaN-on-Si Devices and the related system". 1) Enhanced GaN HEMTs performance through innovations, such as ultra-low ohmic contact, advanced ALE etching technology, and surface treatment; 2) Developed GaN power devices and systems, enabling high-efficiency PFC industrial GaN power supplies ranging from 65W to 4000W; 3) Designed GaN RF devices and power amplifiers, including a high-efficiency Doherty power amplifier for micro-base station applications.; 4) Worked on ultra-wide bandgap Ga_2O_3 SBD and MOSFET devices, paving the way for higher voltage and power electrical applications; 5) Fabricated GaN gas sensors with highly sensitive detection of CO, H_2S, H_2, and particles in high-temperature and challenging environments.

Biography

Dr. Hongyu Yu is a professor at Southern University of Science and Technology (SUSTech) and the Dean of School of Microelectronics. His research is focused on the integrated circuit technology and devices, including CMOS, new ultra-high density memory, GaN device and system integration as well as electronic ceramics. He published nearly 450 academic papers (H-index: 46). He has also edited two books and contributed chapters of four professional books, published/authored nearly 28 US/European patents and more than 80 domestic patents.

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Has Knowledge Economy a Role to Play in Transfusion Medicine?

Cees Th. Smit Sibinga

University of Groningen and IQM Consulting, Netherlands

The history of blood transfusion has been dominated by the search for compatibility for species specificity, the search for how to transfer blood from one individual into another or infuse. Safety has become a major issue since it became clear that blood was not only able to allow mystical miracles to take place but could transmit infectious diseases. The science behind these ideas reflects observation, a thinking and exchange of knowledge and skills, originally documented in reports or case studies of what has happened and was observed, and peer presented – knowledge economy (KE).

In Transfusion Medicine (TM), like other fields in life, there are according to UNDP, four basic indices of human development (HDI) to distinguish – Low HDI, Middle HDI, High HDI and Very High HDI measured by the state of development of health, education and income per capita expressed as an Index. These HDIs are dynamically changing to which knowledge economy or education plays an important role: sharing knowledge and providing a structured education anchored in a legislative system (governance) with sustained educational environment (infrastructure) and climate (attraction).

Unfortunately, most development programs are not focused on the broader picture, have a limited lifetime and are budget and time dependent for implementation by the provider.

However, education, quality and outcome-based, remains the essence to overcome this situation. Knowledge economy could play a paramount role in updating the meagre and fragmented knowledge of those already practicing.

Biography

Prof. Cees Th. Smit Sibinga, MD, PhD, FRCP Edin, FRCPath

Cees Th. Smit Sibinga is a University of Groningen graduate (1965), clinical haematologist (1971), PhD University of Groningen (1972) and specialist of Transfusion Medicine (1975); FRCP Transfusion Medicine Edinburgh 1992, FRCPath Transfusion Medicine London 1995.

He is special professor of International Development of Transfusion Medicine at the University Medical Centre Groningen and University of Groningen. He has been involved in the development of Transfusion Medicine and quality systems and management for economically restricted (poor economics) countries since 1980 through his work with the World Health Organization (WHO), the World Federation of Haemophilia (WFH) and the International Consortium for Blood Safety (ICBS).

Prof. Smit Sibinga has organized 28 well reputed international symposia on Transfusion Medicine in Groningen, published over 400 peer reviewed scientific articles and chapters in books, and edited/authored over 45 books. He published and presented countless scientific abstracts for posters and orals at numerous international professional congresses and meetings.

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Design of Accessible Educational Tools for Independent Learning by Persons with Blindness

Richa Gupta

Indraprastha Institute of Information Technology Delhi, India

Blindness or visual impairment is a significant barrier to independent learning. While there have been advancements in assistive technologies, there remains a critical need for tailored tools that empower individuals with blindness to access and navigate educational materials independently. This gap was particularly amplified during pandemic when students primarily relied on self-learning with some limited teacher interactions. During lockdown, the schools would have to send accessible material to each student's residence, which poses a logistical nightmare. Not to mention the added costs of handling and delivery.

The proposers of this project are committed to addressing this issue and providing equitable learning opportunities for this marginalized community. Through this project, we are trying to make widely and easily available printed text books accessible with audio tagging and digital annotation with gesture-based retrieval using Machine learning models and Augmented Reality using the hardware which is already existing in most homes, *i.e.* smartphone. This tool will address the lack of affordable, digital and accessible educational resources for independent learning by students with visual impairment particularly for remote/self-learning scenarios which allows multi-modal interaction for enhanced learning experience.

With this tool, we will be able to superimposed several layers of digital audio information on one tactile map as well as provide audio annotation for printed books resulting in affordable access and dissemination of learning materials to students as printed NCERT books are available at low cost in many stationery shops across the country. This will reduce dependency of students with visual impairment on specially created tactile learning resources which are both heavy in weight and expensive.

Biography

Dr. Richa Gupta is currently working as Assistant Professor and Head of Department of Human Centered Design, Indraprastha Institute of Information Technology Delhi (IIIT D) and teaches courses on Inclusive Design and Accessibility and Product Design & Prototyping. She completed her Ph.D. from IIT Delhi jointly with Indiana University, USA and her doctoral research investigated haptic perception for enabling accessible graphic and spatial design.

She has also worked as a Visiting Professor at Nagasaki University, Japan. She is the principal researcher at Accessibility & Inclusive Design Lab at IIIT Delhi. She contributed to the design and development of several award-winning translational research projects for persons with blindness as a Project Scientist at AssisTech Lab, IIT Delhi. She was awarded the Neilom Prize for contributions towards the empowerment of persons with disabilities by Neilom Foundation, Maryland. She has also been an IGNITE fellow at Stanford Graduate of Business.

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Structural and Optoelectronic Properties of Newly Designed Lead Halides PbXY (X, Y = F, Cl, Br, I) Janus Layers: DFT Study

Anjana E. Sudheer[1], Golla Tejaswini[1], Matthias Posselt[2] and **D. Murali[1]**

[1]Department of Sciences, Indian Institute of Information Technology Design and Manufacturing, India
[2]Helmholtz-Zentrum Dresden-Rossendorf, Germany

The solar-mediated photocatalytic water splitting mechanism is considered an efficient method to produce hydrogen fuel in an environmental friendly way. The efficiency of this overall water-splitting reaction mainly depends on the productivity of the photocatalyst. Among different low-dimensional materials, 2D materials are well explored for the design of photocatalysts due to its tunable bandgap, suitable band alignments, large carrier mobility and the presence of active sites which can act as reaction sites. However, the ideal efficiency range is limited to these materials due to the possibility of carrier recombination. By introducing built-in polarization in the out-of-plane direction of these 2D materials, it is possible to improve the lifetime of the charge carriers. This will enhance the hydrogen production efficiency of the photocatalyst. In this scenario, we design a novel class of Janus structures PbXY (X, Y =F, Cl, Br, I) by modifying Pb-based 2D halide structures. The designed 2D Janus structures show broken symmetry due to the different electronegative surfaces, which leads to the the built-in electric field in the out-of-plane direction. We ensure the stability of the designed material through formation energy, phonon calculations and ab initio molecular dynamical (AIMD) simulations. The electronic properties are explored using GGA and HSE functionals. The low effective mass and high carrier mobility of the charge carriers may help to enhance the charge transport in the material. Breaking of centrosymmetry, covalent bonding along the z-direction, polarization in the out-of-plane direction, the z-oriented orbitals of CBM all point that these materials are suitable for photocatalytic water splitting reactions. The calculated optical absorption spectra show that the Janus structures are suitable for visible light absorption. Finally, we show that combining both potential difference and HSE bandgap, valence band maximum(VBM)

and CBM straddle the water redox potentials, thus making the Janus structures suitable for hydrogen evolution reaction(HER) and oxygen evolution reactions(OER) on the opposite sides of the Janus structures.

Biography

Anjana E Sudheer, currently a PhD student, conducting her research under the guidance of Dr. D. Murali Department of Sciences at the Indian Institute of Information Technology Design and Manufacturing Kurnool, Andhra Pradesh, India. Anjana completed her master's degree with a fair CGPA of 7.35/10 (73.5%), from the Central University of Kerala, India and qualified for GATE-2021. She embarked on her research career in 2021, specializing in Density Functional Theory (DFT) simulations. Her research primarily focusses on the design and prediction of novel nano structures for optoelectronic applications, with recent work involving the computational design of post transition metal-based Janus structures. She explored the electronic and optical properties of the materials and found that it is suitable for potential application like photocatalytic water splitting hydrogen production and photovoltaic applications. Through her research work she aims to contribute to advancement in sustainable energy.

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Update on Nasopharyngolaryngoscopy in Head and Neck Surgery

Hugo Galera-Ruiz[1] and **Nick Gibbins**[2]

[1]Otolaryngology, University of Seville, School of Medicine, Spain
[2]University Hospital Lewisham, UK

Flexible nasopharyngolaryngoscopy (FN) of the head and neck has revolutionised otolaryngology and allows detailed examination of the naso-, oro-, and hypopharynx as well as the larynx in relative comfort for the patient and with a high degree of definition. A quick, accurate diagnosis helps guide the surgeon towards appropriate investigations and formulating an individualised treatment plan.

This presentation will update on more recent extended uses of the endoscope that have become more commonplace, such as transnasal oesophagoscopy (figure 1), using a channelled endo scope to perform in-office biopsies or treatments, or using alternate imaging modalities that have been more recently pioneered that may help with the diagnosis of mucosal lesions.

FN has revolutionised the examination of the upper aero-digestive tract and the scope of use has now extended beyond the confines of pure examination into the treatment of pathology.

In-office procedures are becoming more commonplace and as technology advances. However, the caveat is that none of these will be possible without good knowledge of the equipment and sound FN examination technique by the clinician. Whenever a clinician thinks that a technique has been mastered, it is always worth going back to the basics to check.

More technology will surely be incorporated into the software available on the FN equipment so that a patient will be able to undergo an array of diagnostic investigations in the outpatient setting followed by a biopsy. In one visit, it may be possible for the patient to get

a complete diagnosis and a treatment plan. The future of out-patient endoscopy is very bright.

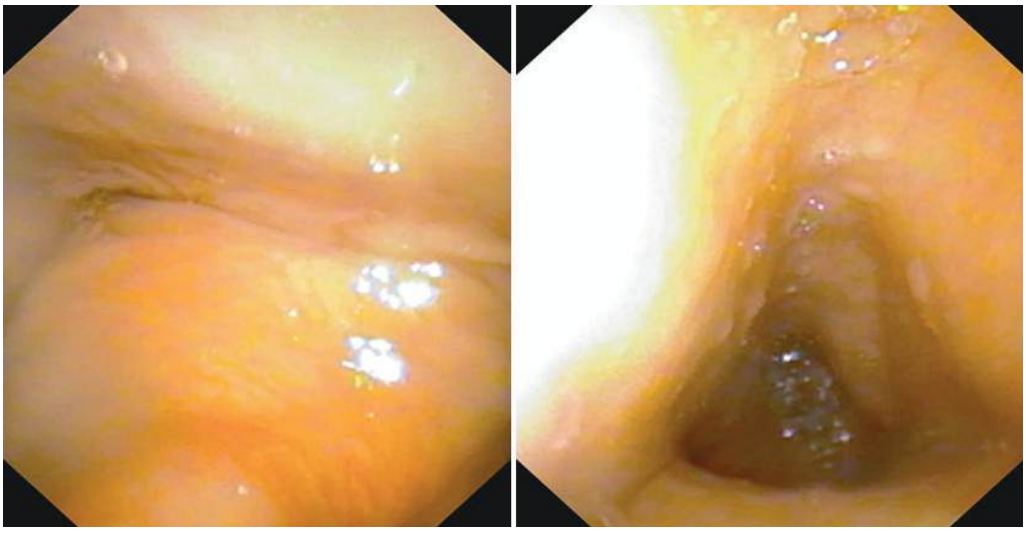

Figure 1: A. Killians space closed. B. Cervical oesophagus.

Biography

Otorhinolaryngologist with more than 20 years of experience in laryngology and head and neck surgery with special interest in new technologies and minimal invasive procedures. His training was done between the United States (Philadelphia and Boston, 1993-1996) and the Hospital Universitario Virgen Macarena in Seville where he work as an attending physician since 2001 and as a Tenured Professor since 2010. During his American stage in Boston, he coincided with Drs. Strong and Vaughn, who introduced the laser in ENT.

He is an examiner of the European BOARD of the specialty since 2010, having also acted as a mentor, leader in rhinology and member of the governing body, which has made an Honorary Fellow and Medal of the institution. Corresponding Academician of the American Academy of Otolaryngology since 2000 having participated in the Committee on Facial Plastic Surgery in two different mandates and finally member of the Royal Academy of Medicine and Surgery of Seville, the dean in Europe.

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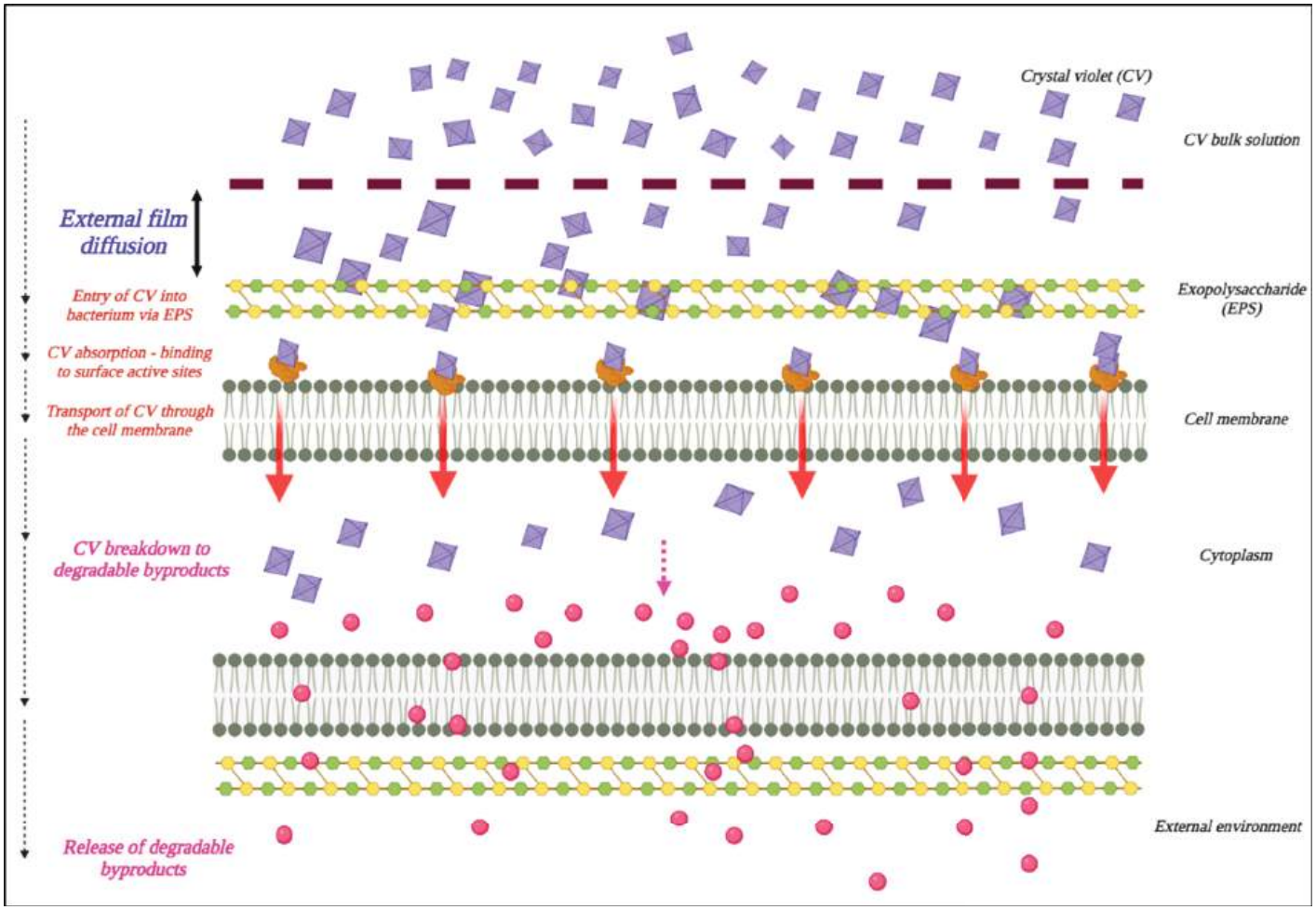
Role of Pesticide Degrading Bacterium, *Rhodococcus Biphenylivorans*, in Breaking Down Crystal Violet Dye

Sirajunnisa Abdul Razack[1], Shanmugavel Sadhanandham[2], Geethalakshmi Ramakrishnan[2], Anchalee Prasansuklab[1] and **Renganathan Sahadevan[2]**

[1]College of Public Health Sciences, Chulalongkorn University, Thailand
[2]Bionanoparticles Laboratory, Centre for Biotechnology, Anna University, India

Synthetic textile dyes are generally recalcitrant compounds whose effluents cause malicious effects to the terrestrial and aquatic ecosystems. The present investigation is an evaluation on utility of a biphenyl degrading bacterium, *Rhodococcus biphenylivorans* SN6, for breaking down a textile dye, crystal violet. The organism was isolated from a bacterial consortium of sewage water. The molecular identification and phylogenetic analysis indicated that *Rhodococcus biphenylivorans* SN6 was 100% like the other *R. phenylivorans* strains. The process parameters namely the dye concentration, biosorbent concentration, pH and temperature were optimized for examining their influence in the maximum decolorization. The standardized conditions for better decolorization of crystal violet yielded a maximum efficiency of 84.118% over a period of 24h. The kinetic studies and adsorption isotherms were performed along with its thermodynamics. The experiment followed a pseudo second order kinetics (R^2: 97%) and befitted the Langmuir isotherm model (R^2: 96%) with Q_{max} as 1250 mg. g^{-1} indicating a monolayer adsorption of dye on the culture. The thermodynamic parameters revealed that the decolorization was endothermic. Enzyme kinetic analysis demonstrated that the experimental study well fitted the Lineweaver Burk model. Thus, the present study suggested that the aerobic organism could be used as a biosorbent to treat dyes and respective effluents.



Biography

Sirajunnisa Abdul Razack, PhD, is a Post-Doctoral Researcher in the College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand. She has nearly fourteen years of research experience in the areas of renewable energy from microalgae, nanomaterials and polymers from biological resources and their environmental, food and biomedical applications. Her current research arena is use of nanomaterials as drug vehicles against neurodegeneration diseases and cancer illnesses. Allied research include bioremediation using bacterial sources and preservation of meat using bioindicator incorporated films. She has published around 35 research articles and 11 book chapters (h-index: 21; citations: 1257; google scholar) with Elsevier, Springer and Taylor and Francis publishing houses.

On Analytical Solutions of a System of Nonlinear Partial Differential Equations

Kholiknazar Kuchakshoev

University of Central Asia, Tajikistan

Differential equations, especially nonlinear partial differential equations (PDE), have wide applications in many fields of science. In general, for nonlinear PDEs and systems of PDEs, the existence and uniqueness theorem and numerical solutions are considered. In this study, we consider the analytical solutions of a system of nonlinear PDEs. We use the Hopf – Cole transformation and method of transition to new variables. We found some analytical solutions of a system of nonlinear PDEs in one - dimensional and n – dimensional cases. The analytical solutions will help to derive new properties of the solution of the system of PDEs, and they can be applied in the approximation of numerical solutions.

Biography

Dr. Kholiknazar Kuchakshoev is an Associate Professor of Mathematics at the University of Central Asia (UCA), School of Arts and Sciences in Khorog campus, Tajikistan. He brings over fourteen years of teaching experience in various higher education roles. Prior to joining UCA, Dr. Kuchakshoev worked as a math teacher in a gymnasium and as a Math instructor in the UCA's School of Professional and Continuing Education in Dushanbe, Tajikistan.

He taught Math at the Russian-Tajik (Slavonic) University and has held various positions including Deputy Dean for Instructional Works and Vice-Executive Director for Science and social issues affiliated with the Moscow State University in Dushanbe.

Dr. Kuchakshoev also worked as a Science researcher with the Institute of Mathematics in Dushanbe, Tajikistan. He holds a PhD in Mathematics from the Institute of Mathematics in Dushanbe, Tajikistan.

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An Interplay of Artificial Intelligence-Based Customer Analysis on the Performance of Customer Relationship Management in Organized Retail Outlets: Serial Mediation Approach

R. Swaranalatha and **K. Karthikeyan**

PSG College of Arts & Science, Coimbatore, India

Artificial Intelligence (AI) is a disruptive technology becoming pervasive in the manoeuvers of organized retail outlets in this contemporary retail business world. Many Retail firms have started using Artificial Intelligence in core retail functions to provide personalized customer services, impressive store experience and for detecting fraudulent practices. It supports in reaching out and engaging customers, managing the customer profiles, processing their demographics and analyse them for various decision-making purpose related to the customers in the automated system. AI supported Customer Relationship Management (CRM) practices are found to have a significant impact on the retail business performance in managing customer interactions successfully and providing scintillating user experience. Based on the review of earlier research studies, Research gap was identified and hence attempt was made to explore the impact of Artificial Intelligence based customer analysis on CRM performance through the mediating role of Customer Centric Business Strategies in the organized retail sector in Coimbatore city. This empirical study was carried out through the primary data, which was collected from 267 Store managers, CRM Managers and Brand Managers in the organized retail outlets of Coimbatore city through a structured well-defined questionnaire. Data analysis done through AMOS 26.0 and Serial Mediation Model 6 revealed that Customer behaviour and Customer focused retailing strategies have significant mediating effect between AI based Customer analysis and CRM performance. This study could support the retail firms to understand the extent of impact of AI based customer analysis on CRM performance and help in designing suitable strategies to evolve themselves in tune with the changing trends and technology.

Biography

Dr. R. Swaranalatha is currently serving as the Associate Professor & Head in the Department of Management Sciences-Retail Management at PSG College of Arts & Science, Coimbatore India. She did her Under graduation – B.Sc. (Agriculture) and her Post graduation in MBM from Tamil Nadu Agricultural University, Coimbatore. She won Dr. C. Subramaniam Gold Medal for being the Best Student in MBM during 1994-1996 at TNAU, Coimbatore. She pursued her PhD in Management from Krishnammal College for Women. She has 18 years of experience in teaching Strategic Management and Entrepreneurship Development in the management domain. She has submitted more than 40 research papers in reputed journals and has won Best Research Award for papers presented in the Conference held at several institutions like Loyola College, VIT, SRM University, Hindustan Institutions, Etc. She has been assigned with several responsibilities in the institution and works for the betterment of the student community and society.

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D.A Pospelov Identified in 1996 Ten "Hot Spots" in the Field of AI

A. N. Averkin and **B. A. Kobrinskii**

Federal Research Center "Computer Science and Control" of the Russian Academy of Sciences, Russia

The widest range of scientific interests of Dmitrii Aleksandrovich Pospelov included numerous problems of artificial intelligence of a methodological and applied nature, management of large systems, the search for new unconventional approaches in computer architecture, and much more. Artificial intelligence is considered as a synthetic science at the intersection of computer science, applied mathematics, systems theory, control theory, logic, philosophy, psychology, and linguistics. To make decisions in intelligent systems, he proposed deductive, inductive, and plausible models that take into account the peculiarities of human reasoning. He analyses cognitive graphics in the context of correlating texts and visual pictures through a general representation of knowledge. Of particular importance was the development of pseudo-physical logic to describe human perception of processes occurring in the real world, which can be represented, in particular, by the logic of relations and logic on fuzzy metric and topological scales. In applied semiotics, processing, and using knowledge in solving various problems; such semiotic systems are open, focused on working with dynamic knowledge bases, and implementing various aspects of the logic of reasoning.

Looking beyond the horizon, Pospelov identified in 1996 ten "hot spots" in the field of AI, a kind of attractors around which, in his opinion, the main efforts of specialists in the field of AI will be concentrated at the end of the outgoing and the beginning of the new 21st century [1]. These include: transition from inference to argumentation; the problem of justification; generation of explanations; search for relevant knowledge; understanding texts; text synthesis; cognitive graphics; metaknowledge; network models; multi-agent systems. This forecast is generally justified.

[1] D. A. Pospelov, “Ten hot spots in artificial intelligence research,” Intellektual’nye Sist., No. 1, 47–56 (1996).

Biography

Alexey Nikolaevich Averkin (b. 09.01.1949) – PhD, Leading Researcher of the Dorodnitsyn Computation Center of the Federal Research Center “Computer Science and Control” of the Russian Academy of Sciences. Member of the Scientific Council of the Russian Association of Artificial Intelligence. Published more than 200 scientific papers and 5 monographs, including an explanatory dictionary on AI in collaboration with D.A. Pospelov. Within the problem area of artificial intelligence created with a hybrid neuro-fuzzy model to describe the functioning of a biological object, a methodology for constructing hybrid information intelligent decision support systems based on parametric logics. Developed the basic principles of a new integrated direction of soft measurements, combining general issues of theory and practical applications of soft computing and smart measurements in conditions of significant information uncertainty in complex man-made and natural systems, based on modular and deep neural networks and neuro-fuzzy models of explainable artificial intelligence.

Boris Arkadievich Kobrinskii (b. 28.11.1944) PhD, Dr. med. sci., professor, Honored scientist of the Russian Federation, Head of the Department of Intelligent Decision Support System of the Federal Research Center “Computer Science and Control” of Russian Academy of Sciences, Chairman of the Scientific Council of the Russian Association of Artificial Intelligence. Published more than 400 scientific papers, 7 monographs and 3 textbook of higher school. Within the problem area of artificial intelligence in the 1980s created expert diagnostic system for hereditary diseases "DIAGEN" for 1200 diseases, including elements of fuzzy logic. Developed a modified version of confidence factors for assessing individual attributes of features with subsequent integration and engineering of imagery rows. The concept of a hybrid intelligent logic-and-linguistic-and-image system based on the combination of an expert system and a neural network with a meaningful explanation is proposed.

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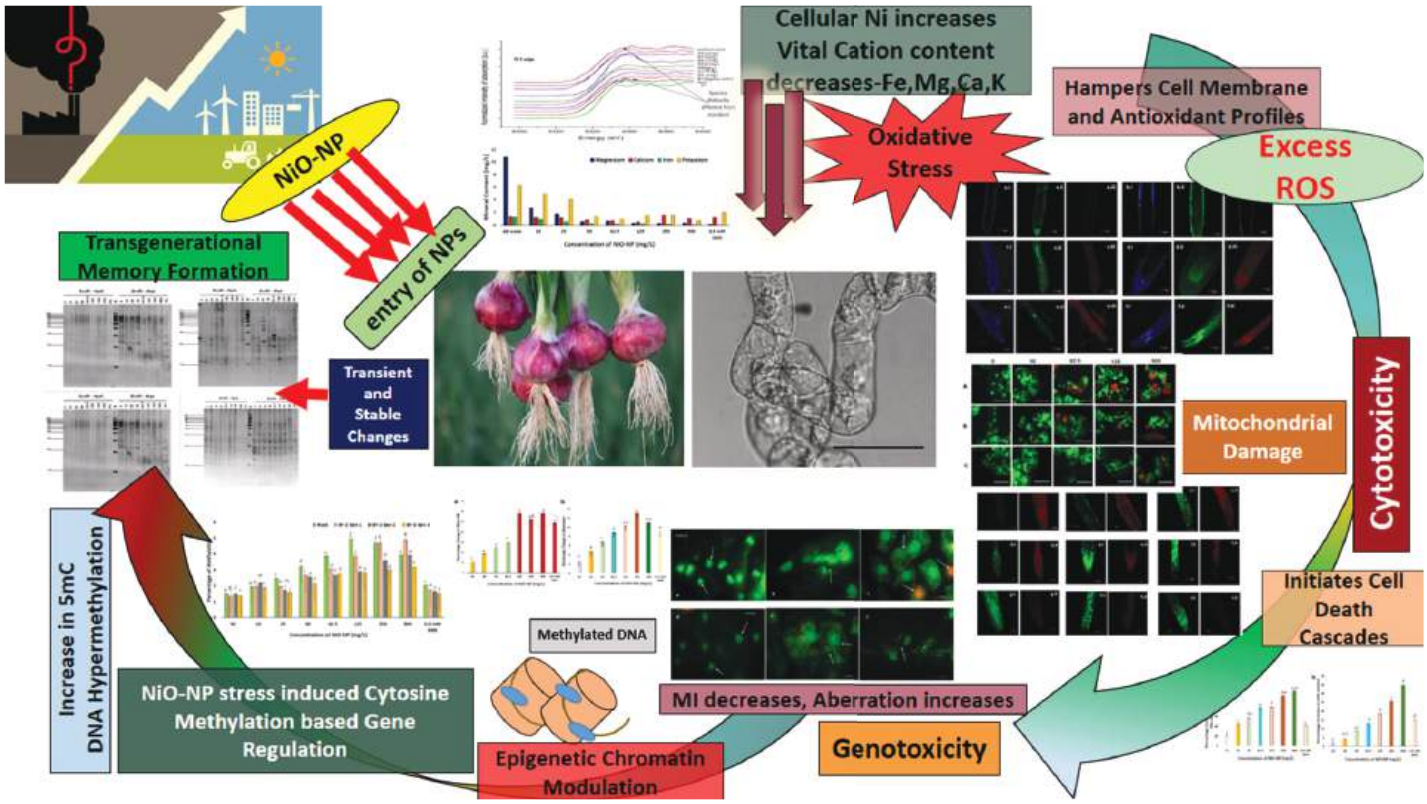
Insight into the Dynamics of NiO-Nanoparticle Induced Methylation Changes and Cell Death Mechanisms in Plant

Indrani Manna[1], Saikat Sahoo[2] and **Maumita Bandyopadhyay[3]**

[1]Institute of Health Sciences, Presidency University, India
[2]Krishna Chandra College, India
[3]Department of Botany, University of Calcutta, India

Nickel oxide nanoparticles (NiO-NPs) is recognized by WHO as a carcinogen that brings in significant phenotypic and physiological damage to plants. The present study demonstrated that exposure to escalating concentrations of NiO-NPs triggered various cell death pathways in model plant systems, *viz*. *Allium cepa* and tobacco BY-2 cells. Further, we found that NiO-NPs induced alterations in global CpG methylation, with evidence of transgenerational transmission in the affected cells. Plant tissues subjected to NiO-NPs exhibited a gradual replacement of vital cations, such as iron and magnesium, as indicated by XANES and ICP-OES analyses, which provided indications of disrupted ionic balance. Confocal microscopy utilizing fluorescent dyes confirmed an increase in hydrogen peroxide and nitric oxide levels following NiO-NP exposure. Dose dependent activation of cell death pathways was noted, particularly autophagosomes were observed in samples treated with lower to moderate concentrations (10–125 mg L^{-1}NiO-NP). Presence of the apoptotic cell death marker, caspase-3-like protein, was detected at medium to high doses (50–500 mg L^{-1}), while the leakage of lactate dehydrogenase, indicative of necrotic cell death, was noted in samples exposed to the highest concentrations (125–500 mg L^{-1}) of NiO-NPs. A concomitant rise in DNA hypermethylation, quantified through an ELISA-based assay, and genomic DNA damage, assessed *via* Comet assay, was observed at elevated doses of NiO-NPs. MSAP profiling confirmed that the NiO-NP induced global methylation alterations occurring in the parental generation, were passed down through two subsequent generations of BY-2 cells, a finding also supported by data from *A. cepa*. Therefore, exposure to NiO-NPs leads to

DNA hypermethylation because of oxidative stress, resulting in the activation of autophagy, as well as apoptotic and necrotic cell death pathways. The global methylation changes induced by NiO-NP exposure can be inherited across successive cell generations.



Biography

Indrani Manna is currently a postdoctoral fellow working at IHS, Presidency University, Kolkata, under the flagship postdoctoral program of the Government of India, DST-ANRF (formerly SERB) NPDF Scheme. In 2022, she received her doctorate from the University of Calcutta, where she studied the effects and toxicity of engineered nickel oxide nanoparticles on plants. She has been studying the nuances of the abiotic stress response in plants for more than 8 years. Her expertise and interest lie in the interaction of plants with heavy metals, soil salinity and artificial nanoparticles, with a focus on changes at the cellular and molecular levels (*viz*. mitochondrial changes); ROS-RNS cascades and their interrelationships; cell death cascades in plant models; cytogenetics; epigenetics and stress memory retention; trans-generational effects of epigenetic changes in plant models. Currently, she has published more than 15 publications as a first author, including original research, reviews, and book chapters.

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Applications of Machine Learning and Deep Learning in Pavement Crack Detection and Characterisation: A Comparative Approach

Harris Khan and **Mustafa Alas**

Faculty of Civil and Environmental Engineering, Near East University, Turkey

Cracking in asphalt pavement structures is one of the major forms of deterioration that not only jeopardises the traffic safety but also compromises the durability and serviceability of the roads. Traditional crack evaluation techniques involve manual human field surveys, which has major flaws such as, requirement of intensive labour force and time, poor repeatability and reproducibility of the data and data collection method and subjectivity of the rating measured by the individual surveyor. Accurate detection and characterisation of the extent of cracking is crucial for the maintenance and longevity of pavement infrastructure. Recently, machine learning (ML) and Deep Learning (DL) methods have arisen as an instrumental tool for crack detection and characterisation. The current study provides a comprehensive analysis of the ML and DL applications in crack identification and characterisation to enable a data-driven pavement management system. A number of machine learning techniques such as; Support Vector Machines (SVM), Artificial Neural Networks (ANN), Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN) and deep learning (DL) techniques were analysed for their suitability in identification of pavement cracks and their extent. The article delves into crack identification and characterisation by focusing on object detection, classification and segmentation methods. Furthermore, the current study discusses the performance evaluation metrics and provides case studies by highlighting the successful application of ML and DL techniques for crack identification and characterisation.

Biography

Harris Khan is a dedicated researcher and professional in the field of civil engineering, specializing in infrastructure maintenance and innovative solutions. With a strong background in construction management and advanced analytics, Harris has contributed to developing data-driven strategies for optimizing pavement performance and durability. He holds a master's degree in construction management and has presented research on various international platforms. Harris's expertise in machine learning and deep learning applications positions him as a thought leader in modern infrastructure solutions.

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Degradation of Energetic Material 2,4,6, Trinitro Toluene using Integrated Approach

Garima Upreti[1], Avantika Shukla[2], Bhumika Sharma[3] and **Anil K Haritash[1]**

[1]Environmental Microbiology and Bioremediation Lab, Department of Environmental Engineering, Delhi Technological University, India

[2]Department of Applied Science and Humanities, Indira Gandhi Delhi Technical University for Women, India

[3]Cranfield University, Centre for Defence Chemistry, Defence Academy of the United Kingdom, UK

TNT red water poses a serious threat to all living organisms due to its toxic, carcinogenic, and mutagenic nature, as well as its resistance to biodegradation. Among the various treatment methods explored, advanced oxidation processes (AOPs) have shown promise as a sustainable solution. This study investigated the integrated use of zero-valent iron (ZVI), Fenton oxidation, and AOP for the degradation of TNT red water. Treatment efficiencies were assessed by measuring chemical oxygen demand (COD), nitrate, and nitrite concentrations using a UV-VIS spectrophotometer. Three chemical treatments were evaluated. Sodium hypochlorite proved effective in decolorizing TNT red water, enabling further processing with AOP. The combined hypochlorite-AOP treatment emerged as the most effective, as it decolorized the water without leaving harmful precipitates that burden the environment. In contrast, Fenton and ZVI treatments required filtration before AOP, leaving precipitates behind. UV-VIS analysis revealed the complete absence of TNT or TNT red water peaks (227 nm and 219 nm), indicating successful degradation. Further assessment showed increased nitrate and nitrite concentrations, signaling the extent of degradation. While Fenton's treatment yielded the highest nitrate levels, hypochlorite-AOP treatment resulted in significantly elevated nitrite levels, indicating superior degradation efficiency. The findings highlight hypochlorite-AOP as the most environmentally friendly and effective chemical approach for treating TNT red water, offering complete degradation without precipitate formation and achieving high ionic concentrations, which are indicative of advanced breakdown of contaminants.

Biography

Garima Upreti is a dedicated research scholar at Delhi Technological University, Delhi, India, with a passion for sustainability and environmental preservation. As a young driven sustainability enthusiast, she focuses her research on energetic waste management, aiming to develop innovative solutions for environmental challenges. Her work explores advanced treatment methods to address contamination in soil and water. Garima's commitment to sustainability reflects her pursuit of groundbreaking techniques that can contribute to cleaner ecosystems and efficient resource management. Her research not only targets reducing waste but also promotes the circular economy by finding value in discarded materials. Through her academic journey, Garima strives to bridge the gap between scientific advancements and real-world environmental issues, aspiring to create a lasting positive impact. She envisions a future where sustainable practices become integral to industrial and societal growth. Her work exemplifies the transformative power of young researchers in shaping a greener tomorrow.

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2D Materials Defects Characterization using AI/ML

Farhan Mahbub, Md Sadatuzzaman Saagoto and Protik Barua

World University of Bangladesh, Bangladesh

The exotic properties of 2D materials make them promising for realizing cutting-edge technologies such as quantum computing, quantum sensing, next generation energy storage etc. There lies significant hurdle in characterizing these 2D materials because of the intricate structure-property relationship. Hence, traditional methods of characterizing 2D materials are time-consuming and overly dependent on the experience of the researchers. Leveraging the power of AI can be a way of making the processes faster. In this review article we will focus on the ML/AI-assisted characterizing processes. ML models including CNN, SVM, RF, KMC are in the fore-front of the paradigm shift of 2D materials characterizing from traditional to advanced techniques. Although the power of AI is very disruptive and promising, there remains several challenges in integrating AI with the conventional techniques. This article will also shed light on these issues. Defects contribute to the exotic properties of 2D materials. It is quite difficult to characterize and design this defects. ML can also play a crucial role in this regard. Defect characterization techniques using data-driven approach will be discussed in detail in this article.

Biography

Farhan Mahbub is an associate professor in the Department of Mechatronics Engineering, at the World University of Bangladesh. Farhan Mahbub received his M.Phil. and Master of Science in Advanced Control system from the University of Salford, UK, in 2015 and 2010. His research interests are in control system engineering, electronics, and automation. He is one of the editors of the book 'Mechatronics: Fundamentals and Applications' published on 4th October 2024 by Springer-Nature.

Md Sadatuzzaman Saagoto, currently serving as the Lecturer of Department of Mechatronics Engineering at World University of Bangladesh. His research interests include quantum materials, machine learning, and artificial intelligence. He completed his undergraduate from Islamic University of Technology, Bangladesh. His motivation for research drives him to be an academician and set a footprint in materials research.

Protik Barua is a Lecturer in Mechatronics at the World University of Bangladesh. He is pursuing his M.Sc. in Robotics and Mechatronics Engineering at the University of Dhaka, Bangladesh, specializing in ML, robotics, and IoT.

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In-situ Bioremediation of 1,3,5-Trinitroperhydro-1,3,5-Triazine Contaminated Sediments using Endemic Microbial Formulation

Avantika Shukla[1], Garima Upreti[2] and **Ranu Gadi[1]**

[1]Department of Applied Science and Humanities, Indira Gandhi Delhi Technical University for Women, India

[2]Environmental Microbiology and Bioremediation Lab, Department of Environmental Engineering, Delhi Technological University, India

Sediment contamination by 1,3,5-trinitroperhydro-1,3,5-triazine (RDX), a commonly used explosive component, poses major environmental and ecological problems due to its toxicity and durability. The goal of this research is to create and test an *in-situ* bioremediation technique that employs an endemic microbial formulation to effectively degrade RDX in polluted sediments.

The experiment entailed extracting and characterising indigenous microbial strains from RDX-contaminated areas, with a focus on their enzymatic pathways capable of breaking down RDX into environmentally benign byproducts. Laboratory-scale experiments were carried out to optimize important parameters such as pH, temperature, and nutrition availability for increased microbial activity. Field studies were then conducted to determine the feasibility and efficacy of the suggested bioremediation approach in real-world situations.

The results demonstrated that the microbial consortium reduced RDX levels by more than 90% in six weeks, exhibiting considerable degrading efficiency while preserving the site's ecological integrity. Analytical techniques such as Ultra high-performance liquid chromatography (UHPLC) and UV-Vis spectrophotometry were employed to track degradation routes and ensure the creation of non-toxic end products.

The results highlight the feasibility of using endemic microbial formulations for *in-situ* bioremediation of explosive-contaminated sediments. This green technology strategy

provides a cost-effective, long-term, and environmentally benign solution for reducing the environmental impact of RDX contamination, making it a good option for large-scale application.

Biography

Avantika Shukla is a dedicated researcher and PhD scholar in the Department of Applied Sciences and Humanities (ASH) at Indira Gandhi Delhi Technical University for Women (IGDTUW), Delhi, India. With a strong academic foundation and a keen interest in sustainability, her research focuses on developing innovative solutions for environmental remediation.

Avantika's current work revolves around harnessing the potential of native microbial communities to address contamination in a sustainable and eco-friendly manner. Her expertise spans bioremediation techniques, environmental pollution control, and sustainable material development, reflecting her passion for creating impactful solutions to pressing environmental challenges.

Avantika is actively involved in presenting her findings at national and international platforms. Her participation at the Advanced Material Science World Congress under the theme "Green Technologies" underscores her commitment to advancing sustainable practices in material science and environmental protection.

In addition to her academic pursuits, Avantika is a lifelong learner who aspires to leverage her research for practical applications, fostering collaborations that bridge the gap between scientific innovation and societal benefit.

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Iron-Tannic Acid Nano-Coating: A Promising Treatment Approach for Enhancing Lactococcus Lactis Antibiotic Resistance

Marwa M. Elmaghrabi[1], Naiyf S. Alharbi[1], Ahmed S. Alobaidi[1], Adel A. Abdulmanea[1], Shine Kadaikunnan[1], Asmaa A. Ramadan[2] and **Jamal M. Khaled[1]**

[1]Department of Botany and Microbiology, College of Science, King Saud University, Saudi Arabia
[2]Ministry of Health and Population, Saudi Arabia

Probiotics are live microorganisms that, when consumed in adequate amounts, positively impact human health by supporting immunity, regulating the gastrointestinal microbiota, and aiding digestion. Probiotics have various applications in the food industry and medical supplements, so further research is needed to evaluate their safety on human health as probiotics pass through the gastrointestinal tract (GIT). Probiotic cells face various challenges and stresses, including the low pH acidic environment of the stomach, which may cause their death before reaching the intestine. Additionally, oxidative stress may adversely affect probiotic cells during their passage through the GIT, particularly during antibiotic treatments. This study aimed to use an advanced nanotechnology tool to protect isolated probiotics to improve their physiological characteristics and assess whether the nanoparticle coating could augment the probiotics' resistance to antibiotic influence. *Lactococcus lactis (L. lactis)* was isolated, cultured, and comprehensively characterized utilizing state-of-the-art methodologies, including the VITEK® 2 compact system, VITEK® MS, and 16S rRNA gene sequencing. The nanoparticle coating was performed using iron (III) chloride hexahydrate and tannic acid, followed by an evaluation of the probiotics' resistance to a range of antibiotics. The analysis through scanning electron microscopy (SEM) and atomic force microscopy (AFM) demonstrated a partial nanoparticle coating of the probiotics enhancing its biological activity to withstand the mentioned harsh conditions, which was further supported by UV/Vis spectroscopy findings, suggesting enhanced resistance to standard antibiotics. The results revealed that this nano-coating notably increased the strain's resistance to a spectrum of standard antibiotics, including

Benzylpenicillin, Tei coplanin, Oxacillin, Vancomycin, Tetracycline, Rifampicin, Erythromycin, and Clindamycin. These findings imply that nano-coated probiotics may effectively counteract the detrimental effects of extended antibiotic therapy, thus preserving their viability and beneficial influence on gastrointestinal health.

Table 1: Antibiotic susceptibility testing data of uncoated probiotics.

Antimicrobial	MIC*	Interpretation	Antimicrobial	MIC	Interpretation
Cefoxitin screen	NEG	-	linezolid	2	S
Benzylpenicillin	<= 0.03	S	Teicoplanin	<= 0.5	S
Oxacillin	<= 0.25	S	Vancomycin	<= 0.5	S
Gentamicin	<= 0.5	S	Tetracycline	<= 1	S
Tobramycin	<= 1	S	Tigecycline	<= 0.12	S
Levofloxacin	0.25	S	Nitrofurantoin	<= 16	S
Moxifloxacin	<= 0.25	S	Fusidic acid	16	R
Inducible clindamycin resistance	NEG	-	Rifampicin	<= 0.5	S
Erythromycin	<= 0.25	S	Trimethoprim/ sulfamethoxazole	<= 10	S
Clindamycin	<= 0.25	S			

***N=3, standard error=zero**

Table 2. Antibiotic susceptibility testing data of nano-coated probiotic.

Antimicrobial	MIC*	Interpretation	Antimicrobial	MIC	Interpretation
Cefoxitin screen	TRM	-	linezolid	>= 8	
Benzylpenicillin	>= 0.5	**R**	Teicoplanin	>= 32	**R**
Oxacillin	>= 4	**R**	Vancomycin	<= 32	**R**
Gentamicin	<= 0.5	S	Tetracycline	>= 16	**R**
Tobramycin	<= 1	S	Tigecycline	>= 2	
Levofloxacin	<=0.12	S	Nitrofurantoin	32	S
Moxifloxacin	<= 0.25	S	Fusidic acid	>= 32	R
Inducible clindamycin resistance	NEG	-	Rifampicin	4	**R**
Erythromycin	>= 8	**R**	Trimethoprim/ sulfamethoxaz-ole	<= 10	S
Clindamycin	>= 8	**R**			

***N=3, standard error=zero**

Biography

Marwa M. Elmaghrabi, PhD

- Microbiolgy Department, King Saud University, Saudi Arabia
- Permanent researcher of stem cells and tissue culture labs at Faculty of Medicine, Alexandria University, Infection Control Consultant.
- Infection Control and Quality Assurance Management (11 years of experience in Medical and Research fields).
- Middle East & Africa Regional Coordinator and Associate Editor, Consortium publisher, Canadian Journal of Molecular Cell Biology.
- Consultant in medical tests, under registration number (73717), branch: Medical Science- Number (25403), Egypt.
- PhD (fully funded scholarship), Microbiology Department, King Saud University, Riyadh, Saudi Arabia.
- Master in Microbiology, Alexandria University, Egypt.
- Postgraduate Diploma in Analytical Biochemistry, Alexandria University, Egypt.

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Simultaneous Removal of Toxic Cationic Water Pollutants using ZnO-Curcumin Decorated Graphene Oxide Composite

Nabanita Chakraborty[1,2], Swati Ghosh Acharyya[2] and **Roy Anindya[1]**

[1]Department of Biotechnology, Indian Institute of Technology Hyderabad, India
[2]School of Engineering Sciences and Technology, University of Hyderabad, India

The bioaccumulation of toxic cationic pollutants poses a serious health risk if consumed from untreated drinking water. A ZnO-curcumin decorated graphene oxide composite was synthesized *via* the chemical precipitation method to remediate the cationic water pollutants. The stability of the composite stability was confirmed by leaching and thermal gravimetric analysis (TGA). The isoelectric point of the composite was noted as 6.5. Cadmium having the lowest permissible limit for drinking water was selected as the preferred heavy metal ion (HMI) contaminant of the study. The Cd (II) removal was preferred in the pH range of 3-7.5. Considering real-time application of the material, pH 7 was selected for adsorption studies experiment design. The composite exhibited pseudo-second-order kinetics and the Langmuir adsorption isotherm. Under ideal circumstances, the composite exhibited a maximum adsorption capacity of 4500±50 mg/gm and an 87 % removal efficiency for Cd (II). The removal process was primarily governed by ion exchange and electrostatic attraction, followed by cation exchange capacity (CEC). The regeneration and reusability of composites were investigated under specific conditions. Additionally, simultaneous removal of Methylene Blue (MB), and Tetracycline was studied for the composite using column flow-bed setup. The dyes and antibiotics influenced Cd (II) adsorption on the composite. The Cd (II) adsorption was affected 25% by the antibiotics and 5% by dyes with decrease in the adsorption capacity to 2100 ±30 mg/gm. According to the study, the nanocomposite has the potential to be used in neutral settings to remediate harmful cationic pollutants simultaneously from real-time tap water and river water samples.

Biography

Nabanita Chakraborty is a PhD student working on purification of toxic water pollutants using nanotechnology. She has dedicated four years in this particular field. She has published two journal papers and have attended three international conferences with one conference proceeding. She has been working in the field of environmental sciences and technology since her post-graduation mainly focusing of remediation of water pollution.

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Resonating Particle Dynamics in Laser Irradiated Matter with Nano-Antenna Dopes

K. Zsukovszki[1] and **I. Papp**[1,2]

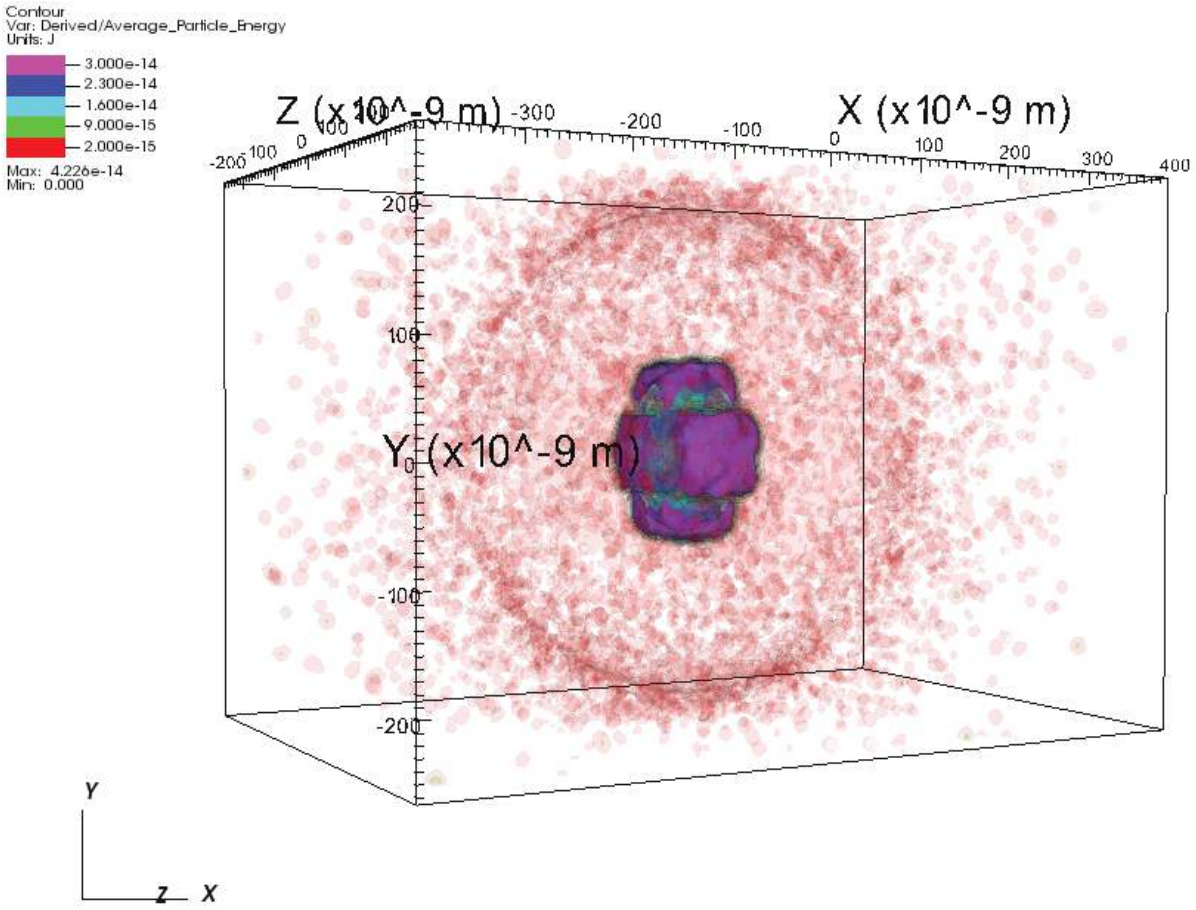
[1]Wigner Research Centre for Physics, Hungary
[2]HUN-REN Centre for Energy Research, Hungary

Recent advancements in laser-induced fusion have revealed that resonating dopes in matter can enhance energy absorption from laser waves, facilitating fusion initiation, particularly in laser-driven inertial confinement fusion (ICF). We numerically model and investigate the interaction of intense laser pulses with matter doped with gold nanoparticles of various shapes. Using a kinetic model implemented in EPOCH numerical software, we examine the response of gold-doped matter to short, intense bursts of infrared radiation (~800 nm, ~100 fs), focusing on electron ejection dynamics, ionization, and energy transfer mechanisms.

Our simulations confirm that nanoantennas significantly enhance energy absorption compared to undoped matter. Among various shapes, dipole and quadrupole nanoantennas outperform spherical nanoparticles in resonance efficiency. Crossed quadrupole nanoantennas maintain resonance regardless of orientation, unlike dipoles, which require alignment with the polarization vector E. In moderate fields (4×10^{15} W/cm^2), energy absorption increases with nanoantenna size, peaking at ~85 nm before saturation. Increasing intensity to 4×10^{17} W/cm^2 results in more than an order-of-magnitude increase in ion energy. Crossed quadrupoles prove the most efficient at producing high-energy protons, outperforming even optimally aligned dipoles.

At high intensities (4×10^{18} W/cm^2), energy gain saturates due to conduction electron ejection, disrupting resonance. Dipole nanoantennas lose efficiency earlier than quadrupoles, making the latter more suitable for extreme fields. We track electric fields, currents, and ionization products, confirming that crossed quadrupoles generate higher-energy protons than dipoles or spherical dopes in fields >10^{17} W/cm^2. These findings suggest that nano-

antenna doping optimizes energy absorption in laser-matter interactions, making crossed quadrupoles a promising candidate for enhancing ICF fuel ignition and other high-intensity laser applications.



Biography

Dr. Konstantin Zsukovszkij, Principal Researcher at WIGNER Research Center for Physics, Budapest, specializes in nanophotonics, undulator radiation, radiation-matter interactions, and applied mathematical analysis. He earned his Ph.D. in 1997 and Doctor Habilitatus in 2011, advancing computational models for laser-driven processes and synchrotron radiation.

As a Research Fellow at ENEA, Rome (1998–2010), he contributed to undulator radiation theory. As Full Professor (2018–2023), he developed models stimulated undulator radiation, heat transfer on nanoscale and for matter-radiation interaction for nanoantenna-assisted laser fusion. His studies on free-electron lasers, heat transfer and high-intensity laser interactions advanced theoretical frameworks in multiple fields of physics.

He has published 100+ papers in *Physical Review A*, *Journal of Synchrotron Radiation*, and *Applied Mathematics and Computation*, with 1,600+ citations (h-index: 26). He received Highly Cited Paper Awards (WoS, 2016–2023) and serves on editorial boards (*Symmetry, Applied Mathematics and Physics*), mentoring Ph.D. students in theoretical physics.

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A Novel Multifunctional Theranostic Platform for Chemo-Photothermal Co-Therapy of Hepatocellular Carcinoma

Uzma Azeem Awan[1], Muhammad Naeem[1], Abida Raza[2] and **Shaukat Ali[3]**

[1]Department of Biological Sciences, National University of Medical Sciences (NUMS), Pakistan
[2]University Institute of Biochemistry and Biotechnology, PMAS-Arid Agriculture University Rawalpindi, Pakistan
[3]Medical Toxicology Lab, Department of Zoology, Government College University Lahore, Pakistan

Background: Hepatocellular carcinoma (HCC) or liver cancer is type of cancer with highest death rate, causing nearly 745,000 deaths globally each year. Regardless of the exciting advances in cancer therapy, low efficacy and high dose-related side effects of anticancer drugs remains one of the dominant reason for cancer related mortality.

Objective: The purpose of the current study was to fabricate an effective stimulus system loaded nano-moieties for co-therapy *in vitro* and *in-vivo*.

Methods: In current study, doxorubicin (DOX) conjugated with polyelectrolyte-poly (sodium-4-styrenesulfonate) (PSS) coated gold nanorods (GNRs) were designed for co-therapy. Near infrared (NIR 808 nm) laser irradiation cause hyperthermia due to GNRs, which enhanced drug release rate to the cells and in a xenograft model of HCC. $HepG_2$ cells were subcutaneously injected into nude mice to establish tumor xenografts. Subsequently, animals were treated with either NIR laser or DOX loaded GNRs + NIR or DOX alone. The DOX-PSS-GNRs were efficiently taken up by the tumor cells. The distribution of the nanomaterial was quantitatively analyzed by ICP-MS.

Results: We found the ablation of tumour cells *in vitro* and *in vivo*, and found that co-therapy offers significantly improved therapeutic efficacy compared with chemotherapy or photothermal therapy alone. By histopathological staining of tumors, we found that the co-therapy showed more apoptotic tumor cells than the other groups. Furthermore, the toxicity study by pathologic examination of the other tissues demonstrated a lower

systematic toxicity of DOX-PSS-GNRs than free DOX.

Conclusion: Thus, the chemo-photothermal treatment based on polymer loaded with DOX and GNRs is a useful strategy for maximizing the therapeutic efficacy and minimizing the dosage-related side effects in the treatment of hepatocellular carcinoma.

Biography

Dr. Uzma Azeem Awan is an Assistant Professor in the Department of Biological Sciences at the National University of Medical Sciences (NUMS), Pakistan since 2018. She holds a PhD in Biotechnology (Cancer Nanotheranostics) from the University of Azad Jammu and Kashmir, Muzaffarabad, Pakistan (2017).

Prior to her current position, Dr. Awan gained valuable research experience as a Visiting Research Fellow at the Georgia Institute of Technology, USA, and as a Research Associate at the National Institute of Laser and Optronics, Pakistan.

Her research interests lie at the intersection of medical biotechnology and advanced materials. She has published various research, review articles and book chapters. She specializes in the synthesis, bioconjugation, and biomedical applications of metallic nanoparticles, including their use in gene interference, drug delivery, and photothermal therapy. Dr. Awan has actively participated in both national and international conferences.

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Additive Manufacturing of Mo-SiC Multimaterial Component

Marina Aghayan[1,2]

[1]A.B. Nalbandyan Institute of Chemical Physics, Armenia
[2]FACT Industries OU, Estonia

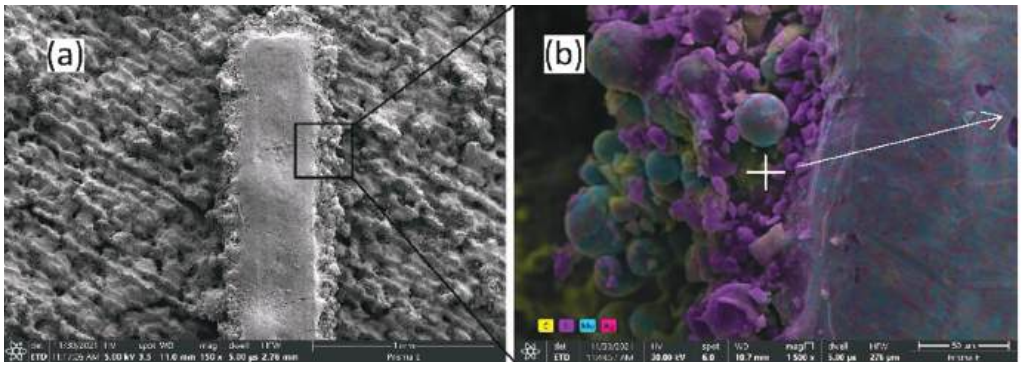
Additive manufacturing (AM) technologies enable the fabrication of components with more design freedom. The geometric and compositional complexity can provide higher functionality, and multimaterial parts have the potential to achieve higher performance. However, the majority of multimaterial printing techniques are still in their early stages and full of challenges. For example, multimaterial powder-bed AM is significantly slower and may result in issues when the metal powders are later mixed. Many materials need to be post-treated individually, and some might not be compatible with one another in terms of shrinkage, melting or sintering temperatures, and interaction.

In this research, we propose a method of fabricating metal—ceramic multimaterial prototype for electronic packages using powder-bed additive manufacturing technology, particularly selective laser melting (SLM). Silicon carbide-based composite was prepared (Table 1), and SLM-ed as an electrical resistive layer. Then the powder was eliminated from the chamber to escape from cross-contamination and molybdenum powder was placed. Molybdenum tracks with diameter of 400μm and length of 15mm were SLM-ed on SiC layer.

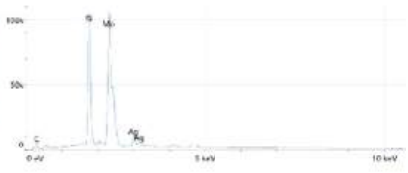
The SLM parameters for silicon carbide and molybdenum are concluded in Table 1.

Initial powder	Laser Current (mA)	Exposure time (µs)	Hacth Distance (µm)	Point Distance (µm)	Layer thickness (µm)
74%SiC-15%Si-5%Y_2O_3-10%BN	2800	40	60	20	25
Molybdenum	4000	80	50	20	25

The findings showed that the SiC-based samples have a rather homogeneous microstructure (Figure 1a). The surface is rough, though. It is easy to see the tracks that were formed during SLM. The surface of the Mo layer is smoother (Figure 1b). Nevertheless, because SiC and Mo have different thermal expansion coefficients, cracks may occur. There is a layer of spherical mass that forms on the tracks. According to the EDS study, the spheres are made of $MoSi_2$, which was created during the Mo-Si interaction.



Element	Atomic %	Atomic % Error	Weight %	Weight % Error
C	23.5	0.2	6.5	0.1
Si	49.9	0.1	32.5	0.1
Mo	19.6	0.0	43.6	0.0



Biography

Marina Aghayan is the head of laboratory of Additive Manufacturing at the A.B. Nalbandyan Institute of Chemical Physics. Her focus lies on additive manufacturing of ceramics, metals, and their composites using selective laser melting and stereolithography/DLP technologies. Mrs. Aghayan is interested in applied research and industrial projects. She has managed and successfully completed more than 20 industrial projects for biomedical and aerospace industries.

Marina Aghayan is patinate to learn and bring research outcomes to industry. She is inventor of 5 patents. She is author of over 40 research papers.

Marina is a co-founder and CEO of two successful deep tech startups with strong R&D focus.

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A Biogenic Approach to Develop Guava Derived Edible Copper and Zinc Oxide Nanocoating to Extend Shelf Life and Efficiency for Food Preservation

Susmita Dey Sadhu[1], Bhasha Sharma[1], Shubhanshu Nigam[2], Anishka Verma[2], Meenakshi Garg[2] and **Avneesh Mittal[2]**

[1]Bhaskaracharya College of Applied Sciences, University of Delhi, India
[2]Netaji Subhash Institute of Technology, India

Nanostructured integrated polymeric coatings have been transpired to preserve vegetables and fruits' quality attributes. Edible nanocoating packaging can significantly prolong the shelf life of fruits by preventing moisture loss and maintaining their freshness. This is because the coating acts as a barrier, preventing water vapor and gases from escaping or entering the fruit, which helps to maintain its firmness, color, and texture. These coatings facilitate barrier properties on the surface of fruits and vegetables and generate a conducive micro-environment by optimizing the concentration and obstructing the ripening process. A bio-nano hybrid based on guava extract intercalated nanoparticles were synthesized using a chemical reduction method for applications in fruit coating. The fabrication of resultant nanocomposites was confirmed by the shifts observed in vibrational frequencies and basal peaks observed by using an X-Ray diffraction pattern. The prepared nanohybrid further elucidates better thermal stability and their hydrotalcite-like structure examined by Field Emission Electron Spectroscopy displayed plate-like structure and homogeneous distribution of nanoparticles into the matrix. The CuO/guava extract nanocomposite has shown 37.79% of weight loss contrary to pristine extract which has 64.92% evaluated using thermogravimetric analysis. The edible nanocoating was developed using the dip-coating method on fresh papaya. To evaluate the efficacy of developed nanocoating, various attributes such as pH, acidity, sensory analysis, weight loss, and water activity coefficient for 18 days were investigated. In addition, the role of dietary sugar with the increase in the shelf life of nanoparticles coating was synchronized. The obtained results revealed that the shelf life of papaya increased with the application of copper nanohybrid coating which propounds its application in food preservation.

Biography

Dr. Susmita Dey Sadhu is working as an Associate Professor at Bhaskaracharya College of Applied Sciences, University of Delhi since 2005. She has completed her Masters in Chemistry (University of Burdwan, WB) followed Ph.D in Rubber Technology from IIT-Kharagpur in 2005. Her research interest includes fields like Packaging, Blend and composites, Nanocomposites and Adhesive applications. She has nearly 50 publications in reputed international journal, 2 patents, nearly 10 book chapters and 3 books published to her credit. She has completed about 5 projects funded by various agencies.

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Electrosynthesis of Organic 2D Conducting Polymer Films

Luiza A. Nascimento[1,2], Kilian Fraysse[3], Kevin Krause[4], Cameron Bentley[4], Rosanne Guijt[5], Paul Stoddart[6,7], Simon Moulton[6,7], Saimon M. Silva[1,2] and **George W. Greene.[1,2]**

[1]The Biomedical and Environmental Sensor Technology (BEST) Research Centre, La Trobe Institute for Molecular Science (LIMS), La Trobe University, Australia
[2]Department of Biochemistry and Chemistry, School of Agriculture, Biomedicine and Environment, La Trobe University, Australia
[3]Institute for Frontier Materials and ARC Centre of Excellence for Electromaterials Science, Deakin University, Australia
[4]School of Chemistry, Monash University, Australia
[5]Centre for Regional and Rural Futures, Deakin University, Australia
[6]The Aikenhead Centre for Medical Discovery, St Vincent's Hospital Melbourne, Australia
[7]Iverson Health Innovation Research Institute, School of Science, Computing and Engineering Technologies, Swinburne University of Technology, Australia

The development of 2D materials is rapidly advancing, however, when it comes to conductive polymers, they can only be grown like nanosheets or in a colloidal media, and when deposited in an interface its two-dimensionality is lost and its conductive properties are hindered. We designed a novel approach for electropolymerizing conductive polymers that tethers the dopant on the electrode surface, and the electropolymerization reaction is carried through regular cyclic voltammetry (Figure 1). The tethered dopant initiates and limits the propagation of the electropolymerization reaction resulting in a defect-free, nanostructured and transparent 2D conductive polymer film with metallic-like conductivity cause by a novel hyper-doping effect able to cover a cm^2 area with no loss in electrical properties. The electrical and electrochemical properties of the 2D film are unprecedently homogenous, in microns scale, as shown by scanning electrochemical cell microscopy. The capability of growing highly conductive, homogeneous and defect-free 2D polymer films

developed in this work presents a great class of a novel functional biocompatible material for future biosensing interfaces and bioelectronic nanodevices.

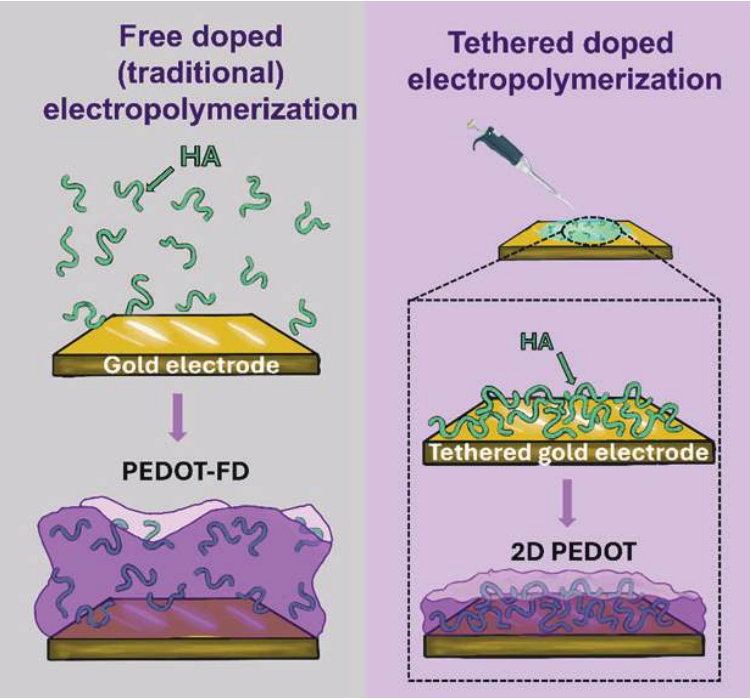

Fig 1: Scheme representing the traditional doping approach for electropolymerization using free HA that grows thick PEDOT, and the tethered HA approach that grows 2D PEDOT.

Biography

Luiza is a Brazilian scientist, graduated in Chemical Engineering and master's in Chemistry, now pursuing her PhD in materials science focusing on electrochemical organic conducting polymers synthesis and biosensing. She works with electrochemical synthesis since 2016 in the beginning of her undergraduate journey, producing photoanodes for water splitting cells, following up with polymer electrochemical synthesis and a COVID-19 electrochemical biosensor in her masters. She now develops 2D conducting polymer films that will be applied in nanoMIPs for biosensing.

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