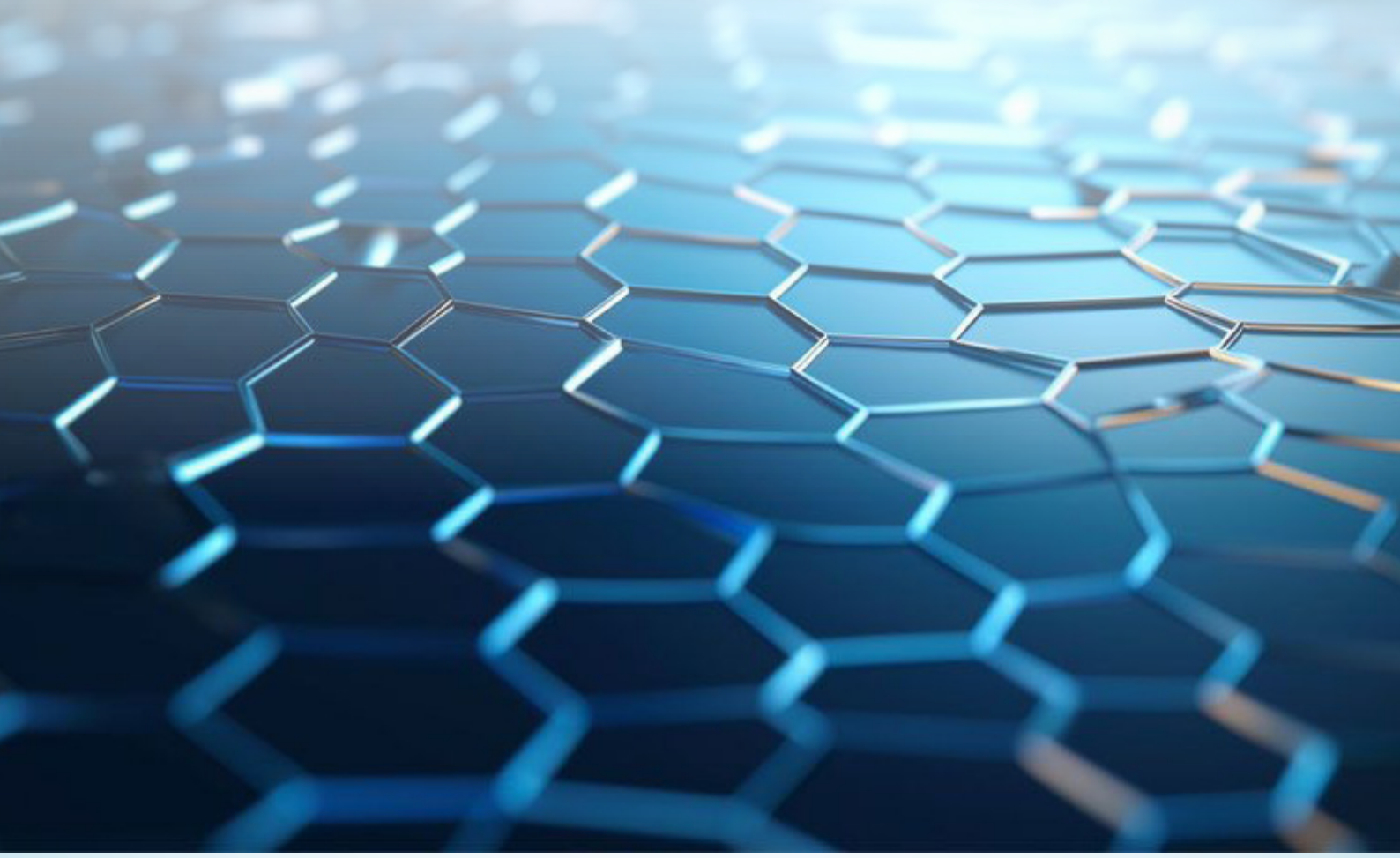
IRIS Scientific Group

2ND GLOBAL CONFERENCE ON

MATERIAL SCIENCE AND NANOTECHNOLOGY



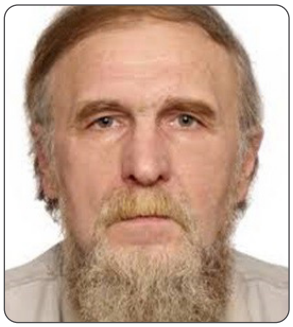
13-14 APRIL, 2026 | ONLINE EVENT

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Keynote Speakers



Stanislav Ordin

Russian Academy of Sciences, Russian Federation



Osman Adiguzel

Firat University, Turkey



Konstantin Zsukovszki

HUN-REN Wigner RCP, Hungary



Paulo Cesar De Morais

Catholic University of Brasilia, Brazil



S.V.A.R.Sastry

Harcourt Butler Technical University, India



Yashu Swami

Manav Rachna International Institute of Research and Studies, India



Welcome Message

Osman Adiguzel

Firat University, Turkey

Dear Distinguished Scholars, Engineers, Colleagues, and Interested Experts!It is my great honour and pleasure as a Scientific Committee Member, to invite you to join with a contribution to the 2nd Global Conference on Material Science and Nanotechnology (GCMN 2026), which will take place from April 13–15, 2026 in Paris, France, organized by Iris Scientific Group, and holds immense importance for attendees.I believe that GCMN 2026-Conference will provide this opportunity for delegates from different cultures and countries. Also, this conference will be performed successfully, with contributions of the qualified scholars, colleagues and experts and with their valuable and informative presentations. The conference will be very beneficial for young delegates by encouraging them and improving their self-confidence of presenting research in an international platform. I am pleased to invite the prospective scholars, academicians, engineers, and other scientists to submit their original contributions to this important conference.



Welcome Message

Konstantin Zsukovszki

HUN-REN Wigner RCP, Hungary

On behalf of the Scientific Committee, it is my great pleasure to welcome you to the 2nd Global Conference on Material Science and Nanotechnology (GCMN 2026), taking place in the inspiring city of Paris, France, from April 13–15, 2026. This year's theme, "Pioneering Discoveries in Material Science and Nanotechnology", brings together researchers, innovators, and industry leaders to explore cutting-edge developments in nanomaterials, smart materials, energy applications, biomedical devices, and beyond. Our goal is to provide a platform where ideas can be exchanged, collaborations forged and scientific progress accelerated. Throughout the conference, we encourage you to actively participate in discussions, share your work, and learn from the diverse perspectives of experts from around the world. The interactions and partnerships that emerge here will undoubtedly shape the future of materials science and nanotechnology.On behalf of the Scientific Committee, I extend a warm welcome to each of you. We look forward to meeting you in person, discovering your contributions, and working together to advance our field. I wish you a productive and enjoyable conference, as well as a memorable stay in the beautiful city of Paris.



Welcome Message

Paulo Cesar De Morais

Catholic University of Brasilia, Brazil

Dear Attendees, Presenters, Organizing Committee and Distinguished Guests: Greetings!On behalf of the Scientific Committee, it is an honor and pleasure to welcome you to GCMN2026 that will be held on April 13-15, 2026 in Paris, France. The French capital is by far the most touristic destination of Europe. Paris has so much to offer to every kind of visitor all year long and April is one of the best months for visiting owing to the pleasant weather and exciting cosmopolite life. In the conference, it is expected presenters from all over the globe, sharing their latest findings and ideas on different topics regarding Materials Science and Nanotechnology, spanning from AI in Nanotechnology up to Quantum Nanomaterials.I thank you for your attention, expecting to meet with you in Paris in April 2026

ABOUT US

Iris Scientific Group

Iris Scientific Group is started to fulfill the requirements and to seek after aggregate objectives of the scientific community particularly focusing in the field of Science and technology to support the efforts to exchange knowledge and ideas which encourage the cooperation between the researchers, scientists, academicians and analysts of interdisciplinary research or same field.

We are expert in conducting conferences, workshops, seminars, and meetings with the peerless and inspired speakers all around the world. We are here to provide you and your association with the opportunities to connect with others, explain your research and make your unique identity in front of others. Our conferences and workshops are known as the sea of learning where we help you to swim and learn everything you want.

In a very short period, Iris Scientific Group became successful in developing a unique platform for experts, budding researchers and professionals from different universities, countries, research institutions, hospitals, companies and industries. Here we provide an opportunity to easily discuss and socialize their techniques of research, goals, facts, latest science discoveries and news.

BOOK OF ABSTRACTS



2nd Global Conference on

MATERIAL SCIENCE AND NANOTECHNOLOGY

13-14 April, 2026 | Online Event

KEYNOTE SESSIONS





K.Zsukovszki

HUN-REN Wigner Research Centre for Physics, Budapest, 1121, Hungary

Ion energy boostand enhanced energy transfer from laser radiation to matter with resonating nanoantennas

Recent advancements theoretical research and experiments on laser-induced fusion demonstrate that resonating dopes in matter can significantly enhance absorption of laser radiation. This may have multiple applications; among themlaser-driveninertial confinement fusion (ICF). Using a kinetic model, implemented in EPOCH numerical software, wesimulate and study the interaction of laser pulses with hydrogen rich matter doped with gold nanoparticles of various shapes and sizes. We examine the response of such gold-doped matter to short, intense (~10^{18} W/cm²) bursts of infrared radiation (~800 nm, ~100 fs), and model the dynamics of electron ejection and ionization, as well as the energy transfer with focus on the energy of protons, which appear upon ionization of matter.

Among various shapes, dipole and crossed antennas stand out for their resonance efficiency. Cross-based nanoantennas maintain resonance regardless of orientation, unlike dipole based antennas,whichrequirealignmentwiththepolarizationvector**E**. Theinfraredlaserintensity

~10^{17} - 10^{18} W/cm² yields best results in terms of ion energy. The gain in the ion energy over that in the field 4×10^{15} W/cm² is more than an order-of-magnitude. Further increase of the laser field intensity over ~4×10^{18} W/cm² does not yield significant energy gain for protons. Energy saturation is observed due to ejection of conduction electrons, disrupting the antenna resonance. Our theoretical results for dipole antenna dopes agree with the experiments, conducted at ELI-ALPs laboratories at Szeged (HU), confirming their validity.

We have identified the double 3D crossed sextuples as most energy efficient nanoantenna;the Yagi-based nanoantennas also provide high energy for protons, exceeding three times the ion energy around dipole antennas. These advanced antenna configurations especially in the close placement enhance the near field between them and prove to be most efficient at producing high-energy protons at high intensities, outperforming optimally aligned dipoles.

Our discoveries suggest that nanoantenna doping optimizes energy absorption in laser- matter interactions, making crossed quadrupoles especially in 3D configuration and paired placement a promising candidate for enhancing ICF fuel ignition and other high-intensity laser applications.

Keywords: nanoantenna, laserpulse, ionization, energy

Biography:

Dr. Konstantin Zsukovszkij, Principal Researcher at WIGNER Research Center for Physics, Budapest, Hungary, specializes in nanophotonics, undulator radiation and free electron lasers, 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.



Osman Adiguzel, Ph.D.,
Firat University, Department of Physics, Elazig, Turkey

Shape reversibility and the role of twinning reactions in martensitic transformations in shape memory alloys

Shape memory alloys take place in a class of advanced smart materials by exhibiting a peculiar property called shape memory effect. This phenomenon is initiated with thermomechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of the materials cycle between original and deformed shapes in reversible way. Therefore, this behavior can be called Thermoelasticity. This phenomenon is governed by crystallographic transformations, thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movements of atoms in <110 > -type directions on the {110} – type close packed planes of austenite matrix, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures. The twinned structures turn into the detwinned structures by means of stress induced martensitic transformation with deformation in the low temperature condition.Lattice twinning and detwinning reactions play important role in martensitic transformations, and they are driven by internal and external forces, by means of inhomogeneous lattice invariant shear. These alloys exhibit another property called superelasticity, which is performed with stressing and releasing the material in elasticity limit at a constant temperature in parent phase region, and shape recovery is performed simultaneously upon releasing, by exhibiting elastic material behavior. Superelasticity is also result of stress induced martensitic transformation and ordered parent phase structures turn into detwinned martensite structure with stressing the material in parent phase region. Copper- based alloys exhibit this property in metastable β-phase region. Lattice twinning and lattice invariant shear is not uniform in these alloys and gives rise to the formation of complex layered structures. The layered structures can be described by different unit cells as 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice.

In the present contribution, x-ray and electron diffraction studies were carried out on two copper- based CuAlMn and CuZnAl alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections. X-ray diffractograms taken in a long-time interval show that diffraction angles and intensities of diffraction peaks change with the aging duration at room temperature. This result refers to the rearrangement of atoms in diffusive manner.

Keywords: Shape memory effect, martensitic transformation, thermoelasticity, superelasticity, twinning, detwinning

The audience take away from my presentation

Shape memory effect is a multidisciplinary subject and in principle, I introduce the basic terms and definition in my presentation, I introduce the experimental result performed on the alloy samples.

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied were focused on shape memory effect in shape memory alloys. He worked as research assistant, in 1975-80, at Dicle University and shifted to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has been retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He supervised 5 PhD- theses and 3 M. Sc- theses and published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Also, he joined over 230 online conferences in the same way in pandemic period of 2020-2024. Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.



Paulo Cesar De Morais, Ph.D.,
Catholic University of Brasilia, Brasilia, Brazil

Exploring nanomagnetism of molecular-dressed ultrafine nanoparticles

This talk will focus on the description of surface functionalized ultrafine $CoFe_2O_4$ nanoparticles (NPs), with mean diameter ~ 5 nm. The investigated properties include DC magnetization and AC susceptibility measurements over the temperature range of 4 – 400 K. All evaluated NPs present the same $CoFe_2O_4$ core, with different molecular surface coatings, increasing gradually the number of carbon atoms in the coating layer, in the following list: glycine ($C_2H_5NO_2$), alanine ($C_3H_7NO_2$), aminobutanoic acid ($C_4H_9NO_2$), aminohexanoic acid ($C_6H_{13}NO_2$), and aminododecanoic acid ($C_{12}H_{25}NO_2$). Importantly, samples were intentionally fabricated in order to modulate the core-core magnetic dipolar interaction, as the thickness of the coating layer increases with the number of carbon atoms in the coating molecule. The magnetic data of the uncoated $CoFe_2O_4$ NPs it is also presented for comparison. All investigated $CoFe_2O_4$ NPs (coated and uncoated) are in magnetically blocked state at room temperature as evidenced by ZFC/FC measurements and the presence of hysteresis with ~700 Oe coercivity. Low temperature magnetization scans show slightly constricted hysteresis loops with coercivity decreasing systematically while the number of carbon atoms in the coating molecule decreases, possibly resulting from differences in magnetic dipole coupling between NPs. Large thermomagnetic irreversibility, slow monotonic increase in the FC magnetization and non-saturation of the magnetization give evidence for the cluster glass (CG) nature in the $CoFe_2O_4$ NPs. The out of phase part of the AC susceptibility for all samples shows a clear frequency dependent hump which is analyzed to distinguish superparamagnetic (SPM), cluster glass (CG) and spin glass (SG) behavior by using Néel-Arrhennius, Vogel-Fulcher, and power law fittings.

Audience Take Away:

- The audience will learn about an efficient way to modulate the magnetic response of nanosized magnets via the thickness of the surface-coating layer.
- The daily research on nanomagnetism deals with modulating the magnetic response of the as-synthesized materials. In this regard, the surface-coating approach, using increasing thickness, will be of great help towards achieving the final needs. This approach can be used to design new experiments, either for teaching or for thesis proposal.

Biography:

Professor Paulo César De Morais (H60), PhD, was full Professor of Physics at the University of Brasilia (UnB) – Brazil up to 2013. Appointed as UnB's (Brazil) Emeritus Professor (2014); Visiting Professor at the Huazhong University of Science and Technology (HUST) – China (2012-2015); Distinguished Professor at the Anhui University (AHU) – China (2016-2019); Full Professor at the Catholic University of Brasília (CUB) – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-years (1987-1988) post-doc position with Bell Communications Research, New Jersey – USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais (UFMG) – Brazil. With more than 13,500 citations, He has published more than 500 papers (Web of Science), delivered more than 200 international invited talks (35 countries), and filed 16patents.



S.V.A.R. Sastry
Department of Chemical Engineering, Harcourt Buttler Technical University, India

Bio-synthesis and characterization of plectranthus amboinicus derived Silver nanoparticles impregnated with zeolite

Abstract: The green synthesis of silver nanoparticles (AgNPs) using plant extracts has gained significant attention due to its eco-friendly, cost-effective, and sustainable nature. The green synthesis approach not only corroborates the significance of phytochemical-assisted nanoparticle production but also aligns with sustainable nanotechnology principles. Silver possesses a remarkable physiochemical property that make it an excellent candidate for nanotechnology applications. In this study, silver nanoparticles were biosynthesized using Plectranthusamboinicus leaf extract, a medicinal plant known for its rich phytochemical composition. The bio-reduction of silver ions (Ag) to AgNPs was unequivocally confirmed through visual observation, where a color change indicated successful synthesis. The incorporation of zeolite as a supporting matrix was further explored to enhance the stability and functionality of the synthesized nanoparticles. The synthesized AgNPs were characterized using various analytical techniques, including UV-Vis spectroscopy, Fourier-transform infrared spectroscopy (FTIR). The UV-Vis spectroscopy results exhibited the absorbance in the range of 350-400 nm. The FTIR analysis revealed the presence of C-H, C=O and O-H boss present in the sample. FESEM images provided an insight into the morphology where the average particle size was confirmed within the range of 10-50 nm. This study unequivocally highlights the potential of Plectranthusamboinicus-mediated AgNPs impregnated with zeolite as a promising nanomaterial for water disinfection, biomedical and environmental applications. The results suggest that this bio-nanocomposite can be explored further for its potential applications in antimicrobial coatings, drug delivery, and wastewater treatment. Future research should focus on optimizing synthesis parameters and exploring large-scale production to facilitate real-world applications.

Keywords: *Bio-synthesis, Silver Nanoparticles, Zeolite Impregnation with silver nanoparticles*

Biography:

Dr. S.V.A.R.Sastry has more than 20 years of teaching and research experience. B.Tech Gold Medalist, M.Tech Silver Medalist and Best Ph.D Thesis Awardee. Authored 12 Patents, 25 International Books, 75 Research Papers. Editor for ten International Journals. Given more than 40 Keynote lectures in various International Conferences held at Brazil, Dubai, Spain, China, Canada, Italy, France and UK. Biography published in Marquis Who's Who in the World, 31st, 32nd & 33rd editions consecutively. University Best Teacher Awardee for five consecutive years from 2008 to 2013. Recipient of International Awards from IBC, Cambridge, England. Received Pillars of the Nation Award for Excellence and Innovation in Education Sector in 2023, Outstanding Alumni Faculty Award from IIT Delhi in 2023, University Research Excellence Award for 2023, 2024, 2025. Honored with "Outstanding Leadership in Research and Innovation" Award in the 29th World Education Summit, New Delhi in 2024.



StanislavOrdin
Russian Academy ofSciences, Russia

NANO-technology and the physics of the missing scale

Beautiful, abstruse quantum-mechanical models created the illusion that humans could easily controlprocessesatthelevelof individualatomsandelectrons. Andmorethanonegenerationof researchers worked on this wave of enthusiasm. But at the same time, striving to be ahead of the curve, only isolated groups of technologists sometimes achieved unique results, while the collective collective created monsters.

The Feynman cellular automaton, realized by NANO-technology, is, in principle, an alternative to the von Neumann-Conway cellular automaton, which lifted the thermodynamic ban on the existence of LIFE it self. And thus, NANO-technology, inprinciple, with the help of NANO-mold, also lifts the ban on the destruction of LIFE. Therefore, using nanotechnology without understanding the Fundamental Laws of the nanoscale is not only ineffective but also extremely dangerous. For now, they employ a purely empirical approach, driven by bluff companies like the graphene company. However, to build nanophysics, it is necessary to understand that it lies at the border between classical and quantum physics. Moreover, the search for the new should not be in mystical changesinfundamental characteristics,which contradicttheadiabatic decomposition of energy, but in nanostructuring, which leads to gigantic effects. And for this, there is a vast experimental and theoretical foundation in the form of research on midi effects and natural and artificial superstructures, which simply requires generalization and understanding.

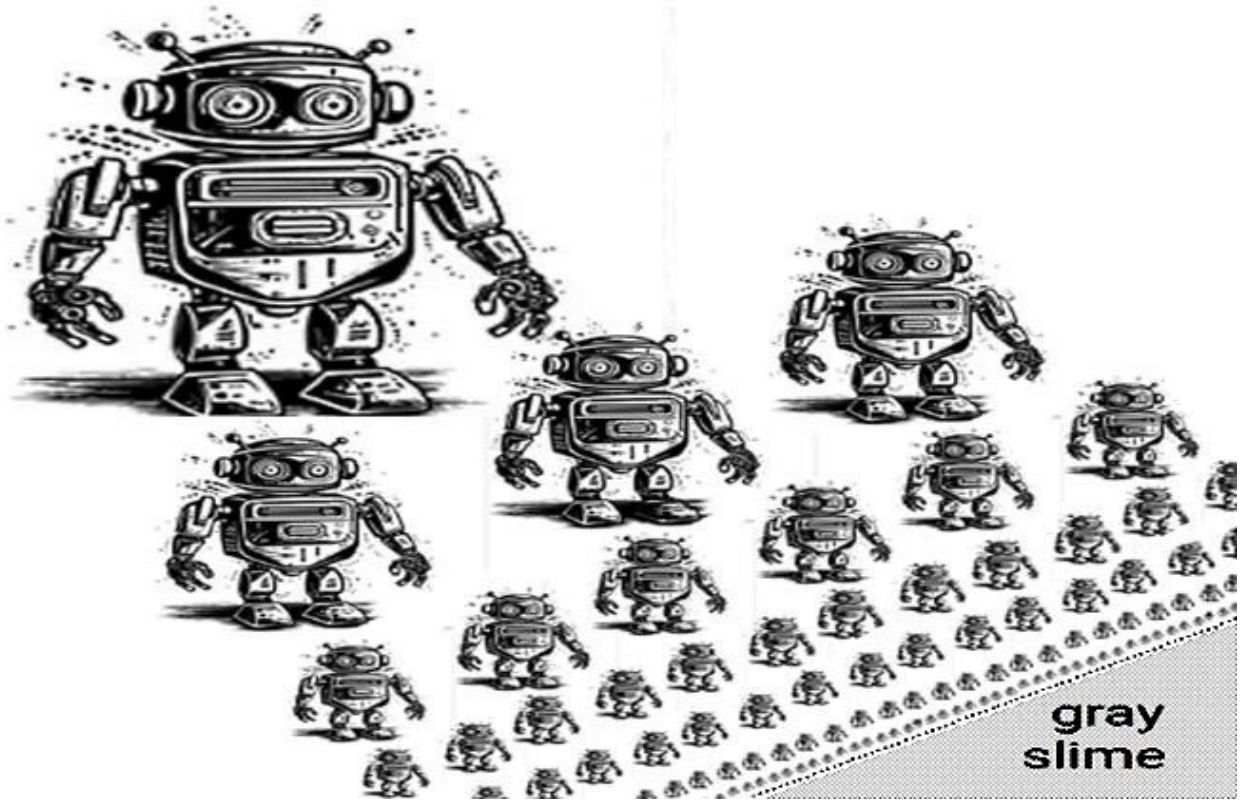


Fig.1. Analternative to LIFE, according to Feynman's linear approximation from the macro level to atoms, is NANOtechnology

electrical energy produced by humanity, but will also define TASKS that are supposedly relevanttoallofhumanity. Andmodernconsumersociety,builtonbureaucraticprinciples,cannot counter this. Rather, it is engaged in a race to actively utilize Artificial Intelligence based on practical NANO-technology.

Thus, NANO-technology has reached the social level. But the ELEMENTS of electronics created by it, without reliance on Fundamental Science, consume billions of times more energy than the recept or sand nervous system of a living organism. So, unintelligent NANO-technologies, devouring planet Earth, leave no room for LIFE! And Artificial Intelligence only facilitates this. In fact, what's happening in the world now is a vortex,suckingall of humanity into complete UNCERTAINTY, which is now fashionably calleda Singularity. Al though this nameis meaningless, asitdenotes the same uncertainty, but for them athematical function being used, i.e., it meansthat the wrong function isbeing used to describe the observed process. And the fact that the wrong function is being used for the vortex observed in any whirlpool or tornado is precisely what the analysis of the Magnetic Field has shown.

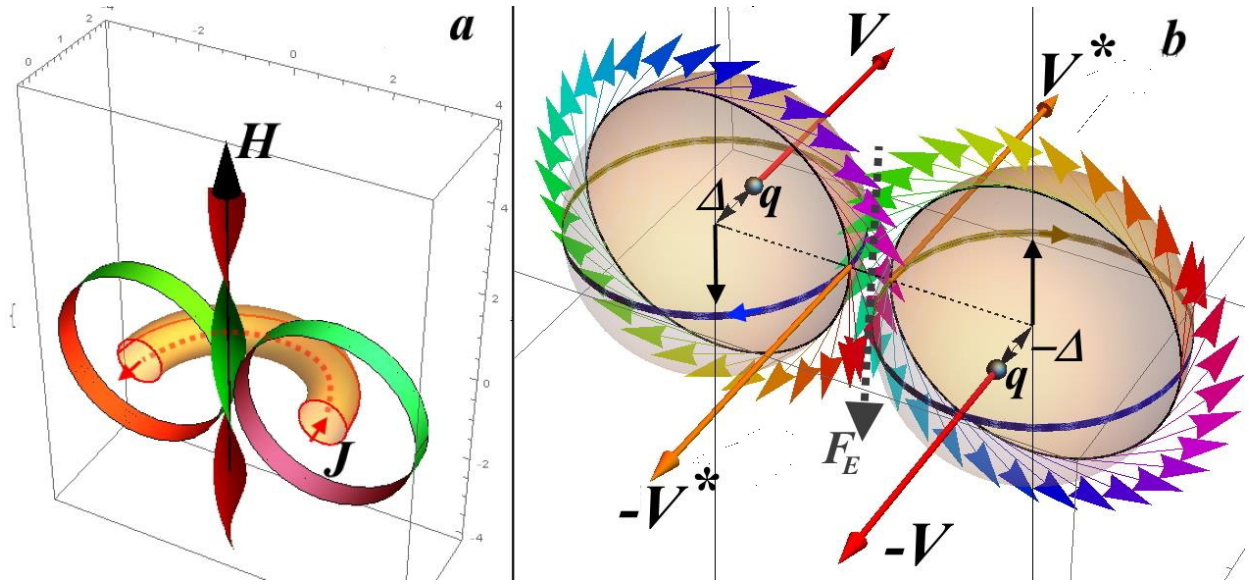


Fig. 2. Magneticfieldofacurrent-carryingsolenoid(a)duetothefrictionof Coulombfields(b). Breaking out of this vortex is extremely difficult, but possible.

To avoid falling into the abyss, one simply needs to act CORRECTLY. To achieve this, NANO technology must move away from IDEAS-TASKS artificially imposed by mystical models, when formulating priority directions, consider the real effects arising at the NANO scale.

1. It is necessary to consider the energy effects associated with the production of Prigogine's Local Entropy. a reduction in the energy consumption of NANO elements.

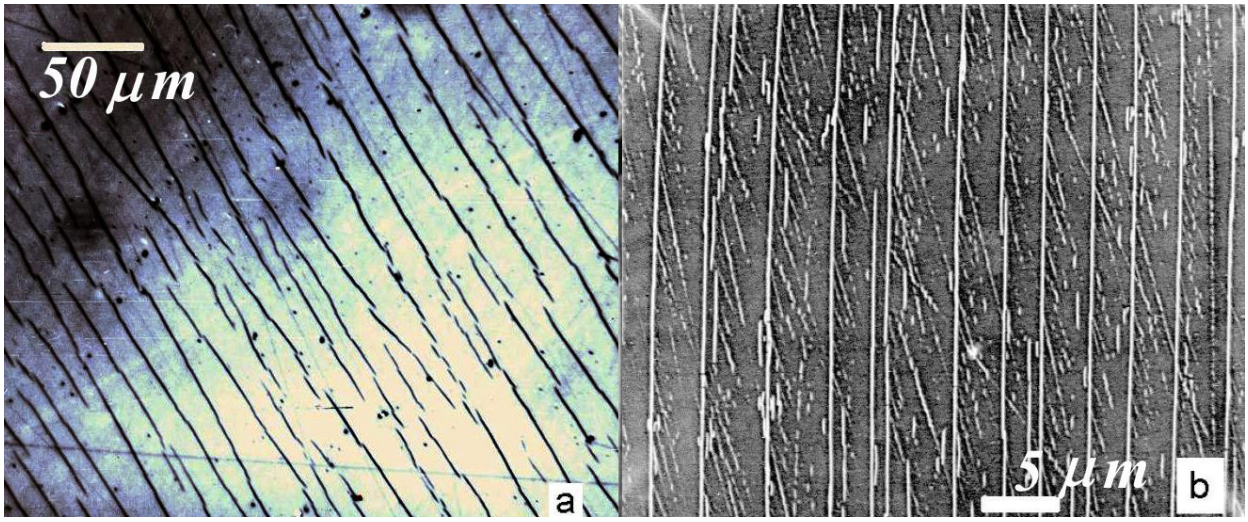


Fig.3 Stochastic regime off ormation of concentration precipitates with a thickness of about 3μm during rapid cooling (a) and formation of a regular network of concentration solitons with a thickness of 30 angstroms during slow cooling (b) of crystals of higher manganese silicide.

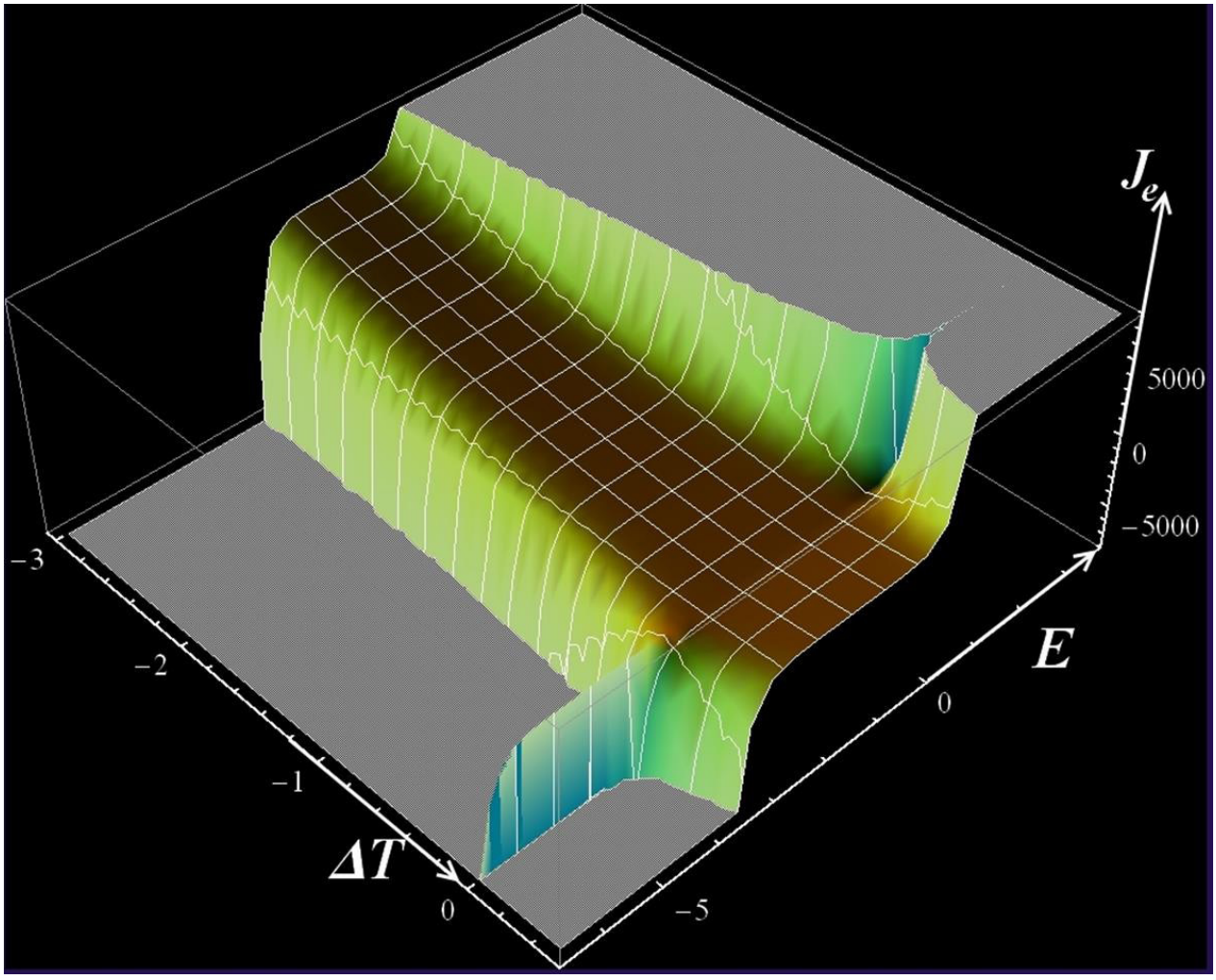


Fig. 4. Volt-Amp-Temperature Characteristic of the p-n Junction.

2. When selecting and creating materials used in NANO-Electronics, one should focus not on the mystical "quantum" p-orbitals of electrons, but on the real, chemical T-orbitals.

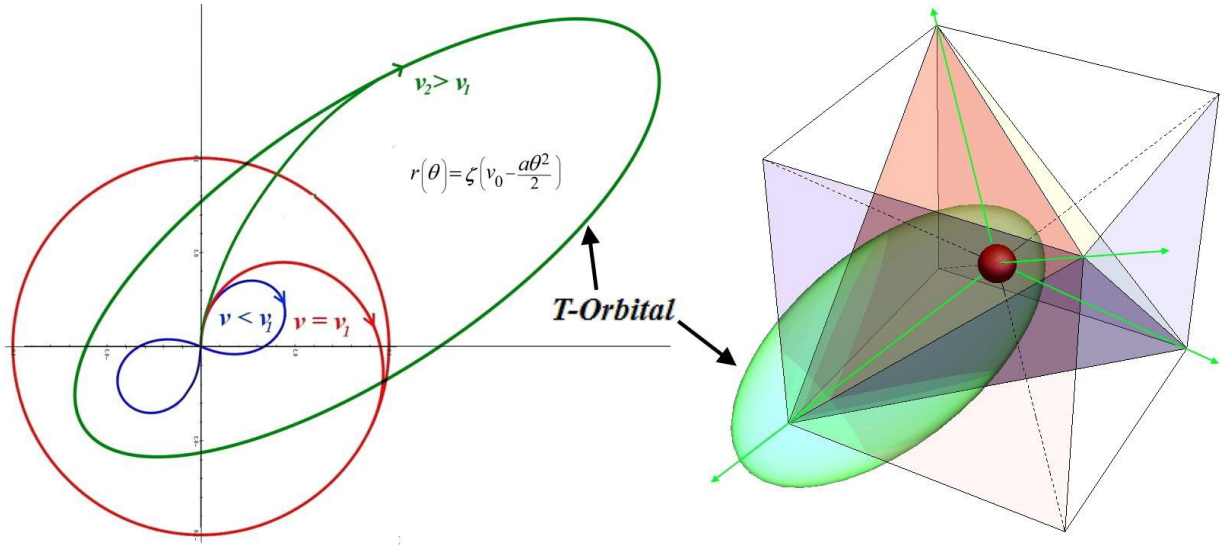


Fig. 5.Resonantellipticalorbit(left) forming a chemical T-Orbital.

3. It is necessary to consider not only the positionof the energy bands of macroscopic materials, but also their change at the

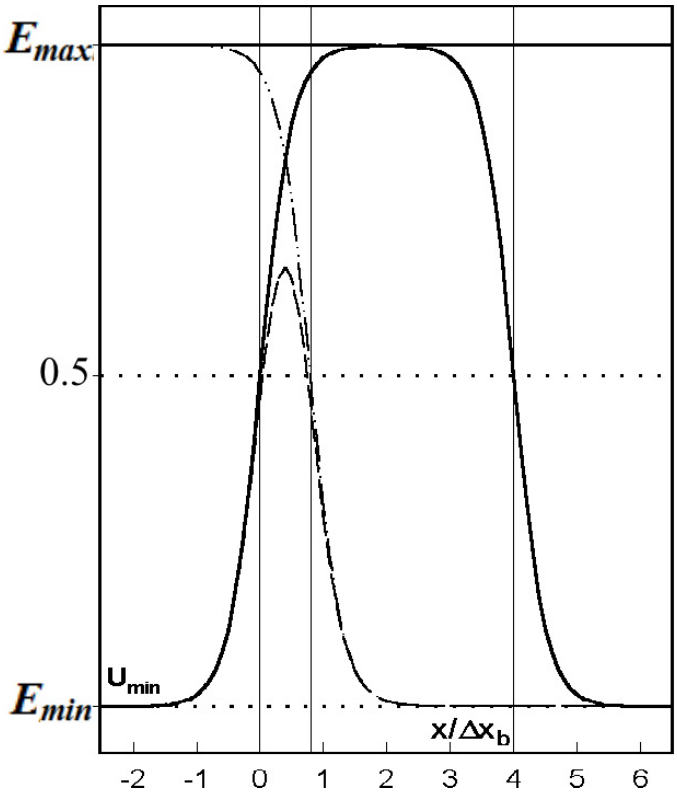


Fig. 6. Reduction in the height of the potential barrier when its thickness is less than the Debyelength.

Biography:

Stanislav Ordin graduated in 1972 from the Faculty of Radioelectronics of the Leningrad Polytechnic Institute, Russia, where he specialized in the quantum theory of solids. In 1974, he joined the Ioffe Institute of the Russian Academy of Sciences, where he is currently a senior research fellow. At the Ioffe Institute, he carried out complex experimental studies on a wide class of materials ranging from metals to dielectrics and from crystals to nanoparticles. Dr Ordin has authored more than 200 scientific papers and 15 patents, as well as 200 popular science articles on the website of the Nanotechnological Society of Russia. He was the scientific supervisor of 10 postgraduate students, all of whom successfully defended their dissertations for doctors of physics and mathematics. He is an "Honored Inventor of the USSR" and a member of the editorial board of the scientific and educational journal NBICS-Science, Technology.



Yashu Swami, Ph.D.,
Manav Rachna International Institute of Research and Studies, India

Smart nanoelectronics: Integrating AI and ML in materials design and nanoscale device optimization

The rapid evolution of nanoelectronics, driven by the ongoing miniaturization of electronic components and the increasing complexity of nanoscale systems, has ushered in new challenges in materials discovery, device fabrication, and performance optimization. Traditional approaches based on physics-driven modeling and experimental trial-and-error are proving increasingly inadequate due to the enormous design space, nonlinear behavior, and data-intensive nature of nanoscale phenomena. In this context, Artificial Intelligence (AI) and Machine Learning (ML) have emerged as transformative tools that offer new paradigms for tackling these challenges.

This paper explores the integration of AI and ML techniques in the field of nanoelectronics, with a particular focus on their applications in materials design and nanoscale device optimization. The convergence of these domains is leading to the development of "smart nanoelectronics", systems that are not only physically compact and energy-efficient but also capable of self-learning, adaptation, and intelligent decision-making during both design and operation.

In materials design, ML algorithms are increasingly used to predict material properties, identify promising nanomaterials, and accelerate the discovery process through high-throughput computational screening. Deep learning and generative models such as variational Auto-Encoders (VAEs) and Generative Adversarial Networks (GANs) have enabled the inverse design of nanomaterials with tailored properties, such as high carrier mobility, thermal conductivity, or flexibility. Reinforcement learning, on the other hand, is finding applications in experimental design, guiding the synthesis of nanostructures with minimal human intervention.

In nanoscale device engineering, AI is being leveraged to optimize device architectures, simulate quantum-level interactions, and predict performance degradation mechanisms. Neural networks and surrogate models reduce the computational burden of multi-physics simulations, enabling faster design iterations and real-time predictive maintenance. Additionally, ML-driven fault detection and classification systems improve reliability in nanoscale transistors, sensors, and memory elements by identifying defects and process anomalies at sub-nanometer resolutions.

The paper also reviews case studies where AI/ML models have successfully accelerated innovation in fields such as nano-biosensors, neuromorphic computing, and energy-efficient nano-devices. Emphasis is placed on interdisciplinary collaboration where insights from materials science, data science, and electrical engineering converge to create intelligent systems with capabilities beyond the reach of conventional electronics.

Despite these advancements, several challenges persist. These include limited availability of high-quality datasets, lack of interpretability in black-box models, difficulties in generalizing models across different material systems, and integration constraints with existing fabrication workflows. Addressing these challenges requires the development of hybrid models that combine domain knowledge with data-driven learning, standardized data repositories, and improved explainability techniques.

In conclusion, the fusion of AI and ML with nanoelectronics represents a fundamental shift in how we approach the design and realization of next-generation electronic systems. By enabling more intelligent, adaptable, and efficient nanoscale devices, this integration stands to significantly impact a wide range of applications—from wearable electronics and biomedical diagnostics to quantum computing and sustainable energy systems. This paper aims to provide a holistic understanding of this emerging field, highlighting key methodologies, breakthroughs, and the road ahead for smart nanoelectronics.

Audience Take Away

I. Understanding the Limitations of Traditional Nanoelectronics Design
- Why classical physics-based modeling and trial-and-error experiments struggle with the complexity, scale, and data intensity of modern nanoelectronics.
- Recognition of the need for new computational paradigms to handle vast design spaces and nonlinear nanoscale phenomena.

II. Role of AI and ML in Accelerating Materials Discovery
- How machine learning algorithms (like deep learning, VAEs, GANs) are revolutionizing the prediction of material properties and the inverse design of nanomaterials.
- Insight into the use of reinforcement learning to optimize experimental design and nanostructure synthesis, reducing human intervention and speeding up discovery.

III. AI-driven Nanoscale Device Optimization
- Application of AI in optimizing device architectures, simulating quantum effects, and forecasting device degradation.
- Use of neural networks and surrogate models to make complex multi-physics simulations more computationally efficient.
- Implementation of ML models for fault detection and reliability enhancement in nanoscale transistors and sensors.

Iç. Case Studies Highlighting AI/ML Impact
- Real-world examples where AI/ML have accelerated innovation in nano-biosensors, neuromorphic computing, and energy-efficient devices.
- Importance of interdisciplinary collaboration combining materials science, data science, and electrical engineering.

ç. Challenges and Future Directions in Smart Nanoelectronics
- Awareness of existing challenges: data scarcity, black-box model interpretability, model generalizability, and integration with fabrication workflows.
- The future need for hybrid models combining domain expertise and data-driven learning, standardized datasets, and explainability techniques to advance the field.

These points will give our audience a clear picture of both the transformative potential and the practical hurdles of using AI and ML in nanoelectronics, preparing them for a rapidly evolving research landscape.

Biography

Dr. Yashu Swami is a Professor in the Department of ECE at Manav Rachna International Institute of Research and Studies, Faridabad, India and a Postdoctoral Researcher at the EE Department, IIT Ropar. With a Ph.D. in Nanoelectronics (MNNIT Allahabad, India). He brings over 15 years of academic, research, and industry experience. His expertise spans VLSI, AI integration, and nanoelectronics. Known for leadership, adaptability, and innovative thinking, Dr. Swami is passionate about interdisciplinary collaboration, academic mentorship, and contributing meaningfully to technological advancement.



2nd Global Conference on

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PLENARY SESSION





Alexander G. Ramm
Mathematics Department, Kansas State University,

Creating materials with a desired refraction coefficient and other applications

It is apriori not clear if it is possible to create materials with a desired refraction coefficient. If it is possible, there are many technological problems that can be solved. In this talk the author proves that it is possible to create materials with a desired refraction coefficient. Moreover, he gives a concrete practical method for doing this. This method is based on an asymptotic solution of the many-body scattering problem by many small particles. The theory of wave scattering by many small impedance particles of arbitrary shapes is developed. The basic assumptions are: $a \ll d \ll \lambda$, where a is the characteristic size of particles, d is the smallest distance between the neighboring particles, λ is the wavelength. This theory allows one to give a recipe for creating materials with a desired refraction coefficient. One can create material with negative refraction: the group velocity in this material is directed opposite to the phase velocity. One can create a material with a desired wave focusing property. Quantum-mechanical scattering by many potentials with small supports is considered. Equation is derived for the EM field in the medium in which many small impedance particles are embedded. Similar results are obtained in [6] for heat transfer in the media in which many small particles are distributed. The theory presented in this talk is developed in the author's monographs [1], [7], [9], [12] and in the papers [2]–[6], [8], [10], [11]. Practical realizations of this theory are discussed in [9]. In [9] the problem of creating material with a desired refraction coefficient is discussed in the case when the material is located inside a bounded closed connected surface on which the Dirichlet boundary condition is imposed.

Biography:

Alexander G. Ramm was born in Russia, emigrated to USA in 1979 and is a US citizen. He is Professor Emeritus of Mathematics with broad interests in analysis, scattering theory, inverse problems, theoretical physics, engineering, signal estimation, tomography, theoretical numerical analysis and applied mathematics. He is an author of 719 research papers, 20 research monographs and an editor of 3 books. He has lectured in many Universities throughout the world, gave more than 150 invited and plenary talks at various Conferences and had supervised 11 Ph.D students. He was Fulbright Research Professor in Israel and in Ukraine, distinguished visiting professor in Mexico and Egypt, Mercator professor, invited plenary speaker at the 7-th PACOM, he won Khwarizmi international award in 2004, and received many other honors. A.G.Ramm as solved inverse scattering problems with fixed-energy scattering data, with non-over-determined scattering data and studied scattering problems with under-determined scattering data. He solved many specic inverse problems and developed new methods in this area. He solved the many-body wave scattering problem when the bodies are small particles of arbitrary shapes and used this theory to give a recipe for creating materials with a desired refraction coecient. These results attracted attention of the scientists working in nanotechnology. He gave formulas for the scattering amplitude for scalar and electro- magnetic waves by small bodies of arbitrary shapes and formulas for the polarizability tensors for such bodies. He gave a solution to the Pompeiu problem, proved the Schiffer's conjecture and gave rst symmetry results in harmonic analysis. He has developed the Dynamical Systems Method (DSM) for solving linear and non-linear operator equations, especially ill-posed. He developed a random elds estimation theory and studied convolution equations with hyper-singular integrals. Recently, he solved the millennium problem, the Navier-Stokes problem (NSP) and proved a paradox in the NSP which shows the contradictory nature of the NSP and the non-existence of its solution on the interval $t \in [0, \infty)$ for the initial data $v0(x)$ not identically equal to zero and the force $f(x, t) = 0$.



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ORAL SESSIONS





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Dielectric barrier discharge plasma based modification of synthesized Ag-TiO_2 nanocomposites for enhancement of photocatalytic activity from UV to visible region

In recent decades, the unabated discharge of dye-containing effluents from textile industries has severely damaged irrigation lands, threatened aquatic ecosystems, and compromised the safety of drinking water. To tackle these problems, we have prepared a Photocatalyst material (Ag–TiO_2 nanocomposite) employing Dielectric Barrier Discharge (DBD) plasma, operated at several voltages (14, 16, and 18 kV DBD). The aim of this project was to achieve the Photocatalytic activity in visible region. This process led to significant improvements in photocatalytic performance, which are closely linked to enhanced structural and optical properties. Structural changes, Surface morphology, elemental composition, optical absorption and functional groups of material have been observed by XRD, FESEM, EDX, UV-Visible spectrometer, and FTIR respectively. Comprehensive characterization by XRD, FESEM, EDX, UV–Vis spectroscopy, and FTIR revealed that the 16-kV plasma treatment produced samples with the highest crystallinity, abundant active surface sites, and a distinct redshift in optical absorption attributable to surface plasmon resonance (SPR). EDX confirmed significant Ag incorporation, while FTIR identified Ag–O, Ti–O, and Ag–TiO vibrational modes whose intensities correlated with increased crystallinity and absorption centers. Consequently, the 16 kV-DBD sample exhibited superior visible-light–driven photocatalytic degradation of methylene blue, methyl orange, and especially methyl green, achieving the highest dye removal rates under visible Light Irradiation. These findings demonstrate that DBD plasma treatment at an optimal voltage markedly enhances the structural and optical properties of Ag–TiO_2 composites, offering a promising route for sustainable, solar-driven remediation of toxic dyes in water.

Audience take away

1.DBD **Plasma Modification**: The audience will learn how Dielectric Barrier Discharge (DBD) plasma enhances Ag–TiO_2 nanocomposites for better photocatalytic activity under visible light.

2. Environmental **Remediation**: The research offers a practical solution for photocatalytic degradation of toxic dyes in water, addressing pollution in textile industry wastewater.

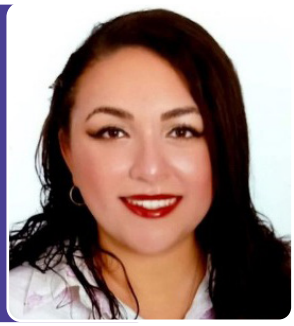
3. Material **Characterization Insights**: Techniques like XRD, FESEM, EDX, UV-Vis, and FTIR are demonstrated to assess the properties of modified materials.

4. Optimizing **Material Design**: The study helps design more effective photocatalysts for sustainable environmental cleanup applications.

- Faculty and researchers in material science, nanotechnology, and environmental engineering can use this knowledge to develop more efficient photocatalytic systems for water purification, improving the sustainability and cost-effectiveness of their research.
- The findings will also help in the design of new materials for solar-driven applications, offering a practical solution to a global problem—environmental contamination by toxic dyes.
- Industrial designers and environmental engineers can use this research to streamline processes for creating more effective, low-energy, and sustainable materials for pollution control.
- This research could also inform teaching by providing new case studies and experiments on plasma modification and photocatalysis.

Biography:

Mr. Abdul Muneeb is currently serving as a Research Associate in the Department of Physics at the University of Engineering and Technology (UET), Lahore, Pakistan. He earned his BS (Hons), equivalent to a Master's degree, from the University of the Punjab, Lahore, and later pursued an MPhil in Applied Physics at UET Lahore. He joined the research group of Prof. Dr. Muhammad Shahid Rafique at the Centre for Nanomaterials and Advanced Research, where he investigated Ag-TiO_2 nanocomposites synthesized via Dielectric Barrier Discharge plasma. He received his MPhil in 2022 and has published several SCI(E) articles.



AghapyYermansYakoup
Zewail City of Science and Technology, Egypt

Characterization, antibacterial, and cytotoxic activities of silver nanoparticles using the whole biofilm layer as a macromolecule in biosynthesis

Recently, multi-drug resistant (MDR) bacteria are responsible for a large number of infectious diseases that can be life-threatening. Globally, new approaches are targeted to solve this essential issue. This study aims to discover novel antibiotic alternatives by using the whole components of the biofilm layer as a macromolecule to synthesize silver nanoparticles (AgNPs) as a promising agent against MDR. In particular, the biosynthesized biofilm-AgNPs were characterized using UV-Vis spectroscopy, electron microscopes, Energy Dispersive X-ray (EDX), zeta sizer, and potential while their effect on bacterial strains, and normal cell lines was identified. Accordingly, biofilm-AgNPs have a lavender-colored solution, spherical shape, with a size range of 20–60 nm. Notably, they have inhibitory effects when used on various bacterial strains with concentrations ranging between 12.5 and 25 µg/mL. In addition, they have an effective synergistic effect when combined with phage ZCSE9 to inhibit and kill Salmonella enterica with a concentration of 3.1 µg/mL. In conclusion, this work presents a novel biosynthesis preparation of AgNPs using biofilm for antibacterial purposes to reduce the possible toxicity by reducing the MICs using phage ZCSE9.

Biography

Aghapy Yermans Yakoup is a graduate, batch 2023, with a biomedical sciences major (BMS) (medical sciences concentration) from Zewail City for Science, Technology, and Innovation. In addition, she have worked as a junior researcher assistant (jRA) in the Center for Microbiology and Phage Therapy (CMP) in Zewail City for Science, Technology, and Innovation from Fall 2021 until Summer 2023. She is working currently as an R&D specialist in Pharmaplast company. She is interested in finding new solutions to get rid of multi-drug-resistant bacteria and inventing new compounds that can be alternatives to antibiotics. Also, she is interested in the medical microbiology field. In the future, she is planning to enroll in a Ph.D. program that aims to find new applicable solutions for infectious diseases in different body systems like the nervous system and cardiovascular system.



[1,2]**Andrey Belousov, MD, Prof*.,[1]Ekateryna Belousova, Dr.**

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Uncovering novel antibacterial mechanisms of magnetite nanoparticles(MCSB): A new frontier in nanomedicine

This study investigated the effects of physical factors induced by magnetite nanoparticles (specifically, constant magnetic fields and sorption activity) on microorganisms belonging to various taxonomic groups. Biomarkers included the intensity of free radical lipid peroxidation (FRLP) and bacteriostatic activity. It was found that magnetite nanoparticles elicited differentiated responses in microorganisms (Fig.1). The primary influencing factor for *Candida albicans*, *Escherichia coli*, and *Pseudomonas aeruginosa* was the magnetic field, whereas for *Staphylococcus aureus*, sorption played a more significant role. A statistically significant reduction in the rate of lipid free radical consumption was observed across all tested strains following treatment with magnetite nanoparticles. Microbiological studies revealed pronounced bacteriostatic effects of magnetite nanoparticles on *Escherichia coli*, *Klebsiella pneumoniae*, and *Staphylococcus aureus*. A similar effect was observed when physiological saline pre-treated with these nanoparticles was applied. A correlation was demonstrated between the degree of bacteriostatic activity and the intensity of FRLP reactions. The maximum effect against *Staphylococcus aureus* was achieved under conditions where sorption was the dominant mechanism, whereas for *Escherichia coli* and *Klebsiella pneumoniae*, the greatest effect was observed under the predominant influence of the magnetic field. Of particular interest was the pronounced bacteriostatic effect exhibited by physiological saline pre-treated with magnetite nanoparticles. This phenomenon is presumed to result from changes in the polarization structure of water induced by the applied magnetite nanoparticles, which likely affects microbial viability (Fig.2).

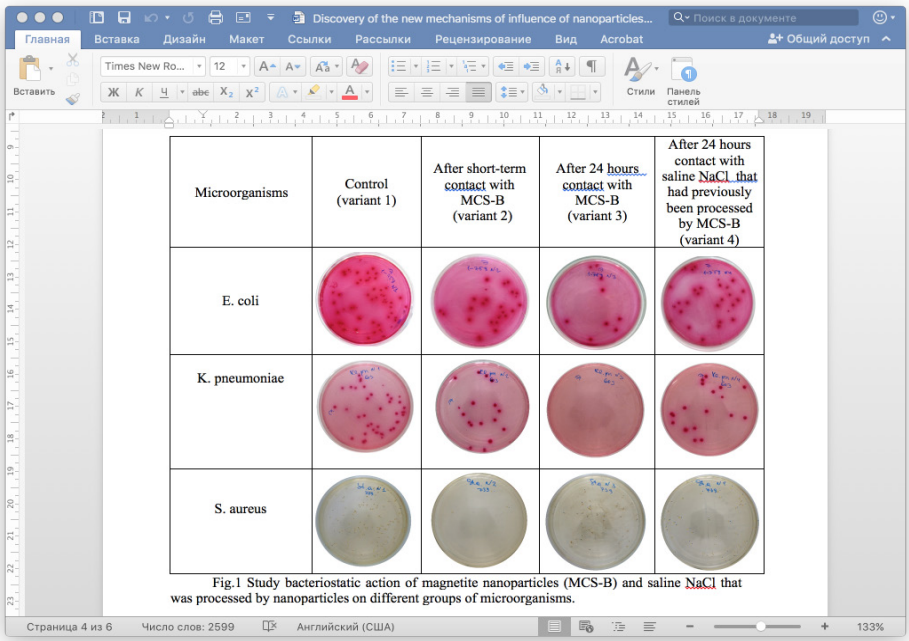


Fig.1 Study bacteriostatic action of magnetite nanoparticles (MCS-B) and saline NaCl that was processed by nanoparticles on different groups of microorganisms.

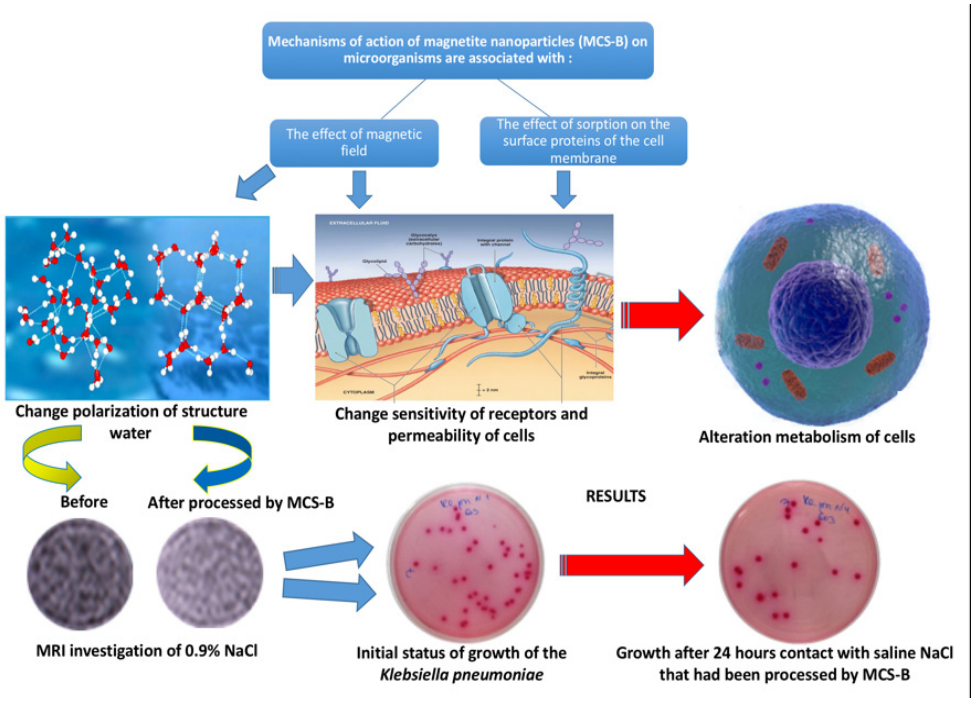


Fig. 2. Simplified scheme of the effect of physical factors of magnetite nanoparticles (MCS-B brand) on microorganisms.

1. How can the audience use the acquired knowledge?

This knowledge can be used to develop new antibacterial coatings, preparations, or disinfection methods that do not rely on traditional antibiotics. This is especially relevant in the context of increasing antibiotic resistance.

2. How will this help the audience in their work?

- Microbiologists can investigate the mechanisms of action of magnetic nanoparticles and use them to create alternative antiseptics.

- Medical technologists can propose new methods for sterilizing solutions without chemical reagents.

- Medical equipment developers can integrate nanostructures into filters, catheters, and implants to prevent infections.

3. Can other educators use this study to expand their research or teaching?

- Yes, this study can be incorporated into:

- Courses on nanotechnology in biomedicine,

- Lectures in medical microbiology and biotechnology,

- Laboratory workshops in experimental biophysics or free radical pathology.

4. Does it offer a practical solution that could simplify or make a designer's work more efficient (in a broad sense – system developer)?

- Yes. The findings can be applied in the development of:

- Water purification and sterilization systems,

- Antibacterial materials and packaging for biomedical use,

- "Smart" fluids for therapeutic applications.

5. Will it improve design accuracy or provide new insights for solving a design problem?

Yes. The study enables more precise selection of treatment modes, consideration of microorganism type, and adjustment of parameters (magnetic field vs sorption) for specific tasks.

6. List all other advantages:

- Enables the use of saline pre-treated with nanoparticles as a safe antiseptic medium.

- Offers new pathways for non-pharmacological control of microbiota.

- Provides targeted effects – selective influence on specific microorganisms.

- Serves as a foundation for developing nano-active biomaterials and magnetically controlled delivery systems.

- Reduces toxic load compared to conventional antibiotics.

Biography:

Andrey Nikolaevych Belousov is Doctor of Medicine, Professor. Author a new medicine product – nanotechnology preparations based on magnetite nanoparticles (Fe_3O_4) (www.nanolab.com.ua): Micromage-B (officially registration in Ukraine); Magnet-controlled sorbent brand of MCS-B for extracorporeal detoxication of biological liquids (officially registration in Ukraine and was allowed for medical practice); NanoBiocorrector for intravenous application – ICNB (intracorporal nanosorbent). A.N. Belousov is author new method of extracorporeal hemocorrection using magnet-controlled sorbent (MCS-B). The published more 340 scientific works on results application of nanotechnology preparation in experimental and practical medicine. At now Andrey Belousov - the Head of Laboratory Applied Nanotechnologies, DM, Professor of Kharkiv National Medical University, Ukraine.



Antonio Pantano Ph.D*, Nicola Montinaro Ph.D., Guglielmo Marchesa M.S., Donatella Cerniglia Ph.D.,
Università degli Studi di Palermo, Italy

Characterizing nanoparticle dispersion with a novel micro-thermographic approach based on pulsed laser excitation

This work wants to propose an innovative nondestructivepulsed thermographic approach utilizing a nanosecond pulsed laser as a heat source for assessing the presence of nanoparticle aggregates in nanocomposites. Different degrees of dispersion levels of carbon nanotubes (CNTs) enriched epoxy resin nanocomposites were investigated with a cooled infrared camera equipped with a macro lens to improve the geometric resolution of the images (up to 6 μm). The technique successfully exploits the high energy flux delivered by the laser in a short time, allowing for a significant improvement in energy resolution. Clusters with sizes as low as 30 μm were clearly identified as embedded in the matrix with well-defined contours. This research represents a significant advancement in image quality and time reduction for fast non-destructive evaluations (NDE) in the field of nanocomposites. In turn, the process is suitable for automated in-line quality control of manufactured parts that must meet desired specifications.

Bibliography:

1. Montinaro N., Marchesa G., Cerniglia, D., Pantano, A., Nanoparticles Dispersion Assessment by a Novel Pulsed Laser-Induced Micro Thermography Technique, Polymer Composites, 0:1–13, 2025.

2. Montinaro N., Fustaino M., Bellisario D., Santo L., Quadrini F., Pantano A. "Testing the Dispersion of Nanoparticles in a Nanocomposite with an Ultra-Low Fill Content Using a Novel Non-Destructive Evaluation Technique", Materials, 15(3), 1208, 2022. DOI: 10.3390/ma15031208, ISSN: 19961944.

3. Bellisario D., Quadrini F., Santo L., Montinaro N., Fustaino M., Pantano A.. "Hybrid nanocomposites with ultra-low filling content by nano-coating fragmentation", Polymer-Plastics Technology and Materials, 61 (1), pp. 41–55, 2022. DOI: 10.1080/25740881.2021.1948060, ISSN: 25740881.

4. Montinaro N., Fustaino M., Pantano A. "Carbon nanotubes dispersion assessment in nanocomposites by means of a pulsed thermographic approach", Materials, 13 (24), art. no. 5649, pp. 1-13, 2020. DOI: 10.3390/ma13245649, ISSN: 19961944.

5. Pantano A., Montinaro N., Cerniglia D., Micciulla F., Bistarelli S., Cataldo A., Bellucci S., "Novel non-destructive evaluation technique for the detection of poor dispersion of carbon nanotubes in nanocomposites". Composites Part B: Engineering, Vol. 163, p. 52-58, 2019. DOI: 10.1016/j.compositesb.2018.10.097, ISSN: 1359-8368.

Funding:
POC 1.1.1 – P.O. FESR SICILIA 2014/2020, Obiettivo Tematico 1, Obiettivo specifico 1.1, Azione 1.1.5
Aknowledgement: Progetto: "Produzione Eolica con Ridotto Impatto Ambientale 2 - PERIMA 2"

Audience Take Away:

- Participants will be introduced to an innovative non-destructive evaluation technique for assessing nanoparticle dispersion in composite materials.
- People from industry may be very interested in a non-destructive evaluation method capable of ensuring product quality and compliance with specifications.
- This research may be useful to other faculty to expand their research or teaching on non-destructive evaluation of nano composites.

- This NDE technique could offer a practical solution to address the challenge of testing the production of components made of nanocomposites, mitigating issues related to poor nanoparticle dispersion.
- The non-destructive evaluation method presented here enhances design accuracy by ensuring adherence to strict requirements, given that nanoparticle dispersion can be readily tested.

Biography:

Antonio Pantano is full professor at the Engineering Department of the University of Palermo (Italy). He earned is M.S. (1999) and Ph.D. (2002) in Engineering Mechanics from Michigan State University. From 2002 to 2004 he was Postdoctoral Associate at the Massachusetts Institute of Technology working on carbon nanotube enabled materials. In 2004 he moved to the Department of Mechanics, University of Palermo, where he was professor "Rientro dei Cervelli", a position for outstanding scientist. From 2007 he is professor, first associate and later full, at the University of Palermo. He has published 9 books and more than 100 research articles

Benedy kt Michal Josef Campbell-Biezanek,
Researcher, United Kingdom

The exponential polar manifold

This is a kind of infinite trumpet-shaped surface. The narrow end extends to a point at minus infinity representing our "number" zero and the broad end extends out to an infinite circle.The number oneis represented by a circle atzero exponential magnitude. Without this device, it is very hard to understand what anybody means by the number one. I mean, one meter we all understand or one idea, but mathematicians seem to think that the number one means something, even without any units at all. I am here to tell you that we have all been conned into thinking that one-nothing means something where as actually one-nothing means nothing at all. For certain advanced topics like relativity and quantum physics, the abstract set theory of numbers that we have all been told isall thatcan exist, is utterly useless and weneed togetrealwith ournumber theory. We need to forget all about the delusional neo-Pythagorean school with their abstract set theory of numbers.

Audience takeaway.

- We can use this new framework of numbers to understand the need for the mathematician's complex numerical plane; I hope that we have all beentaught that already.
- We can understand where the so-called complex numbers come from and what they actually mean or imply.
- We will end up understanding the relationship between time and space.
- Once a person becomes familiar with the **exponential polar manifold**, Maxwell's field equations and Einstein's General Theory become plain for all to see on the simple **flat numerical plane (FNP)**, the FNP is a simple derivative of the master framework, the exponential polar manifold.
- On the flat numerical plane the so-called "speed of light" becomes 1/(-1.i1) and c2 becomes minus one. 1/(-1.i1) means one unit of space per unit of imaginary historic depth.

Biography:

The author is a former electrical design engineer who, at the age of 57, took up pure Natural Philosophy in 2007. I retired far too early and decided to give upon. being a pointless playboy for achieving something useful for mankind. Nobody pays me anything, I have to do everything for the love of my own philosophical mind-sport



Dr. Dharmendra Kumar[1*], Prof. (Dr) Pramod Kumar Sharma[1]
[1]Kharvel Subharti College of Pharmacy, Swami Vivekanand Subharti University, Meerut India 250005

Quercetin-loaded banana starch nanoparticles: A novel anti-cancer delivery system

Nowadays, polymeric nanoparticles are one of the most chosen drug delivery systems for the treatment of life-threatening diseases such as cancer. Drug loading, drug entrapment, and drug release have been the challenges in nanoformulations till now. Various researchers are working to improve these limitations. Evaluation of drug loading, entrapment, size release, and activity of prepared starch nanoparticles. In the present study, starch was isolated from a novel source, i.e., unripe banana fruit. Banana starch contains amylose and amylopectin in a certain ratio (26-28:72-74). Banana starch was selected as polymer due its unique composition and function Such as amylose is a straight- chain polymer of D-glucose linked by 1-4 glycosidic bonds, while amylopectin is a branched-chain polymer of D-glucose linked by α-1,4 glycosidic bonds and α-1,6 glycosidic bonds. These structural differences impart unique drug release properties: amylose facilitates immediate release, while amylopectin provides sustained release. This dual release capability makes banana starch an intriguing candidate for drug delivery applications. Quercetin-loaded banana starch nanoparticles were prepared using the nano-precipitation method. Drug loading and drug entrapment were determined by different methods. The percentages of drug loading and entrapment efficacy were found to be 51.9 %. SEM analysis of nanoparticles reports the size of nanoparticles from 66.67 nm to 113.33 nm. *In-vitro* drug release was found to be 44.84 % within the first hour and 96.96 % within 12 hours. Prepared nanoparticles showed a good antioxidant effect against the DPPH radical scavenging model was found 98 percent. Percentage inhibition of cancer cells at different concentrations (0.001, 0.01, 0.1, 1, 10 µg/ml) of prepared nanoparticles and isolated quercetin were found to be 3.11, 11.52, 54.56, 57.21, 83.48, and 2.38, 2.11, 6.22, 36.92, and 72.45, respectively. Histopathological studies of tissues confirmed that burn-created wounds were healed by prepared nanoparticles within 21 days. Prepared nanoparticles suppressed the anti-inflammatory response, as confirmed by the histopathological studies.

Biography:

Dr. Dharmendra Kumar is an Associate Professor,KharvelSubharti College of Pharmacy, Swami VevikanandSubharti University, Meerut, India. Dr. Kumar has published over 15 Patents, 15 books and more than 25 research papers in prestigious journals indexed by SCI and Scopus. He is actively involved with various publishing houses worldwide as an editor, author, and reviewer



Enis SERT*, **Şadan Özcan, MehmetBurakKaynar**,

Ph.D. – Physics Department, Çankırı Karatekin University, Türkiye;
Ph.D. – Nanotechnology andNanomedicine Department, Hacettepe University, Türkiye;
Ph.D. – Physics Engineering Department, Hacettepe University, Türkiye (Retired)

From perovskites to spinel ferrites: Toward optimized magnetic nanoparticles for hyperthermia applications

Magnetic hyperthermia is a promising minimally invasive cancer treatment approach based on heat generation by magnetic nanoparticles under alternating magnetic fields. In our previous studies, $La_{1-x}Sr_xMnO_3$(LSMO)perovskitenanoparticlesan dtheirCu-dopedderivativesweresynthesizedviathe sol–gel method and systematically investigated in terms of structural, magnetic, and magnetothermal properties.

These studies demonstrated that LSMO nanoparticles exhibit superparamagnetic behavior near room temperature and possess tunable Curie temperatures (287–357 K), enabling self-regulated hyperthermia. The heating efficiency, quantified by the specific absorption rate (SAR), was strongly dependent on particle size distribution, with optimized samples reaching approximately 36.5 W/g. However, while compositional tuning through doping allows adjustment of Curie temperature, excessive doping leads to reduced heating performance.

Building on these findings, current efforts focus on alternative magnetic nanostructures with enhanced efficiency. In this context, spinel ferrite nanoparticles (such as Fe_3O_4-based systems) emerge as strong candidates due to their high SAR values, efficient magnetic loss mechanisms, and well-established synthesis routes. Compared to perovskite systems, spinel structures may offer improved heating performance while maintaining suitable magnetic properties for biomedical applications.

Overall, this work highlights the critical role of particle size engineering and compositional control in magnetic hyperthermia, while proposing spinel ferrites as promising complementary or alternative materials for future investigations.

AudienceTakeAway

1. Understanding of self-regulated magnetic hyperthermia via Curie temperature tuning
2. Insight into the critical role of nanoparticle size on SAR and heating efficiency
3. Comparative evaluation of perovskitevs.spinel magnetic nanostructures
4. Awareness of design parameters for optimizing magnetic nanoparticles in biomedical applications

Biography

Enis Sert received his BS degree inPhysics form Boğaziçi University, MSc degree in Physics Engineering, and PhD inNanotechnology and Nanomedicine form Hacettepe University. He is currently a facultymember at Faculty of Science, Çankırı Karatekin University. His research focuses on magnetic nanomaterials, magnetic hyperthermia, and biomedical applications of functional nanostructures. His work particularly investigates the relationship between particle size, composition, and magnetothermal performance.

Haim Livni*
Oslo Reliability, Israel

Nano reliability models

The phrase "f sky is the limit with nanotechnology " suggests its immense and limitless potential across many fields, from medicine and electronics to materials science and energy. Yet the laws of nature are valid in the nanometric domain too. This paper ivestigates the limitations imposed by these laws at the nanometric level on the reliability of nanome

Material defects caused by the movement of particles, or collisions between them at a molecular level are investigated. These collisions are characteristic to all materials.Their mathematical expression are random walks. Einstein associated Brownian motions with the second law ofher modynamics. Brownian motion has been shown to cause a Wiener process degradation. This paper introduces other types of random walks as mechanism for the prevailing degradation models, which till now were proved empirically. The failure mechanisms described herein are a Physics of failure approach. Yet it validates some of the basics of Reliability Standards (e.g. the existence of constant failure rates, the Arrhenius model)



L.Mergola,
B.S. degree, Ph. D, Assistant professor, University of Salento, Italy

Photothermal activity evaluation of grape marc-mediated gold nanoparticles and their applicability in antimicrobial disinfection and photothermal cancer therapy

Nanoparticles-mediated photothermal therapy (PTT) is an emerging approach of cancer care which exploit the unique optical characteristics of nanoparticles that, if irradiated with specific incident electromagnetic radiation, undergo a synchronization of free conductive band electrons that collectively move in resonance with the incident light, causing a strong local electromagnetic field with consequent localized heating that can cause cancerous cells suppression, preserving healthy tissues. However, the photothermal-converting ability depends on the photothermal agent used. To this aim, a new class of green gold nanoparticles were developed starting from winery waste extract and their photothermal ability was evaluated. After a grape marc hydrothermal extraction at 65°C, the extract obtained, rich in reducing sugars and polyphenolic agents, was successfully employed in gold nanoparticles preparation, as confirmed from the appearance of a plasmonic band at 535 nm. The UV-vis spectrum revealed also the presence of second peak at 286 nm, typical of phenolic groups, demonstrating the presence of a polyphenolic layer on the nanoparticle surface, also confirmed from FTIR studies. TEM and XRD analyses revealed their crystalline nature with an average diameter of about 30 nm. The presence of a third peak in the near infrared region (750 nm) makes synthetized gold nanoparticles good photothermal agents with a temperature increase of about 22.1 ^{o}C after NIR laser irradiation (10 min, 808 nm, 1.7 W.cm^{-2}). Biocompatibility studies on human fibroblasts and breast cancer cells (MCF-7) demonstrated good biocompatibility also at high concentrations (400 μg mL^{-1}) since the cell viability remains superior to 70% during 72 hours of studies. Finally, antibacterial and antitumoral effects of synthesized nanoparticles were observed after NIR laser irradiation with a cell viability inhibition at higher concentration of 41.7% and 52.5% in S. Aureus and E. Coli, respectively, as well as a reduction of MCF-7 viability to 37%.

Biography

Dr. Lucia Mergola is an assistant professor at the University of Salento. She received her PhD degree (2013) from University of Salento in Materials engineering and structures, under the supervision of Professor Giuseppe Vasapollo (Emeritus Professor in Chemistry). She was a postdoctoral research fellow (2015-2021) in the Department of Engineering for Innovation at University of Salento. In February 2015, she contributed to the production of a published review titled "Molecularly Imprinted Polymer: Present and future prospective", that received the Best Paper Award 2015 of the International Journal of Molecular Science (MDPI). Moreover, in May 2017, she received the PJ ZEON Award for outstanding paper published in Polymer Journal 2016, announced by the Society of Polymer Science Japan (SPSJ). In 2022 she started a new experience as Researcher in the Department of Engineering for Innovation at the University of Salento. A lot of scientific works were disseminated worldwide through participation in international congresses.



Musaab Habib Bangash

Public Health Engineering Department, Pakistan

Laboratory validation of chlorine dose effect on disinfection by products formation in water distribution networks

Safe drinking water is essential for human health, yet the formation of chlorination disinfection by-products in distribution systems remains a concern. This study examines the occurrence of two major disinfection by-products, Trihalomethanes (THMs) and Trihaloacetic Acids (THAAs), in high-density polyethylene (HDPE) and galvanized iron (G.I.) pipes under controlled laboratory conditions. A small-scale laboratory distribution model was developed to represent real field water supply networks. Different chlorine dosages were applied to evaluate how pipe material and chlorine concentration influence the formation of THMs and THAAs. Identification and quantification of these by-products were carried out using gas chromatography with electron capture detection and mass spectrometry(GC-MS). The study highlights how operational factors and pipe characteristics affect DBP formation within distribution systems. The findings provide practical insight into controlling these by-products and support improved strategies for delivering safer drinking water through optimized chlorination practices in distribution networks.

Keywords: Chlorination Disinfectant Products (DBPs), Laboratory-based prototype model, Chlorine Controlled Dosages, Trihalomethanes, Trihaloacetic acids.

Introduction

In the 21st century, drinking water disinfection is considered an important public health measure, effectively preventing waterborne disease by removing pathogenic microorganisms. Chlorination is one of the best yet least expensive methods to deactivate microorganisms and is a feasible agent for giving surety for procrastinating microorganisms' developmental activities in the supply network.[1]. A free chlorine residual is maintained up to a maximum of 0.2 mg/L, which must be maintained in the distribution network because it reduces the likelihood of further contamination. Dissolved organic matter in water is a complex natural element present in water due to anthropogenic activity, and is known as the main cause of the production of chlorine DBPs in water[2] The findings by [3] found that the most prevalent group among DBPs is THMs, THAAs, which were formed during the reaction of chloramine and chlorine with organic and inorganic species.

Distribution Systems (WDS) play a huge role in the secondary formation of DBPs, which may lead to the risk of excessive DBPs generation while passing through WDS. [4].Different regions use different pipe materials for drinking water transportation according to the supply and regulations. Cast iron pipe is the most widely used pipe material, but cast iron pipe easily corrodes and produces iron, accelerating DBPs formation [5]. Compared to other pipes, galvanized steel pipes showed a higher rate of chlorine decay[5]. Besides hydraulic shock, which can lead to the release of microplastics in plastic pipes,the release of microplastics may contribute to the formation of further contaminates the water quality[6]. Volatile chlorinated hydrocarbons are found to be carcinogenic, and the USA (EPA) has regulated 0.005mg/L as the minimum permissible contamination level of these volatile chlorinated hydrocarbons[7].

Different countries have different mean concentrations of THM, ranging from zero to 1000mg/L in Nigeria, it has been found between zero to 95mg/L in treated water samples. [8] similarly in the United States, up to 18mg/L of DBPs were detected in finished water and up to 22mg/ L DBPs in distribution systems [9], while in China, the average concentrations of THMs, HAAs over the entire period of treatment were 19.9mg/L,3.4mg/L [10] therefore the concentrations of THMs and HAAs in the water distribution system are spatially variable[11]. For densely populated Pakistan, with an average age of 70 years, cancer cases due to THMs are rising each year in this situation, Karachi (the biggest metro city of Pakistan), with 18 million people, is estimated with a great number of cancer cases. [12]but according to[13]twin cities of Pakistan, i.e., Rawalpindi and Islamabad, still reported lower cases than Tehran.

For the quantification of THMs and HAAs formation[14]conducted experiments for pipe setups like [15]In which 56 days were selected for the investigation of the DBPs development under-maintained booster chlorination dosages during the whole experiment. To the best of our knowledge, there has been no reference to comparative studies investigating prominent DBPs in the water distribution pipe medium.

A total of 6 samples were selected based on the specified dosage for the identification and quantification ofthenature of the pipe in the study area district Mardan, Pakistan. Each sample was investigated under controlled chlorine dosages. A prototype experimental lab setup was built to replicate a vast water supply network flow in G.I. and HDPE for the uninterrupted water flow in distribution pipes under controlled conditions.The two main chlorination disinfectant by-products specifically THMs and THAAs were investigated for quantification under GC-MS equipped with (ECD) with and without filtration media.

I. Methodogy

Calcium hypochlorite, in granular powder form, was obtained from the water quality laboratories of the Public Health Engineering Department in Khyber Pakhtunkhwa, Pakistan. THMs and THAAs, two standardizing chemicals for DBPs, were obtained from Standard Sales in Pakistan. Ethyl acetate, a liquid-liquid separator, was obtained from the Public Health Engineering Department KP.

A multi-staged random sampling technique is employed to provide coherent sampling over all three zones of District Mardan Region, which is the second-largest district in Pakistan's KP Province. To detect and quantify the production of Chlorination DBPs, primary sampling units (PSU) were chosen for each of the three regions, specifically two from industrial areas and one from regulated zones. Water from the ground source was chosen for distribution in these three district zones, with which elevated head tanks or overhead reservoirs were employed to provide head elevation and deliver it to the consumers.

A pilot-scale laboratory model of a water distribution system was developed to facilitate adjusting chlorine dosages. This system integrates loops made of HDPE with supporting galvanized iron pipes. Each loop was around 5 to 10 feet in length, with a pipe diameter of 1 inch. The loops were fitted with ball valves, elbows, unions, and sockets to analyze the properties of water and control water pressure and velocity. Furthermore, they have been utilized to channel the water flow in the intended direction. The water's velocity was controlled between 0.2 m/s and 1.8 m/s. The LLE technique was employed to separate the funnel into two distinct layers. Subsequently, water was extracted from the solute using a funnel dropper, leaving behind the solute as the residual.

Gas Chromatography-Mass Spectrometry (GCMS-5977B AGILENT TECHNOLOGIES USA) Analytical conditions were employed to identify THMs and THAAs, as per the guidelines set forth by the Environmental Protection Agency (EPA) in 55.1.

I I. Results And Discussion

The proportion of detected DBPs varied among the water samples from zone 1, zone 2, and zone 3. The identification of essential parameters for the production of DBPs was conducted for each water sample, average range of parameters is presented in Table 1. The study was performed sequentially, starting with a concentration of 0.2mg/L, followed by 1.8mg/L, and finally 2.4mg/L. Initially, for chlorine dosage.

Table 1 Water Parameter Range for All Samples Taken

S. No	Parameters	Range	S. No	Parameters	Range
1	pH	7.2-7.8	5	Temperature	30-38 °C
2	DO	5-5.7 mg/L	6	Hardness	Soft water
3	Turbidity	1-3 NTU	7	Total Organic Matter	1.8-2.2mg/L
4	Taste	Fair			

Initially, for a chlorine dosage of 0.2 mg/L, no focused elements DBPs, i.e., Trihalo acetic acids andTrihalomethanes were

traced rather than any other of their family derivatives. For zone 2 with an enhancement in chlorine dosage to 1.8mg/L sample, for searching for chlorine DBPs, the sample was investigated under GC.MS (ECD) for about 5-6 hours, and it couldn't discover any halogenated Chlorine DBPs, but rather any of their family members. This non-tracing of none of the members of THMs or THAAs in even the second sample from zone 2 diverts our results towards the lesser amount of Chlorine DBPs production in the HDPE nature of pipe medium due to a lesser amount of reaction between the pipe material and water sample in the presence of organic matter. In contrast, subject DBPs, one element trichloromethane, was recognized at 1.8mg/L chlorine in the same G.I pipe medium,soquantifying about 0.193 mg/L THMs were quantified.

The zone 3 water sample with 2.8 mg/L chlorine dosage, focused on halogens family members including trichloroacetic acid and trichloronitromethane, was traced with peak number 2 at 4.340 mins in the obtained chromatograms, so about 0.2mg/L THAAs were quantified, and about 0.167 mg/L THMs were found as shown in Figure 1.

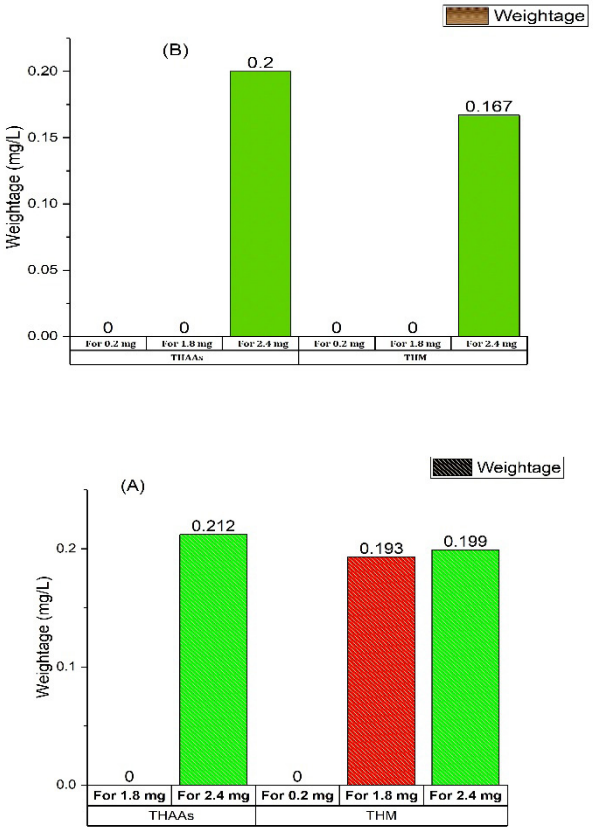


Figure 1a. Chlorine DBPs obtained weightage in GI passed medium pipe .b Founded THAAs and THMs for different chlorine dosages in HDPE.

III. Conclusion, Results, or Summary

Examining various regulated chlorine dosages reveals a tendency to increase chlorine quantities, which correlates with a more pronounced detection of chlorine disinfection byproducts (DBPs) and a proportional boost in quantification, particularly observed at dosages of 0.2 mg/L, 1.8 mg/L, and 2.8 mg/L. The behaviors of identification and non-identification varied based on the characteristics of the pipe media and other significant water quality factors, including pH, hardness, dissolved oxygen, turbidity, discharge, and flow duration. It has been determined that enhancing chlorine dose in relation to pipe characteristics exhibits intricate natural behavior, resulting in fluctuations in production following the addition of chlorine. The detection of significant THMs and THAAs further supports their abundant presence, attributable to their notable characteristics and generation potential when oxidizing agents such as chlorine interact with other chemicals in water samples.

Biography

Dr. Engr. Musaab Habib Bangash is a Civil and Environmental Engineer and currently serving as Deputy Director (Technical) at the Public Health Engineering Department, Government of Khyber Pakhtunkhwa. He holds a PhD in Environmental Engineering from the University of Engineering and Technology, Taxila, with research focused on water quality and disinfection by-products in drinking water systems.

With extensive experience in the WASH sector, he has been actively involved in the planning, design, and implementation of water supply and sanitation projects, including donor-funded and climate-resilient interventions. His work spans water quality monitoring, environmental pollution assessment, wastewater management, and sustainable infrastructure development.

Dr. Bangash has contributed to technical planning, environmental compliance (IEE/EIA), and policy-level inputs, while also engaging in research and capacity building. His areas of interest include sustainable water



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The development of graphene oxide-based nanocomposite coatings as anti-corrosion novel surfactant

The development of graphene based materials has been significantly increasing since they were invented. In various academic and industrial interests, graphene-based materials have achieved remarkable attention due to its distinctive chemical, mechanical, thermal, electrical and excellent anti-corrosion properties. This study presents the successful formulation of acrylic-epoxy-based polydimethylsiloxane (PDMS) polymer nanocomposite coatings via the solution intercalation method along with the inclusion of different content (0.5-3 wt.%) of graphene oxide (GO) nanoparticles that acted as nanofillers. These coatings have the potential to enhance the anti-corrosion performances and can be utilized for numerous applications. Several important aspects were presented in this investigation: (1) fabrication of highly conductive GO nanoparticles, (2) water contact angle (WCA), (3) cross-hatch test (CHT), (4) electrochemical impedance spectroscopy (EIS) and (5) field emission scanning electron microscopy (FESEM). The WCA measurements confirmed that the inclusion of nanofillers and PDMS had enhanced the surface hydrophobicity of the coatings. The CHT indicated that all the coatings had superior surface adhesion behaviour, receiving 4B and 5B ratings. The EIS studies that were conducted over a period of 60 days revealed that the inclusion of smaller content of nanofiller enhanced the corrosion protection performance of the coatings. The best corrosion resistance was achieved by the 0.5% GO coating sample, which exhibited an impedance modulus value ($|Z|_{0.01\ Hz}$) exceeding 10^{10} $\Omega\ cm^2$ throughout the immersion period. Finally, the FESEM micrographs confirmed the excellent dispersibility of GO nanoparticles (up to 2 wt.%) in the matrix. Hence, this study will be useful to explore this newly invented material for enhancing the corrosion protection performances of hybrid coatings.

Audience Take Away

- Corrosion is a serious threat to both economy and society. Hence, addressing these issues are essential to prolong the lifespan of metal-based substrates. The audience will be exposed to the new avenues and processes to prolong the corrosion reaction
- The findings of this research will significantly benefit the audience as prolonging the corrosion reaction will result in a remarkable cost reduction to replace the degraded metal/steel substrates. The multifunctional coatings that are described in this study provides a practical solution as it is well-known that corrosion issues cannot be solved but instead it can only be prolonged. Moreover, the study includes other beneficial explanations to why smaller content of nanofillers and uniform dispersion is more favorable in terms of enhancing the corrosion protection performance and smaller content used indicates the involvement of lowest cost of materials but yet providing a potential solution to this issue. In addition, the techniques employed in this study improved the efficiency of the coating design and wastage of coatings etc. were avoided. In overall, the findings reported in this study is essential for the researchers particularly in the field of corrosion science and it opened new avenues to further explore graphene derivatives for corrosion related applications.

Biography:

Prof. Ts. Dr. Sachin Sharma Ashok Kumar is a material scientists experienced in the development of graphene and graphene oxide nanomaterials incorporated with reinforced composites, supercapattery, batteries, hydrogen storage, polymer nanocomposites, corrosion coatings and 3D composites for numerous engineering applications. He received both of his BSc. degree (Hons.) and MSc. (Hons.) in Mechanical Engineering minor in Materials Science from Wichita State University, USA in year 2011 and 2012, respectively. He received his PhD in Advanced Materials Science Engineering in University of Malaya in 2023. His current research involves the synthesis of super-hydrophobic graphene-based polymer nanocomposite coatings to enhance corrosion resistance. He has published numerous articles in high ranked journals, participated in international conferences/exhibitions as a keynote speaker and has received several excellence awards at international levels. He is currently a member registered with the Board of Engineers Malaysia (BEM) and Malaysia Board of Technologists (MBOT).



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Effect of aluminum doping concentration on the corrosion performance of electrophoretically deposited ZnO coatings on A36 steel

Corrosionofmetallicmaterials remains one of the major challenges for various industrial sectors, particularly in structural and transportation applications, due to its detrimental effects on material integrity, component service life span, and the associated increase in maintenance costs. In this context, the development of advanced protective coatings has become a key strategy to mitigate corrosion processes and enhance the durability of steels exposed to aggressive environments. Among the materials investigated, aluminum-doped zinc oxide (Al:ZnO) has attracted increasing attention due to its chemical stability, tunable physicochemical properties, and its potential application as a functional coating.

This study evaluated the corrosion resistance of Al:ZnO coatings deposited on A36 carbon steel substrates. Aluminum-doped ZnO powders (2–4 at.% Al) were synthesized via a coprecipitation method using zinc nitrate and aluminum nitrate as precursors. The pH of the solution was adjusted to 10 with NaOH, and the reaction mixture was maintained at 80 °C for 2 h to promote precipitate formation. The resulting solid was subsequently recovered by centrifugation, washed to remove residual species, dried at 80 °C, and calcined at 500 °C for 1 h to obtain the doped material.TheAl:ZnO powder was dispersed in ethanol and deposited onto A36 steel substrates by electrophoretic deposition using a two-electrode configuration, applying a potential of 5 V for 5 min at room temperature. The coated samples were then dried at 60 °C for 24 h. The corrosion behavior of the coatings was evaluated using potentiodynamic polarization measurements in a 3.5 wt.% NaCl solution. The results showed a decrease in corrosion current density with increasing aluminum content in ZnO. In particular, the coating containing 4 at.% Al exhibited the lowest corrosion current density ($\approx 4.14 \times 10^{-6}$ A·cm^{-2}), compared with coatings containing 2 and 3 at.% Al. These results indicate that increasing the aluminum content in ZnO enhances the corrosion resistance of coatings deposited on A36 steel in saline environments, highlighting their potential for the development of protective coatings for metallic structures exposedtoaggressiveconditions.

Audience Take Away

- The results will provide the audience with insights into metal oxides and the influence of aluminum doping concentration on the corrosion resistance of A36 steel.
- Moreover, the audience will gain practical insight into the use of electrochemical techniques, such as polarization curves, to evaluate corrosion behavior.
- Finally, the results will contribute to a broader understanding of how nanomaterial-based protective coatings can be used to mitigate corrosion in steel structures operating in aggressive saline environments, highlighting their potential to improve durability and performance in metallurgical and metal-processing industries.

Biography

Fernanda Retana is a professor at the School of Chemistry at the Universidad Autónoma de Nuevo León (UANL) in Monterrey, Mexico. She obtained her Ph.D. in Materials Chemistry from UANL in 2022. Her research focuses on the synthesis and characterization of nanostructured materials for applications in corrosion science, solar energy conversion, and catalysis. She has extensive experience in materials synthesis and electrochemical and optical characterization techniques. Her current research interests include the development of functional nanomaterials, protective coatings, and advanced electronic devices, particularly for applications in the metal processing and energy industries. She has participated in several research projects related to surface engineering and functional materials.

BOOK OF ABSTRACTS

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