IRIS Scientific Group

Global Conference on Material Science and Nanotechnology

April 28-30, 2025

"Theme: Emerging Trends and Breakthroughs in Material Science and Nanotechnology"

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ABOUT US

Iris Scientific Group

IRIS Scientific Group stands as a pioneering organizer of international scientific conferences, recognized for its dedication to facilitating global research dialogue and interdisciplinary collaboration. Since its inception, the organization has consistently delivered high-quality academic events across diverse fields, including Medicine, Life Sciences, Environmental Sciences, Engineering, and Technology.

With a clear vision to connect researchers, scholars, and professionals from across the world, IRIS Scientific Group curates conferences that serve as platforms for sharing novel research, exchanging innovative ideas, and nurturing academic partnerships. Each event is meticulously designed to foster meaningful interactions, encourage cross-disciplinary learning, and contribute to the advancement of scientific knowledge.

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IRIS Scientific Group continues to build a reputation as a trusted facilitator of academic excellence. Through its forward-thinking approach and unwavering focus on research impact, it remains dedicated to shaping the future of science and innovation on a global scale.

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KEYNOTE FORUM

Stanislav Ordin
Russian Academy of Sciences, Russia

Thermoelectronic Efficiency

Thermoelectronics includes invariant ELEMENTS of Thermoelectricity, Thermoemission and p-n junction theory. And the Local NANO-THERMO-EMFs discovered and used to build the Unified Theory of NANO-scale, which are orders of magnitude greater than the Seebeck EMF, can have practical application for increasing the Efficiency of Energy Conversion of traditional devices. They are also a diagnostic tool for any microelements. But most importantly, they prompted the UNDERSTANDING that between the micro and Marco-worlds, Physics missed a scale where their linear approximations do not work, the Thermoelectronic Laws of the NANO-scale. Thus, Thermoelectricity, which was initially included in the FUNDAMENTALS of Nonequilibrium Thermodynamics, returned again to the Fundamental Science of the NANO-scale missed by Physics and actually expanded Electronics to Thermoelectronics, which revealed the previously unaccounted aspect of increasing the Efficiency of Energy Conversion - taking into account the spatial scale. Moreover, the Refinement and Expansion of the Theory of Thermoelectricity became the background (foundation) of all Evidence-Based Physics

Keywords: Thermoelectricity, Potential Barriers, Thermal Emission, NANO-effects, Thermoelectronics.

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. DrOrdin 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

Vladimir G. Chigrinov

Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong

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Azo dye photo aligned nanolayers for liquid crystals:new applications

Photoalignment and photopatterning has been proposed and studied for a long time [1]. Light is responsible for the delivery of energy as well as phase and polarization information to materials systems. It was shown that photoalignment liquid crystals by azodyenanolayers could provide high quality alignment of molecules in a liquid crystal (LC) cell. Over the past years, a lot of improvements and variations of the photoalignment and photopatterning technology has been made for photonics applications. In particular, the application of this technology to active optical elements in optical signal processing and communications is currently a hot topic in photonics research [2]. Sensors of external electric field, pressure and water and air velocity based on liquid crystal photonics devices can be very helpful for the indicators of the climate change.

We will demonstrate a physical model of photoalignment and photopatterning based on rotational diffusion in solid azodyenanolayers. We will also highlight the new applications of photoalignment and photopatterning in display and photonics such as: (i) fast high resolution LC display devices, such as field sequential color ferroelectric LCD; (ii) LC sensors, including polarization sensors for polarimetriccameraas; (iii) LC lenses with a variable focal distance; (iv) LC E-paper devices, including electrically and optically rewritable LC E-paper; (v) photo induced semiconductor quantum rods alignment for new LC display applications; (vi)100% polarizers based on photoalignment; (vii) LC smart windows based on photopatterned diffraction structures; (vii) LC antenna elements with a voltage controllable frequency.

Biography

Professor Vladimir G. Chigrinov is Professor of Hong Kong University of Science and Technology since 1999. He is an Expert in Flat Panel Technology in Russia, recognized by the World Technology Evaluation Centre, 1994, and SID Fellow since 2008. He is an author of 6 books, 31 reviews and book chapters, about 333 journal papers, more than 718 Conference presentations, and 121 patents and patent applications including 50 US patents in the field of liquid crystals since 1974. He got Excellent Research Award of HKUST School of Engineering in 2012.He obtainedGold Medal and The Best Award in the Invention & Innovation Awards 2014 held at the Malaysia Technology Expo (MTE) 2014, which was hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014. He is a Member of EU Academy of Sciences (EUAS) since July 2017. He got A SlottowOwaki Prize of SID in 2018 http://www.ee.ust.hk/ece.php/enews/detail/660. He is 2019 Distinguished Fellow of IETI (International Engineering and Technology Institute). http://www.ieti.net/news/detail.aspx?id=184 http://www.ieti.net/memberships/Fellows.aspx. Since 2018 until 2020 he works as Professor in the School of Physics and Optoelectronics Engineering in Foshan University, Foshan, China. 2020-2024 Vice President of Fellow of Institute of Data Science and Artificial Intelligence (IDSAI) Since 2021 distinguished Fellow of Institute of Data Science and Artificial Intelligence. He is IETI Fellow (https://www.ieti.net/pro/memberdetail.aspx?ID=539) since 2019.Since March 2022 he is A Fellow of National Academy of Technology for his contributions to Information Electrical and Electronic Research : http://www.usnat.org/fellows.htmlHe is a Editor in Chief of Liquid Crystal section in Crystals journal since 2023 https://www.mdpi.com/journal/crystals/sectioneditors/liquid_crystals

Paulo C. De Morais
Catholic University of Brasilia, Brazil

Exploring cuprous oxide polycrystalline thin films as an improved sensor for chemicals

In this keynote talk, cuprite (Cu2O) thin films' properties will be presented and discussed. Moreover, the potential application of the introduced cuprite thin films as sensor for chemicals will be explored. The presented Cu2O thin films can be successfully produced from metallic copper thin films, via thermal annealing carried out at moderate temperatures (say 200 oC), for about 20 hours in air atmosphere. On its turn, the copper thin films supported onto glass (say borosilicate) substrates can be easily fabricated by thermal evaporation of the metal. The as-produced cuprite thin films may present nanometer size thickness (typically in the range from 50 nm up to 500 nm), whereas the Cu2O crystallite mean size can be found in the range from 5 nm up to 30 nm, the latter being sensitive to the film thickness. The optical bandgap remarkably depends on crystallite mean size, varying in the range from about 2.10 eV up to 2.40 eV. Quantum confinement effect is herein assumed to play a key role in the opening of the optical bandgap. Electrical properties of the as-produced cuprite thin films indicated a p-type semiconductor behavior, with carrier density of about 1014 cm-3. Finally, sensor testing the as-produced cuprite thin films demonstrated a response to ethanol gas at room temperature, with the thinner film being more sensitive to the gas detection than the thicker film, which was related to the grain size change. This talk addresses the important development of chemical sensors based on cuprite thin films, with high room temperature response, suitable for portable devices, in particular for breathe ethanol testing.

Audience Take Away Notes

- An alternative route of synthesis for cuprite thin films will be presented
- The alternative fabrication route can be employed to different applications
- The audience can be inspired to develop different technological applications

Biography

Professor Paulo César De Morais, 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 HUST – China (2012-2015); Distinguished Professor at AHU – China (2016-2019); Full Professor at the Catholic University of Brasília (UCB) – 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 13,000 citations, He has published over 500 papers and more than 15 patents.

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PLENARY TALK

Alexander G. Ramm
Kansas State University, USA

Wave scattering by many small particles, creating materials with a desired refraction coefficient and other applications

The theory of wave scattering by many small impedance particlesof arbitrary shapes is developed. The basic assumptions are: a d λ, where a is the characteristic size of particles, d is the smallestdistance between the neighboring particles, λ is the wavelength.This theory allows one to give a recipe for creating materials witha desired refraction coefficient.One can create material with negative refraction: the group veloc-ity 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 smallsupports is considered.Equation is derived for the EM field in the medium in which manysmall impedance particles are embedded.Similar results are obtained in [6] for heat transfer in the media inwhich many small particles are distributed. The theory presented in this talk is developed in the author'smonographs [1], [7], [9], [12] and in 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 refractioncoefficient is discussed in the case when the material is located insidea bounded closed connected surface on which the Dirichletboundarycondition is imposed.

Biography

Alexander G. Ramm is the author of 660 research papers and 13 monographs in analysis, applied mathematics, theoretical numerical analysis, ill-posed and inverse problems, and mathematical physics. He has given many lectures at various Universities throughout the world. He has several professional honors: Distinguished Visiting Professorships in UK, Mexico, Egypt, Mercator Professorship, Plenary talks at many Conferences, Khwarizmi International award. He is a member of editorial boards in many professional Journals. His main fields of expertise are: spectral and scattering theory, inverse and ill-posed problems, theoretical numerical mathematics, tomography, random fields estimation, wave scattering by many small particles and creating materials with a desired refraction coefficient.

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POSTERS

Dariusz Bochenek[1*], Dagmara Brzezinska[1], Artur Chrobak[1], Dariusz Oleszak[2]
[1]University of Silesia in Katowice, Faculty of Science and Technology, Institute of Materials Engineering, 75 PułkuPiechoty 1a, 41–500 Chorzów, Poland
[2]Warsaw University of Technology, Faculty of Materials Science and Engineering, Wołoska 141 02-507 Warsaw, Poland.

Technology and electrophysical properties of three-component multiferroic composites.

The paper presents the technology and electrophysical properties of two ternary multiferroic composites (with a ferroelectric/magnetic percentage of 90/10) obtained by the free sintering method. In the first composite (BT-BF-F), the ferroelectric component was BaTiO3 (BT) and BiFeO4 (BF) (in the amount of 50/50), and the magnetic component was zinc-nickel ferrite (F). In the second composite (BT-PZT-F), the ferroelectric component was BaTiO3 (BT) and strontium and chromium doped PZT-type solid solution (PZT) (in the amount of 50/50), while the magnetic component was zinc-nickel ferrite (F). The component powders were mixed in a high-energy planetary ball mill for 20 h and calcined at 900°C for 3 h, while the multiferroic composite samples were sintered by the free sintering method at 1250°C for 2 h. The multiferroic ceramic composites' crystal structure, microstructure, DC electrical conductivity, and dielectric, ferroelectric, and magnetic properties were investigated. Studies have shown that the use of two ferroelectric materials in the composite composition has a beneficial effect on the performance parameters, favoring the preservation of high dielectric and magnetic properties of multiferroic composites. The BT-BF-F composite sample exhibits better magnetic properties (higher magnetization values and higher saturation of the magnetic hysteresis loop) but weaker ferroelectric properties (no saturation of the ferroelectric hysteresis loop). In contrast, the BT-PZT-F composite sample exhibits high ferroelectric properties with saturation of the ferroelectric hysteresis loop P-E (maximum polarization Pm=11.2 µC/cm2, residual polarization Pr=2.95 µC/cm2 and coercive field Ec=0.57 kV/mm) but lower values of magnetic parameters. Multiferroic ceramic composites built based on magnetic and ferroelectric materials show interesting functional properties that are adequate for applications in modern microelectronics.

Audience Take Away Notes

- Description of the technological process of multiferroic composite materials with functional properties;
- Familiarization with the method of visualizing the distribution of magnetic and ferroelectric phases in the microstructure of a multiferroic composite;
- Learning the methods and ways of maintaining high ferroelectric and magnetic properties in multiferroic composite materials

Biography

Prof. dr hab. DariuszBochenek is currently employed as a Professor at the University of Silesia in Katowice (Poland) and is the head of a research group at the Institute of Materials Engineering dealing with the production and testing of ceramic materials and multiferroic composite materials with functional properties for microelectronic and micromechatronic applications. He is a member of the Polish Ceramic Society PTCr's board. He is also a member of the Polish Society of Microscopy PTMi, the European Microscopy Society (EMS), and the International Federation of Societies for Electron Microscopy (IFSM).

Dariusz Bochenek[1], Dagmara Brzezinska[1*], Maciej Zubko[1],
[1]University of Silesia in Katowice, Faculty of Science and Technology, Institute of Materials Engineering, 75 PułkuPiechoty 1a, 41–500 Chorzów, Poland

Technology and dielectric properties of multicomponent PZT-type ceramics modified with europium/tungsten

This work obtained a multicomponent PZT-type material doped with manganese Mn, antimony Sb, europium Eu, and tungsten W using the classical sintering method (pressureless sintering). Three compositions with the general formula Pb (Zr0.49Ti0.51)0.94Mn0.021Sb0.016EuxW0.018-x/2O3 were tested and analyzed, with a variable amount of europium Eu (from 0.008 to 0.012) and tungsten (from 0.014 to 0.012) admixture. The component powders were mixed in a planetary ball mill for 24 h in the technological process. The powder mixture was synthesized by calcination at 850°C for 4 h, while the ceramic samples were sintered by the free sintering method at 1150°C for 2 hours. XRD studies have shown that the obtained multicomponent PZT-type materials have the structure of a tetragonal system with a point group of P4mm. The microstructure of ceramic samples is characterized by fine and properly crystallized grains with sharp and clearly visible grain boundaries. Dielectric studies of PZT-type materials have revealed high values of permittivity with simultaneously low dielectric loss values and low electrical conductivity, which are important parameters for microelectronic applications.

Audience Take Away Notes

- Description of the technological process of multicomponent ceramic materials of the PZT-type with functional properties;
- Learning the methods and ways of maintaining the microstructure of ceramicmaterials with high homogeneity;
- Learning the methods and ways of doping ceramic materials to obtain their optimal electrophysical properties.

Biography

DrDagmaraBrzezińska is currently employed as an assistant professor at the University of Silesia in Katowice (Poland) in a research group at the Institute of Materials Science and Engineering dealing with the production and research of ceramic materials and multiferroic composite materials with functional properties for microelectronic and micromechatronic applications.

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SPEAKER SESSIONS

Arun Kumar Singh
Department of Pure and Applied Physics, Guru GhasidasVishwavidyalaya, Bilaspur 495009(C.G.), India.

Organic–Inorganic Hybrid Materialfor High Performance Electronic Devices

Inorganic-organic hybrid materials have attracted immense interest in modern electronic and optoelectronic applications due to their unique properties and create novel device architectures with new functionalities. The solution-processed π-conjugated conducting polymers are of significant fundamental and technological interest for portable electronic/ optoelectronic devices. However, charge transport in organic semiconductors has generally been limited due to a lack of orderedchains and highly crystalline structure and poor connectivity. Here, we report the enhancement in optical, structural, and electronic properties of organic polymer semiconductors by incorporating inorganic 2D nanosheets. By introducing 2D nanosheets into polymer enhanced the long-range ordering and aggregation in organic semiconductors. The synthesized organic-inorganic hybrid materials exhibit improved molecular ordering and transport properties. The grazing incidence X-ray diffraction analysis and atomic force microscopy reveal the long-range ordering and highly crystalline thin films of polymer chains over the substrate.The influence of morphology and orientation on macroscopic charge transport performance is studied by fabricating organic field-effect transistors (OFETs), Schottky diodes and photodetectors. Our methodology of using inorganic 2D nanosheetsassisted aggregation of organic semiconductor offers a simplistic route to regulate the crystallization of organic semiconductors for high-performance organic electronics.

Audience Take Away Notes:

- All those who interested in organic semiconductor (OS) materials and related work will enjoy.
- It will also be of great interest to material scientists from diverse backgrounds.
- Participants may learn about electronic properties of hybrid materials.
- Participants may learn about device fabrication and measurements.

Biography

Dr. Arun Kumar Singh is working as Professor at Department of Pure and Applied Physics, Guru GhasidasVishwavidyalaya, Bilaspur, India. He received his M.Sc. degree in Physics from Banaras Hindu University, Varanasi, India and received his Ph.D. degree from School of Materials Science and Technology, IIT (BHU), India. After Ph.D., he joined postdoctoral research work at Graphene Research Institute, Sejong University, South Korea. He got India most prestigious research award, “INSPIRE Faculty awards” from DST, India. He has published many papers as a main author and co-author in international journals/ conferences in the area of materials science/physics.He is also edited two books as editor and written seven book chapters. His research work basically includes the charge transport in organic semiconductors/two dimensional nanomaterials and their electronics device applications. He is life member of many scientific societies and reviewer of International scientific journals.

Christopher OluwatobiAdeogun*, C .O Adeogun Ph.D.
South China University of Technology, China

The Physics Behind Nanotechnology & Mathematical Modelling

Experimental studies of infinite (unrestricted at least in one direction) quantum particle motion using probe nanotechnologies have revealed the necessity of revising previous concepts of their motion. Particularly, quantum particles transfer quantum motion nonlocality energy beside classical kinetic energy, in other words, they are in two different kinds of motion simultaneously. The quantum component of the motion energy may be quite considerable under certain circumstances. Some new effects were predicted and proved experimentally in terms of this phenomenon. A new prototype refrigerating device was tested, its principle of operation being based on the Experimental studies of infinite (unrestricted at least in one direction) quantum particle motion using effect of transferring the quantum component of the motion energy

Audience Take Away Notes

- In this book, the audience can see how these principles help explain phenomena related to heat transfer, phase transitions, and fluctuations at the nanoscale. Understanding these principles is crucial for designing and optimizing nanoscale devices and systems.
- It provides a quantitative framework for describing complex phenomena and optimizing device performance. Mathematical models in nanotechnology often involve differential equations, statistical methods, and computational simulations. It is crucial for understanding the mechanical properties of nanomaterials. Models based on continuum mechanics, such as elasticity theory and plasticity theory, can predict the behavior of nanomaterials under different loading conditions. These models help in designing materials with desired mechanical properties and optimizing their performance.
- Yes, it provides a practical solution to a problem that could simplify or make a designer's job more efficient.
- Yes, it will improve the accuracy of a design, or provide new information to assist in a design problem.
- Contributes to the understanding of nanoscale phenomena, materials, and processes.
- Offers new methods or materials that address real-world problems, such as energy storage, medical treatments, or environmental sustainability.
- Provides foundational knowledge for applications in electronics, healthcare, agriculture, or manufacturing.
- Leads to developments like more effective medicines, stronger materials, or cleaner environments.

Biography

Doctor of Space Physics having expertise in Software Engineering, Space Physics & Telecommunications. Christopher is a University Lecturer and also a Consultant to Organizations both locally and internationally. His research interests are in the areas of: Telecommunications, Ionosphere& Space Physics, Theoretical Physics, Mathematical Modelling, Nanoparticles, Neural Networks, Signal Processing, Hydrodynamics, Nuclear Structure Properties, Nanotechnology & Material Science, Electronic Communications, Optical Communications, Power, Energy and Emerging Technologies & Globalization. He has a good experience teaching courses like: Electrodynamics, Astrophysics, Celestial Mechanics, Electronic Communications and Ionosphere Physics. He has various research manuscripts to his credit published in International Journals of repute. A scholar, and an erudite academic who has spoken in various academic conferences both locally and internationally. He is currently working on Nuclear Structure Properties & Nanotechnology in Space. He is a member of the Space Physics and Mathematical Modelling Research Group, Glasgow, Scotland, United Kingdom. He was the only Nigerian Researcher invited to speak at the 16th International Conference on Nuclear Structure Properties NSP 2023 May 8 – 10, 2023, Karabük University Turkey, Science Faculty, and Department of Physics. The conference was held to commemorate Turkey's 100th year Anniversary.

NaseemAhmad[a], and Kimoon Lee* [a, b]

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Tuning the Optical and electrical properties of CoWO4 Systems by Cu Doping

Probing and controlling the fundamental properties of the $CoWO_4$, a tungsten based ternary oxide, is always a challenging task for researchers. Before utilizing $CoWO_4$ in novel applications, adequate control and optimization of various physical properties and parameters have always been crucial. Over the past decade, thorough research attempts have been made to provide better manipulation and insights of the physical properties of functional $CoWO_4$ using dilute doping of metallic impurities. Subsequently, we utilize defect-induced engineering supported by Cu substitution at the Co sites in the $CoWO_4$ lattice to modify its physical properties and parameters. At the outset, a solid-state reaction route has been employed to synthesize high-quality pure and Cu-doped $CoWO_4$. The samples were then characterized using Powder XRD, and their pure wolframite-monoclinic polycrystalline phase, referred to as space group P2/c, was confirmed. The unit cell volume of the samples declines with the Cu content, confirming the successful doping of the Cu ions at the Co site assigned to the smaller ionic radius of Cu^{2+} ions (73 pm) as compared to that of the Co^{2+} ions (74.5 pm). X-ray photoelectron spectroscopy confirms the presence of the various ionic states of Co, Cu, W, and O. The band gap of $CoWO_4$ was found in declining order with the increasing Cu doping content. It was also observed that the 6% Cu doping in $CoWO_4$ material sufficiently improves its conductivity and also advances polarization, which promotes future applications for this material in various electronic devices.

Audience Take Away Notes

- In my presentation, the audience can get new insight into controlling the fundamental properties of the oxide systems.
- It opens new door to improve their knowledge in the following way.
- Insight into how small-scale doping (6% Cu) can fine-tune electrical and optical properties in transition metal tungstate.
- Potential to replicate or build on your method for similar materials.
- A deeper understanding of the structure-property relationship in doped oxides.

Biography

Dr. Naseem Ahmad is a postdoctoral fellow at Kunsan National University, Gunsan, South Korea. He holds a PhD in Applied Physics from Aligarh Muslim University, where he developed expertise in material science and advanced nanotechnology. His research focuses on the synthesis, controllable modification, and fundamental understanding of electrical transport, optical, and magnetic properties in nano and bulk materials.

His work primarily explores strongly correlated oxides, ferrites, and oxide-perovskites, aiming to enhance their functional properties for applications in electronics, energy storage, and magnetic devices. Through his research, Dr. Ahmad contributes to advancements in material design and characterization, helping bridge the gap between fundamental physics and technological innovation.

Manojit De*, H. S. Tewari
Guru Gobind Singh Educational Society's Technical Campus, Bokaro, Jharkhand

Tailored NiFe2O4 nanostructures: Synthesis, Structural, Vibrational, Magnetic study

Due to their high electrical resistivity and minimal eddy current losses, nickel ferrite ($NiFe_2O_4$) and its doped variants have garnered significant technological interest and commercial utility, particularly in electromagnetic interference (EMI) applications. These materials are widely used in devices such as hard disk drives, laptops, and various electronic components. Their exceptional combination of properties—such as high resistivity, elevated magnetic permeability, compositional stability, and low energy losses—has attracted the attention of researchers exploring their potential across a wide range of applications. Growing interest in ferrite-based magnetic materials also stems from their versatile roles in ferrofluids, data storage, and targeted drug delivery.In this study, pristine nickel ferrite ($NiFe_2O_4$) along with cadmium (Cd) and strontium (Sr) substituted nickel ferrite nanostructures were synthesized using a self-propagating auto-combustion method. Structural and magnetic characterizations were carried out at room temperature to investigate the influence of composition on material properties. X-ray diffraction (XRD) confirmed the formation of a single-phase cubic spinel structure, while Raman spectroscopy identified five characteristic phonon modes indicative of the spinel phase. Fourier-transform infrared (FTIR) spectroscopy revealed two distinct absorption bands corresponding to the stretching vibrations in tetrahedral and octahedral coordination sites. Field emission scanning electron microscopy (FESEM) images showed the development of porous microstructures in the $NiFe_2O_4$ samples. Magnetic characterization included measurements of saturation magnetization, magnetic moment, and Y–K angles. The low ratio of remanent to saturation magnetization suggested the presence of multi-domain structures in the synthesized nano ferrites. Enhanced magnetic behavior observed in the doped samples was attributed to A-site substitution within the spinel lattice.

Audience Take Away Notes

- Synthesis Method: Pristine $NiFe_2O_4$ and Cd/Sr-doped nickel ferrite nanostructures were synthesized using a self-propagating auto-combustion method.
- Structural Confirmation: XRD analysis confirmed a single-phase cubic spinel structure, and Raman spectroscopy detected five active phonon modes characteristic of the spinel phase..
- Microstructural and Magnetic Properties: FESEM revealed porous microstructures, and magnetic measurements (saturation magnetization, magnetic moment, Y–K angles) indicated multi-domain structures.
- Effect of Doping: Improved magnetic performance in doped samples was attributed to A-site substitution in the spinel lattice.

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Biography

Manojit De is currently working as an Associate Professor in the Department of Physics at Guru Gobind Singh Educational Society's Technical Campus, Bokaro, Jharkhand, India. He received his M.Sc. and Ph.D. degrees in Physics from Guru GhasidasVishwavidyalaya, Bilaspur, India. He has over seven years of teaching experience and more than eleven years of research experience. He has published numerous papers as both a lead author and co-author in international journals and conferences in the field of materials science and physics. He has also been invited to deliver lectures and serve as a session chair at various national and international seminars and conferences. Additionally, he has served as a reviewer and editorial board member for several international journals. He is a life member of several scientific societies. His research primarily focuses on perovskite-

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[e] Department of Electrical Engineering, Faculty of Engineering, University of Malaya, Kuala Lumpur 50603, Malaysia

Polyaniline/ZnO Hybrid Nanocomposite: Morphology, Spectroscopy and Optimization of ZnO Concentration for Photovoltaic Applications

The optimal combination of semiconducting polymer–inorganic nanocomposites can significantly enhance the performance of polymer-only-based photovoltaic devices. In this study, polyaniline (PANI)/zinc oxide (ZnO) nanocomposites were synthesized by blending ZnO nanoparticles with PANI in four different ratios to optimize their photovoltaic efficiency. A simple coating technique was used to fabricate PANI, ZnO, and their nanocomposite at varying ZnO nanoparticle concentrations (1 wt%, 2 wt%, 3 wt%, and 4 wt%) to assess their potential for high-power conversion efficiency. The PANI/ZnO nanocomposites were characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), atomic force microscopy (AFM), Fourier transform infrared (FTIR) spectroscopy, ultraviolet-visible (UV-vis) absorption, energy dispersive X-ray (EDX), and current-voltage (I-V) measurements. XRD analysis revealed a distinct narrow peak corresponding to the wurtziteZnO (101) plane. SEM images confirmed the successful formation of the PANI/ZnO composite, showing the integration of crystalline ZnO into the PANI matrix. Elemental composition was verified through EDX, confirming the presence of bothPANI and ZnO without any impurities. FTIR spectroscopy provided insights into the chemical bonds and stretching vibrations, which were assigned to specific peaks. The bandgap narrowing observed with increasing PANI/ZnO content resulted in significant optical enhancement. I-V measurements were performed to evaluate the effect of the nanocomposite on the electrical properties of the PANI/ZnO films, analyzing different ZnO concentrations (1 wt%, 2 wt%, 3 wt%, and 4 wt%) under both light and dark conditions at standard test conditions (STC) of 1.5 AM globally. The highest power conversion efficiency (PCE) of 4.48% was achieved for the PANI/ZnO (3 wt%) composite, indicating that the conductivity of the PANI/ZnO nanocomposite thin films improved as the concentration of the nanocomposite increased.

Audience Take Away Notes

- Understanding the Potential of PANI/ZnO Nanocomposites in Photovoltaic Devices: The audience will learn about the effective use of polyaniline (PANI)/zinc oxide (ZnO) nanocomposites as an active layer in enhancing the photovoltaic performance of solar cells. They will understand how adjusting the ratio of ZnO nanoparticles can optimize power conversion efficiency (PCE).
- Techniques for Fabricating and Characterizing Nanocomposites: The presentation will explain simple methods for preparing and characterizing nanocomposites, including coating techniques and the use of XRD, SEM, AFM, FTIR, and I-V measurements. The audience will understand how these techniques help analyze material properties, such as crystallinity, optical characteristics, and electrical performance.

- Practical Implications for Nanocomposite Design and Application: The audience will gain insights into how different concentrations of ZnO (1 wt%, 2 wt%, 3 wt%, and 4 wt%) in the PANI matrix affect both optical and electrical properties, with a direct correlation to the efficiency of photovoltaic devices. This knowledge can guide future development and fine-tuning of nanocomposite materials for improved solar cell performance.
- Enhancement of Conductivity and Power Conversion Efficiency: The research demonstrates that incorporating specific ratios of PANI and ZnO nanoparticles can significantly improve the conductivity of thin films and boost power conversion efficiency. This takeaway will be particularly beneficial for professionals designing or working with solar cell materials.
- Researchers and engineers can apply this knowledge to design more efficient photovoltaic materials, especially those working with organic or hybrid solar cells. Understanding the role of nanocomposites in boosting power conversion efficiency can lead to the development of more cost-effective, higher-performance solar cells.
- Faculty and researchers in the field of material science can use these results to explore further optimization of polymer-nanoparticle combinations, opening doors for new research into various nanocomposites and their impact on other types of devices, such as sensors or light-emitting
- The study provides a practical solution for solar cell designers looking for materials that enhance both the optical and electrical properties, making the process more efficient in terms of both cost and performance.

- **Benefits:**

1. Improved Design Accuracy: This research provides new data on how the combination of PANI and ZnO can be optimized for improved efficiency, giving designers valuable insights to improve the accuracy of their designs.
2. Efficiency in Material Selection: By understanding the effect of varying ZnO concentrations, designers can select the best materials and ratios for their specific needs, simplifying the design process and improving overall solar cell efficiency.
3. Opportunities for Further Research: This work can inspire other researchers to explore different nanocomposite combinations, further advancing the field of photovoltaics.
4. Simplified Material Engineering: By revealing how different nanoparticle concentrations influence the properties of PANI/ZnO nanocomposites, this research can help material engineers streamline the process of material selection and fabrication for more efficient solar cells.

Biography

Shabina Ali is an experienced physicist specializing in thin-film solar cell research, with expertise in organic solar cells and photovoltaic technology. She holds an M.Phil. in Physics (2023) and a Master's in Education (2018). Currently a secondary school teacher, she has previously served as a STEM coordinator and teacher. Shabina has secured significant research funding for projects on perovskite solar cells and flexible solar cells. She has supervised undergraduate theses and authored several publications. Shabina's skills include SEM, TEM, and software like SCAPS-1D and VASP, alongside a strong teaching and leadership record.

Maryam MotallebiAghgonbad, Ph.D.,Ehsan MotallebiAghkonbad
Department of Physics, Faculty of Science, Urmia University, Iran
Department of Physics, Faculty of Science, Urmia University, Iran

Iron, Copper, and Zinc oxide nanoparticles supported on graphene oxide nanosheets using pulsed laser ablation process in liquid medium

In this study, pulsed laser ablation in liquid (PLAL) process was used to prepare graphene oxide (GO) nanosheets. Also, we have prepared Iron, Copper and Zinc oxide nanoparticles supported on graphene nanosheets using PLAL method and studied the structural and optical properties of the samples. Although much attention has been paid to laser ablation in gaseous medium since the early 1980s, some researchers started to investigate the laser of solid targets in liquid medium. Among the advantages of nanomaterials synthesis by pulsed laser ablation in liquid (PLAL) compared to air, we can point out the lack of contamination of the laboratory environment, including ensuring the safety of researchers and high precision instruments. Also, in the PLAL method, there is no need to use expensive vacuum chambers or clean rooms. In this research, nanosecond pulsed Nd:YAG laser with a wavelength of 532 nm was used to ablate the targets. The dimensions of nanomaterials can be changed and controlled by changing the parameters of the laser ablation, including the ablation time and the repetition rate, and also by choosing the appropriate solvent in which the ablation process takes place. The effect of composition ratio of materials on structural and optical properties was investigated. Structure of the samples was studied using TEM images and XRD pattern. TEM images showed non-deformed GO nanosheets. Iron oxide nanoparticles were homogeneosly attached to GO nanosheets, Copper oxide nanoparticles were surronded by small GO nanosheets and the interesting point about zinc oxide nanoparticles was that instead of being deposited on the graphene oxide nanosheets, they preferred to hang from the sides of the sheets. In XRD pattern of graphene nanosheets, GO and reduced GO nanosheets were identified. The absorption measurement of the samples in colloidal state was performed using a UV-vis single beam spectrophotometer in the wavelength range of 250 to 800 nm. After deposition of the samples on glass substrates by spin coating technique, the spectroscopic ellipsometry method was used to investigate the linear optical properties including the real and imaginary parts of dielectric function, absorption coefficient and optical band gap energy. The optical band gap energy of the samples with composition ratio of 1.4 ml GO and 0.6 ml metal oxide was calculated using Tauc relation for Fe, Cu and Zn, 3.60, 3.45 and 3.43 eV, respectively. In copper oxide and graphene oxide samples, absorbance and transittance in ethanol, deionized water and dimethylformaide media were compared. The copper oxide sample synthesized in dimethylformaide had the highest transmittance and the lowest absorbance. For copper oxide sample prepared in ethanol, the lowest transmittane and the highest absorbance was observed. For the GO sample prepared in demethylformamide and ethanol, the result was completely opposite to the results of the copper oxide samples.

Audience Take Away Notes

- Compared to other methods, pulsed laser ablation method in liquid medium, has some significant advantages, including the lack of contamination of the laboratory environment, ensuring the safety of researchers and high precision instruments and no need to use expensive vacuum chambers or clean rooms.
- In recent years, a lot of research has been done in relation to graphene and nanoparticles deposited on graphene

nanosheets, but considering that at the nano scale, the smallest change in the synthesis conditions results in many changes in the properties of the synthesized samples, a significant difference is observed between the results of different works. The experimental results of our research can be a guide for students active in the nano field in academic projects.

- Due to various applications of metal and metal oxide nanoparticles on GO nanosheets, such as supercapacitors, electronics, photocatalytic activities, antibacterial activities, energy storage, and decolorization, the results of this research can be interesting to researchers in these fields.

Biography

Maryam, MotallebiAghgonbad, Ph.D. in solid state physics, has finished her high school education (2004) at National Organization for Development of Exceptional Talents, received B.Sc. (2008), M. Sc. (2011), and Ph.D. (2018) at Urmia University. Her thesis has been encouraged by Iran Nanotechnology Innovation Council in 2011. She has worked on synthesis and studying structural and optical properties of nanolayers and nanoparticles using different physical and chemical methods, including laser ablation, physical vapor deposition, chamical bath deposition and sol-gel method. She has 30+ scientific papers in addition to two research projects. Currently, she is a supervisor and advisor for M.Sc. and Ph.D. thesis on nanomaterials at Urmia University.

AsmaaReda*, KasemRady, Ezzat El-fadaly, Mobarak Hassan
Sadat City University, Egypt

Review on structural and electrical properties of Co- Mn -Zn and its applications

Several years of worldwide revolutionary developments in nanoscience, combining physics, chemistry, material science, theory and even biosciences, have brought us to another level of understanding. The remarkable progress in science and technology is established with the advancement in nanoscience and nanotechnology. Basically, ferrites are ceramic materials, dark grey or black in appearance and very hard and brittle. Ferrites may be defined as magnetic materials composed of oxides containing ferric ions as the main constituent. Ferrites have much less electrical conductivity compared to metallic ferro magnets, continues to be the most important magnetic materials in various high-frequency applications, having repressed eddy currents and lowered energy loss in high-frequency use. Therefore, ferrites are playing a great role in many devices of every-day life (ac and dc motors, power distribution systems, video and audio applications, microwave devices, antenna rods, loading coils, core material for power transformers in electronics, high-frequency devices, memory devices such as hard disks, floppy disks, capacitor electrode, catalysis, drug delivery, water treatment, and gas sensor.Ultrafine Cobalt Zinc ferrite powders have been synthesized by co-precipitation method. Moreover, the effect of substituting Mn2+ ions on the crystal structures, microstructure, and dialectical properties of Co-Zn ferrites were studied. The effect of this dopant on the average of crystallite/grain size, lattice parameter, density, the purity of the formed phase, and morphology of the synthesized nanoparticles was determined. The prepared powders were characterized using X-ray diffraction, Fourier Transformation, Infrared Spectra, Transmission electron microscopy, and LCR Bridge. We obtained an improvement in the dielectric properties of the prepared samples, making them suitable for use in high-frequency applications due to the substitution by Mn ions.

Biography

AsmaaReda has completed her master's degree Environmental science in Physics from Sadat city University, Egypt. She is a scientific researcher in physics and environmental science especially in nanoscience in Sadat city University, Egypt. She has publications in springer, and her publication in Q2, and serving as a reviewer member of springer Journals

SantoshiMisra
St. Ann's College forWomen, Mehdipatnam, Hyderabad, Telangana State, India

AI-Driven Mathematical Modeling for Optimizing Nanofluid Heat Transfer Systems

Nanofluids, engineered by dispersing nanoparticles in base fluids, have gained significant attention due to their enhanced thermal properties. However, optimizing their heat transfer efficiency requires precise modeling of governing equations involving fluid dynamics, heat conduction, and nanoparticle interactions. This study integrates artificial intelligence (AI) with mathematical modeling to develop predictive frameworks for nanofluid behavior in heat transfer applications. Machine learning algorithms, trained on experimental and simulated data, enhance traditional models by accurately predicting thermal conductivity, viscosity, and convective heat transfer coefficients under varying conditions. AI-assisted optimization techniques further refine nanoparticle concentration, shape, and flow parameters to maximize efficiency. The proposed framework bridges theoretical and experimental gaps, providing a robust tool for designing next-generation thermal management systems in energy, electronics, and biomedical applications.

Key Words:
Nanofluids, Heat Transfer, Mathematical Modeling, Artificial Intelligence (AI), Machine Learning, Thermal Conductivity, Convective Heat Transfer, Optimization, Fluid Dynamics

Biography:

Dr. SanthoshiMisra is an experienced mathematics educator and researcher, currently serving as the Dean of Student Affairs and Head of the Mathematics Department at St. Ann's College for Women, Mehdipatnam, Telangana, India. She holds a Ph.D. in Mathematics from GITAM University, and her academic journey includes a Master of Science in Mathematics with Computer Science and a Bachelor of Science in Mathematics, Physics, and Computer Science, both from Osmania University. With over 20 years of teaching experience, she has played a vital role in shaping mathematics education, specializing in subjects such as Differential Equations, Algebra, Real Analysis, Linear Algebra, Vector Calculus, Numerical Analysis, Number Theory, and Mathematical Modelling. Beyond her teaching responsibilities, Dr. Misra has contributed extensively to interdisciplinary research, particularly in applied mathematics. Her Ph.D. research led to significant advancements in her field, earning her a prestigious government research grant from NCERT. She remains dedicated to fostering logical reasoning, problem-solving skills, and innovation in mathematics education. With a strong commitment to mentoring students and academic leadership, she continues to shape the future of mathematical sciences through research, education, and student engagement.

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Irreversible and reversible reactive chromatography: analytical solutions and moment analysis for rectangular pulse injections

This work is concerned with the analysis of models for linear reactive chromatography describingirreversible A → B and reversible A ↔ B reactons. In contrast to previously published results rectangularreactant pulses are injected into initially empty or pre-equilibrated columns assuming both DirichletandDanckwerts boundary conditions. The models consist of two partial differential equations, accountingfor convection, longitudinal dispersion and first order chemical reactions. Due to the effect of involvedmechanisms on solute transport, analytical and numerical solutions of the models could be helpful tounderstand, design and optimize chromatographic reactors. The Laplace transformation is applied tosolve the model equations analytically for linear adsorption isotherms. Statistical temporal momentsarederived from solutions in the Laplace domain. Analytical results are compared with numericalpredictions generated using a high-resolution finite volume scheme for two sets of boundary conditions.Several case studies are carried out to analyse reactive liquid chromatographic processes for a widerange of mass transfer and reaction kinetics. Good agreements in the results validate the correctness ofthe analytical solutions and accuracy of the proposed numerical algorithm.

Audience Take Away Notes

- The audience will learn that how in nanotechnology, nanoparticles adsorbents used for waterpurification are just like chromatography.
- Yes, faculty can use this research to expand their research and teaching.
- Analytical and numerical solutions of the considered models could be helpful to understand, design and optimize chromatographic reactors.

Biography

Dr. Sameena Bibi is an Assistant Professor in the Department of Mathematics at Air University Islamabad,Pakistan since 2007. She holds a PhD degree in Applied Mathematics from COMSATS UniversityIslamabad in 2015 and M.Phil. degree from Quaid-e-Azam University, Islamabad in 2006. Her researchfocuses on liquid chromatography, numerical analysis, optimization, fluid dynamics, etc., bridgingtheoretical and practical applications of mathematics.With over a decade of academic engagement, Dr. Sameena has attended numerous national andinternational conferences since 2008, presenting her work and staying abreast of advancements inmathematics. She has authored around 9 research articles contributing to the body of knowledge in herfield.

SVAR Sastry
Department of Chemical Engineering, HBTU Kanpur, India

Hydrothermal Synthesis of Two-dimensional Nanoparticles for Nano lubricant Applications : A Pathway for Enhanced Efficiency

Two-dimensional (2D) nanomaterials synthesised by hydrothermal means have becomea key technology in nanotechnology, especially for applications requiring accuracy inparticle shape, crystallinity, and surface properties. This process creates well-definednanostructures by means of chemical reactions in aqueous medium at high pressures andtemperatures. The most extensively researched 2D nanomaterials produced byhydrothermal techniques are iron-based nanoparticles, zinc oxide (ZnO), and titaniumdioxide (TiO_2). Advanced lubricants with better tribological properties have beendeveloped through a revolution in the field of lubricants with the addition ofnanomaterials. For the purpose of attaining homogeneous dispersion within lubricatingmatrix, these nanomaterials' size, shape, and surface functionality can be preciselycontrolled during their hydrothermal production. These two-dimensional nanomaterialscan have their surface properties precisely altered through hydrothermal synthesis, whichbenefits their lubricating system performance. Improved dispersion stability and efficacyof the nanomaterials in the lubricant can result in decreased wear, decreased friction, andenhanced thermal stability. This can be achieved by optimizing the particle size, shape,and surface fictionalization.

Biography

Dr. S.V.A.R.Sastry has more than 20 years of teaching and research experience. He was B.Tech Gold Medalist from NIT Jalandhar, M.Tech Silver Medalist from IIT Delhi and got Best Ph.D Thesis Award from JNTU Kakinada. He has authored 12 Patents, 22 International Books in the area of Renewable Energy, Unit Operations & Heat Transfer. He has published more than 64 Research Papers and presented papers in more than 60 International Conferences. He is a Member Scientist of CORE GROUP of Scientists on Tree Borne Oil seeds for promotion, utilization and socio-economic linkages in Southern India. He is a Senior Member of Institution of Engineers, Indian Institute of Chemical Engineers, Indian Desalination Association, International Association of Computer Science and Information Technology and Institute for Engineering Research and Publication. He has been awarded Outstanding reviewer status by Elsevier, U.S. and granted full free access to Scopus by Elsevier, U.S. He is an Editor for five International Journals and Editorial Board member for six International Journals.His Biography has been published in Marquis Who's Who in the World, 31st, 32nd & 33rd editions consecutively. He got the Andhra Pradesh University Best Teacher Award from JNTU Kakinada for five consecutive years from 2008 to 2013. He is a Recipient of International Awards from IBC, Cambridge, England. He got selected for inclusion in "100 Best Educators of 2014"; "2000 Outstanding Intellectuals of the 21st Century"; "CAMBRIDGE CERTIFICATE for Outstanding Educational Achievement"; and the prestigious "Leading Professionals of the World-2014" by International Biographical Centre (IBC), Cambridge, England.He is giving consultation in the design and implementation of 'High Speed Industrial Vaporizer', 'Mixing Device for Chemical Absorption Process' and 'Exploring Disruptions, Formulations, and Technologies in Lubricant Industry' to Convetit, U.S. He has given more than 30 Keynote lectures in various International Conferences held at Brazil, Dubai, Spain, China, Canada, Italy, France and UK. He received the Pillars of the Nation Award for Excellence and Innovation in Education Sector from the Delhi Vidhan Sabha in 2023. He got the Outstanding Alumni Faculty Award from IIT Delhi in 2023. He got the University Research Excellence Award for 2023 and 2024 from HBTU Kanpur. He is selected as Fellow by Institution of Engineers (India) in 2024. He is appointed as 'Regional Mentor of Change for Uttar Pradesh' by Atal Innovation Mission, NITI Aayog, GOI, New Delhi in 2024. He was honored with the "Outstanding Leadership in Research and Innovation" Award in the 29th World Education Summit, New Delhi on 5th July, 2024.Presently, he is working as the Associate Dean (Research & Development); Deputy Controller of Examinations and University Counsellor at the Harcourt Butler Technical University, Kanpur, Uttar Pradesh, India..

Suresh C Ameta
PAHER University, Udaipur – 313001 (INDIA)

Use of nano materials in photocatalytic treatment of waste water

There are two burning problems faced by living beings all over the globe. These are ever increasing water pollution and global warming. Photocatalysis has emerged as an eco-friendly technique for treatment of waste water containing non-biodegradable contaminants. These are stable enough, so that different treatment technologies are not sufficient enough to degrade or remove these toxic compounds. The problem of water pollution may be resolved to a greater extent by using photocatalytic materials. Most of these materials are less effective due to their large band gaps, which can be tuned by certain modifications of semiconductors such as doping, sensitization, composite formation, use of co-catalyst, Z- or S-schemes, etc. Use of nanomaterials can help in this direction due to increase in surface area (or active sites), but side wise, there is a widening of band gap. This all will be discussed with present status and future trends.

Biography

Prof. Suresh C. Ameta obtained his Master's Degree from University of Udaipur and was awarded Gold Medal-1970. He obtained Ph.D. degree from Vikram University in 1980. He has served as Professor & Head, Department of Chemistry, North Gujarat University Patan (1994) and M. L. Sukhadia University, Udaipur (2002-2005) & Head, Department of Polymer Science (2005-2008). He also served as Dean, P.G. Studies for a period of four years (2004-2008) in M. L. Sukhadia University, Udaipur and Dean, Faculty of Science, PAHER University, Udaipur (2011-2019). Now, he is serving as Professor of Eminence (Distinguished Professor), Faculty of Science, PAHER University, Udaipur. Prof. Ameta has an experience of more than 50 years of Teaching and Research. He has successfully guided 120 students for Ph. D. Prof. Ameta has occupied the prestigious position of President, Indian Chemical Society, Kolkata (2000-2001) and is now lifelong Advisor. He was awarded a number of prizes during his career like National prize twice for writing Chemistry books in Hindi, Prof. M. N. Desai Award, Prof. W. U. Malik Award, Scientist of the Year Award, National Teacher Award, Prof. G. V. Bakore Award and above all, the Life Time Achievement Awards by Indian Chemical Society (2011), Kolkata Indian Council of Chemists, Agra (2015) and Association of Chemistry Teachers, Mumbai (2018) and North Gujrat University, Patan (2022). Dr. Ameta has more than 450 research papers and 36 books to his credit. He has contributed Chapters in Books published by Trans-Tech, Switzerland, Nova Science, Taylor & Francis, Elsevier, Springer, and Apple Academic Press, USA. He has seventeen books to his credit; including Green Chemistry, Microwave Assisted Organic Synthesis and Solar Energy Conversion & Storage, Group Theory, Photocatalysis, Solar Energy Conversion & Storage, Advanced Oxidation Processes for Waste Water Treatment and Sonochemistry all from International Publishers. Indian Chemical Society, Kolkata has published a Special issue of the Journal of Indian Chemical Society on his Sixtieth Birthday in 2008 and also instituted a National Prize in his honor as Prof. Suresh C. Ameta Award to be given to a Senior Scientist of the country from 2003 onwards. He has delivered Invited Lectures/ Keynote addresses in International Conferences at China, Japan, UK, USA, Spain, Italy, etc.

Andrey Belousov*, Elena Malygon, Ekateryna Belousova
Kharkiv National Medical University, Ukraine

Impact of Magnetite Nanoparticles (ICNB) on Protein and Lipid Bond Stability in Preserved Erythrocyte Membranes

This study was devoted to the learning changes in the structure of erythrocyte membranes at the level of molecular bonds during their storage at a positive temperature by means method of infrared spectroscopy (IR). Objects of research were red blood cells (RBCs) into bags containing preservative CPD and RBCs into bags containing preservative CPDA-1. As membrane protective used saline which had previously been treated with magnetite nanoparticles (ICNB) by the Belousov's method. The physiological solution that was treated with nanoparticles was added to the preserved RBCs according to the developed method. Sample of control was the addition of intact saline. Analysis of changes occurring in the IR spectra of samples of control and test in the CPD medium was showed that during the first 28 days storage of: 1. In the suspension of control of the RBCs, noticeable destructive changes in the molecular structure membrane of erythrocytes at the 14th day storage begins. After three weeks, the molecular structure membrane of erythrocytes is completely destroyed; 2. In the sample of test there was a weakening and rupture of molecular bonds only at the 28th day storage of RBCs. Complete destruction of the structure of membrane of erythrocytes occurs at the 35th day storage. Analysis of changes occurring in the IR spectra of samples of control and test in the CPDA-1 medium was showed that during 49 days storage of: 1. In the suspension of control of RBCs noticeable destructive changes in the molecular structure begins in four weeks, and after six weeks storage the molecular structure of erythrocytes membrane are completely destroyed; 2. In the sample of test, a significant weakening of intra-and intermolecular bonds in the structure of erythrocytes membrane occurs after six weeks. However, the complete destruction of the structure is not observed. After seven weeks storage of erythrocytes obvious violations of the molecular structure of lipids and proteins that make up the RBCs are visible but some of the strongest compounds still remain. In general, the results clearly showed that the presented method of application of nanotechnology significantly increases the storage time of RBCs in different versions of preservatives due to mechanisms to reduce violations of the molecular structure of proteins and lipids in the erythrocyte membranes. Presented method of application of nanotechnology is not only safe for use in practice in the Blood Service, Transfusiology and Hematology, but also is the most promising innovation project.

Audience Take Away Notes

The information presented expands the audience's knowledge of the possibilities of practical application of nanotechnology products in medicine. Presented method of application of nanotechnology is not only safe for use in practice in the Blood Service, Transfusiology and Hematology, but also is the most promising innovation project.

Biography

Prof. Andrey Belousov is Doctor of Medicine. Author a new medecine products – nanotechnology preparations based on magnetite nanoparticles (Fe3O4) of the size 6-12 nm: the peroral form - Micromage-B (the biologically active additive officially registration in Ukraine); Magnet-controlled sorbent brand of MCS-B for extracorporaldetoxication of biological liquids (officially registration in Ukraine and was allowed for medical practice); Nanobiocorrector for intravenous application – ICNB (intracorporalnanosorbent). The published more 310 scientific works on results application of nanotechnology preparation in experimental and practical medicine. A. Belousov - the Head of Laboratory Applied Nanotechnologies of Belousov, DM, Professor of Department Anesthesiology, Intensive Care Kharkiv National Medical University, Ukraine.

Olaniyi Awe
Obafemi Awolowo University, Ile-Ife, Nigeria

Characterization ofItagunmodiSouthern Nigeria Alluvial Gold Ore Nano-particles using SEM-EDX Method

Alluvial gold ores are being processed by artisanal miners across various locations in Itagunmodi Southern Nigeria based on rule of thumb through gravity panning method. However, to optimize the current method being used or project the adoption of another gold extraction procedure, a comprehensive mineral ore characterization is critical. Samples of alluvial gold ore were obtained, plant matters were removed, and ore samples were properly labeled. Each of these samples was dried, grounded, thoroughly mixed and consolidated into pellets. SEM-EDX (Scanning Electron Microscopy with Energy Dispersive X-ray analysis) standard procedures were used to characterize the as-received alluvial gold ore samples. Each ore specimen that was analyzed was carefully preserved to circumvent any surface contamination or damage. Samples were subsequently loaded in the sample holders of the SEM-EDX machine. Electron beam from the SEM was used to probe each of the loaded samples; it interacted with the atoms of the sample, causing these atoms to emit characteristic X-rays that defined the sample. The EDX/EDS detector further analyzed these X-rays to identify the elements that were present in the sample and their relative abundance. The results of the SEM analysis showed that there are different mineral phases in the research samples studied, the most abundant being Fe and Si compounds. Essentially, Itagunmodi alluvial gold ore samples are made up of mineral elements such as Al, Si, Au, Rb, O, Mo, Br, Mg, Ba, Ca, P, K, Tb, Cr, Ti and Fe. SEM results showed the surface morphology of the samples, and also corroborate mineral ore constituents as identified by other methods of X-Ray Diffractometry and X-Ray Fluorescence. The results showed that the alluvial gold ores in the studied area are good feed samples for gravity separation as all of the mineral elements identified and their compounds have specific gravities that are lower that of gold mineral. The panning (gravity differential based) method as currently being used by artisanal miners at Itagunmodi, Southern Nigeria should be further studied for process optimization. The abundant gold alluvial ores in the area should also be further studied to ascertain their gold recovery response to other modern gold extraction methods.

Audience Take Away Notes:

- The study adopts and promotes the application of SEM-EDX (Scanning Electron Microscopy with Energy Dispersive X-ray analysis) as a powerful technique in material characterization.
- The method being promoted combines high-resolution imaging with elemental analysis, allowing for detailed characterization of materials at a microscopic level, including surface morphology, elemental composition, and chemical mapping.
- Material characterization is essential for process selection, development and optimization
- Extractive Metallurgist and Industries understand the relevance of adequate ore characterization to recovery efficiency, tailings/ waste handling and environmental issues control

Biography

Olaniyi Awe has Ph.D. in Materials Engineering from Obafemi Awolowo University, Ile-Ife, Nigeria(2023). His thesis was on the extraction of gold from its ore using borax-based pyro-metallurgical method. He has both M.Eng (Mineral Processing Option, Metallurgical and Materials Engineering), and B.Eng(Metallurgical and Materials Engineering) from Federal University of Technology, Akure, Nigeria in good grade. The Author research interests include materials characterization, Mineral processing and Extractive Metallurgy. He has his research outputs presented in journals and academic conferences. The last was the paper - *Determination of Gold Recovery Efficiency of Traditional Panning Method on ItagunmodiSounthern Nigeria Alluvial Gold Ore Samples* - presented at 60th Nigerian Mining and Geosciences Annual International Conference held 16th – 21st February,2025.

IRIS Scientific Group

Global Conference on

MATERIAL SCIENCE AND NANOTECHNOLOGY

April 28-29, 2025

KEYNOTE FORUM II

Stanislav Ordin
Russian Academy of Sciences, Russia

Antigraphene

The modern intensive stage of development of science is associated with its desire for compilation - formal systematization of the obtained research results based on Local regularities. Compilation also has some value, but it does not lead to a Unified Picture of the Description of Nature, but to a piecewise-fragmented one, to a Picture of PRIMITIVE cubes. And this is nothing more than a crisis of Science aimed at building a Unified Picture based on Fundamental Laws. At the same time, in the absence of their UNDERSTANDING, digging into ELEMENTARY Things, subjectively, causes irritation/rejection in people of science who want to use the "Cubes" accessible to their understanding, most of which are not ELEMENTARY, but PRIMITIVE, i.e. in principle, cannot form an ideal structure of the Picture of Nature.

Such PRIMITIVE "cubes" also include the use of idealized theoretical models, in particular for an ideal two-dimensional system.

An ideal two-dimensional system can be calculated more easily and this is very useful. Let's say that all Geometric Optics is built on its basis, on the basis of the Ideal, infinitely thin Boundary of the division of two media. But if we study the Boundary itself, then it can no longer be considered infinitely thin.

So, when constructing a model of the GRAPHENE structure, they use a model of an idealized two-dimensional Boundary, whereas the boundary of even a single crystal of Graphite, as has long been shown, is not an ideal plane (Fig. 1).

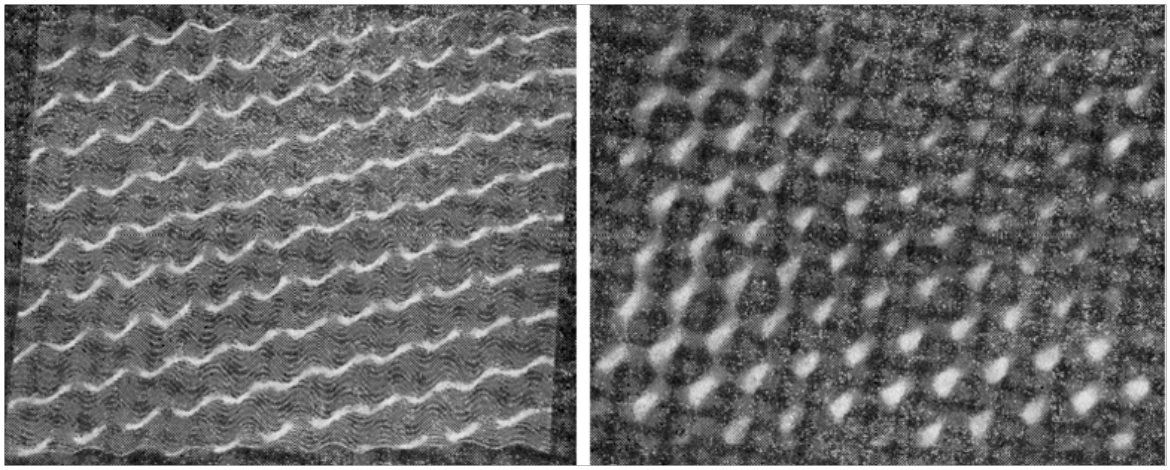

Fig. 1. Scanning electron micrograph of the surface of a graphite single crystal.

As shown by joint studies of rhombohedral single crystals of graphite and its dielectric analogue boron nitride, the non-flatness of the hexagon layers perpendicular to the C axis is determined at the atomic level by the alternation of interlayer bonds with voids in the plane (Fig. 2).

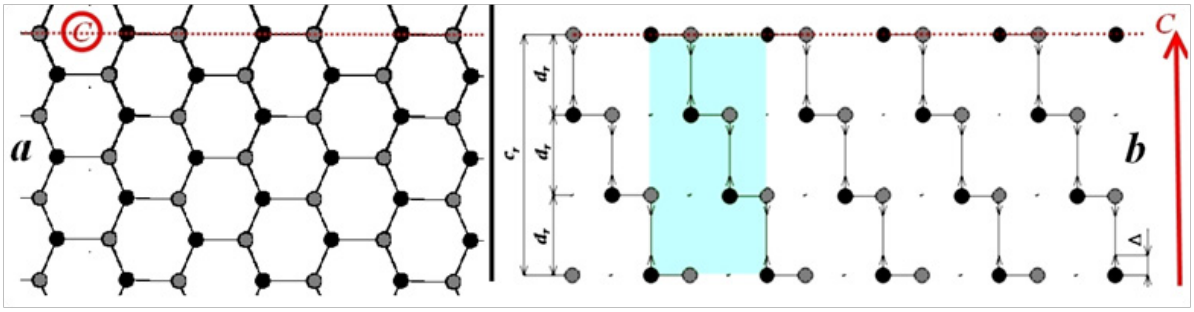

Fig. 2. The plane of hexagons of the rhombohedral phase of graphite and boron nitride (a) and the alternation of interplanar bonds in the plane of hexagons (b), leading to a regular displacement of atoms from the plane.

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. DrOrdin 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

Roya Dastjerdi
Yazd University, Iran

Let'strain our brain to peakour intellectual skills up;breakthrough multiaspects sustainabletechnologies and products

Regarding the theme of this conference"Emerging Trends and Breakthroughs in Material Science and Nanotechnology"with focus on providing"a pivotal platform for leading researchers, scientists, and industry experts","concerning the future of material science and nanotechnology",I decided to share my research skillsand experiences with young researchers and give them a view that how to step successfully towards this pathway. In fact, I will set the focus of this speech on an inspiring review of some secrets of my research skills.In this speech, I will discuss how training our mind for a comprehensive and concurrently a profound perspective in each step ofour research process can help us to design an exact and perfect hypothesis-driven research work well-engineered considering all environmental, technical, economic, safety and practical aspects to achieve the perfect products with remarkable potentiality of mass production, and concurrently, cutting-edge, groundbreaking, breakthroughpublications.

The base of these skills is training our mind to improve our intellectual skills step by step, and using fundamental principles, especially mechanisms and so forth, in the associated phenomena with our problem, raising proper questions toward merging into the solution, analyzing our answers, and so on, the vital intellectual skillswhich areincreasingly fading by developing artificial intelligence (AI). I will discuss why it should be consider a major concern and should not be ignored. One of the rewards ofaccomplishing this skill is that you be more dependent on your mind than what may not be accessible for you in all conditions such as the most equipped laboratories, supportive colleagues and students, most credible supervisors and colleagues, most credible universities, highly encouraging academic atmosphere, AI,etc. When you benefit these advantages too, you can certainly soar to the top. Rewarding these skills, even when you face a challenge in a situation you have no access to books, web, or AI, you can confidently use your mind to find the solution. I only will speak about what I could satisfy without benefiting a majority of these advantages. Consequently, if I could overcome these challenges, you will certainly can, of course better, regarding your superior minds and conditions. I will give you some examples of my own research works to encourageyou in each case. In fact, I will prove my statements with my own research works in different scopes of my research fieldsinnanotechnology.Since this proficiency is best to figure out in childhood, it can beoffered to be also considered in parenting and elementary educations to bring up the better living skillsfor humanity in all its aspects and specially prevent the AI development side effects on the human intellectual skills..

Enjoy every single moment of your research process.

Biography

Roya Dastjerdi, PhD, Associate Professor, winner of national and international awards, has comprehensively worked on green biomimetic photocatalysis, green air, water, and wastewater purification, comprehensively engineered green and sustainable production techniques for mass production, advanced surface and bulk nano-biofunctionalization, sustainable multifunctional nanofunctionalizations, medical textiles, regenerative medicine, DDS, green, smart, bioactive and antibacterial polymers, nanocomposites,etc. She has successfully worked on the main fundamental challenges on different humanitarian aspects of smart nano-bio-engineered textiles. Her accomplishments offer pathways for many advances with remarkable potentiality to scale-up. She has also proposed 60+ published cutting-edge mechanisms guidelines and pathways (see Research excellence menu in her website https://pws.yazd.ac.ir/nanobiotex/en). She has written one book in the field and recorded 20 national patents. She has been selected as one of the national elite and received more than 1000 international invitations from high-ranked scientific events, institutes, publications, and etc.
Her university's website: https://pws.yazd.ac.ir/nanobiotex/en
Google scholar page:https://scholar.google.com/citations?user=VeC4KAEAAAAJ&hl=en

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