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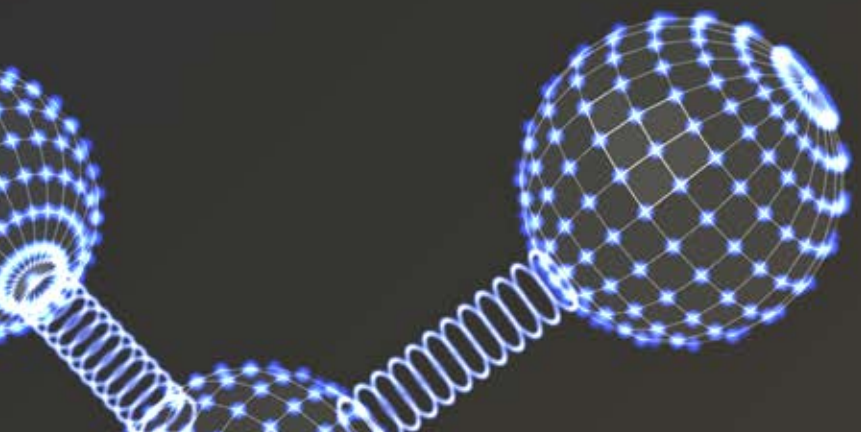
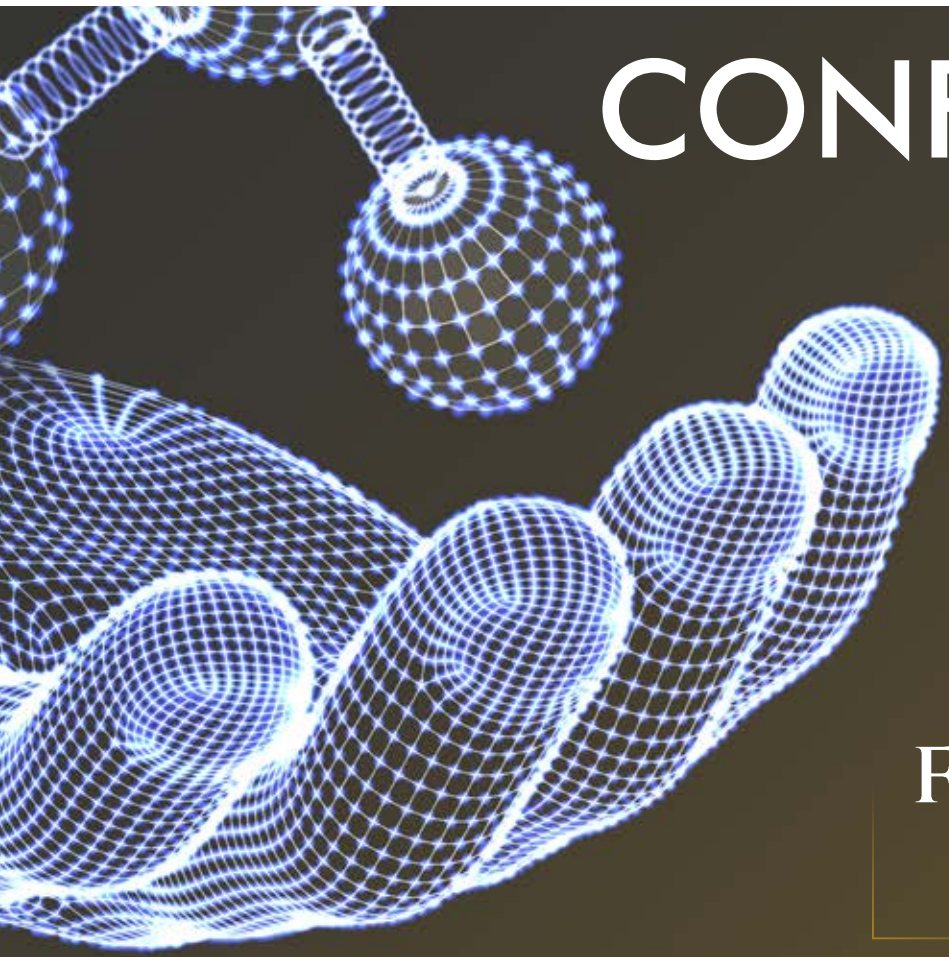


6TH EDITION OF

WORLD NANOTECHNOLOGY CONFERENCE



24-25
APRIL, 2023

ORLANDO, FLORIDA, USA

HYBRID EVENT

Venue:
Hilton Garden Inn Lake Buena Vista/Orlando
11400 Marbella Palm Ct, Orlando, FL 32836, United States

BOOK OF ABSTRACTS

magnus Group

24-25 APRIL

BOOK OF
ABSTRACTS

6TH EDITION OF

WORLD NANOTECHNOLOGY CONFERENCE

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Oliwia Metryka
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Rehana Badar
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United States

Yongqiang Wang
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Laboratory, United States

Zuzana Chaloupková
Czech Advanced Technology
and Research Institute,
Czech Republic

Thank You All...

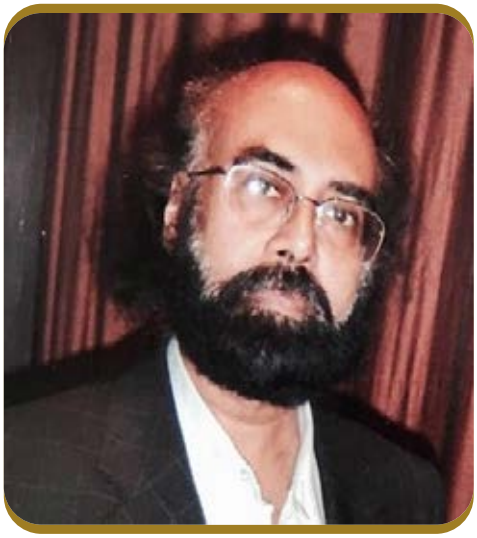
Welcome Message

It is an honor and pleasure to welcome you to the World Nano 2023 conference ! Throughout my career, I have spent over 25 years in the nanotechnology research, education, and commercialization. When I started researching nanotechnology in the 1990's, I heard comments like “Nanotechnology is only hype….it will never amount to anything. It is the small science which should remain small.” But, we have persisted and nanotechnology is now a proven technology that has solved and will continue to solve numerous problems in society. Nanotechnology is well positioned for the future as various projections place nanotechnology as one of the fastest growing technologies in the decade ahead with the global nanotechnology market size valued at US $1.76 billion in 2020 and projected to reach $33.63 billion by 2030. Further, as we continue to emerge from COVID, it is so important to make up for lost time. Even though most of us continued to do research, publish papers, and attend on-line conferences throughout COVID, we have lost a considerable amount of time to meet and establish new collaborations to solve the world’s most pressing problems. At a time when clearly we need new medicines to fight old and new diseases (especially viral), new approaches to offset global warming, new technologies to build stronger and lighter buildings, and better electronics to meet our ever changing world, we need conferences more now than ever. This is especially true since over the “COVID years”, filling the research debate gap usually occupied by conferences, social media has taken over as a major source of false science where social media postings can go unchecked, true scientific debate is prohibited by those that post, and opinions are formed which are harmful to both scientists and research. Social media clearly does not represent the appropriate scientific process - conferences do ! So, please come out, discuss and debate the latest in nanotechnology and let’s change the world ! Let the bright sun in Orlando stimulate your next ideas that can solve the world’s most pressing needs in medicine, energy, electronics, and so much more !

Yours Sincerely

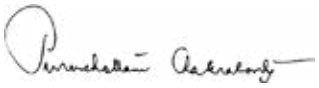
Thomas J. Webster, Hebei University of Technology, China

Welcome Message



It is my great pleasure to write a Welcome Message for all the delegates and participants of the 6th Edition of World Nanotechnology Conference, to be held during April 24–26, 2023, in Orlando, USA.

The prefix “nano” stems from the ancient Greek for “dwarf”. In science, it means one billionth (10-9) of a meter, that means, one nano-meter (nm) is ~ 40,000 times smaller than the thickness of a human hair. A virus is typically 100 nm in size. Therefore, Nanotechnology is the manipulation of matter at the atomic and molecular scale to create materials with remarkably varied and new properties. Nanotechnology is a rapidly expanding area of research with enormous potential in many sectors, ranging from healthcare to construction, nano-magnetism to spintronics, opto-electronics to photonics, quantum optics to quantum computation, microbiology to medicine, food processing to functional food development, detection of food pathogens to food safety, etc. Everyone encounters nanotechnology in a range of daily consumer products, for example, antimicrobial properties of silver nanoparticles are used in hand washes, bandages, socks, etc. The ability to manipulate structures and properties at the nanoscale in medicine is like having a sub-microscopic lab-bench on which one can handle cell components, viruses or pieces of DNA, using a range of tiny tools, robots and tubes, thus revolutionizing drug delivery, gene therapy, diagnostics, and many more areas of research, development and clinical application. By building nano-robots that can “walk” and carry out repairs inside cell components, nanotechnology is bringing that scientific dream closer to reality. Therefore, given the promise of nanotechnology, the scientific race is on to harness its potential - and to profit from it. The 6th Edition of World Nanotechnology Conference (World Nano 2023), to be held during April 24 – 26, 2023 in Orlando, USA is going to a unique meeting encompassing almost all branches of nanoscience, such as life sciences and nano-medicines, nanobiotechnology and safety, energy and environment, nano engineering, biomaterials, nanometrology, carbon nanotechnology, nano-photonics, computational modelling, wet nanotechnology, vaccines and medicines for coronavirus, etc. World Nano 2023 will be an exceptional platform for exchanging the prospective ideas and views of a bunch of global experts and prominent researchers amongst the budding scientists, research scholars, technologists and industrialists all over the world. I convey my heartiest greetings to the organizers, delegates and participants of the conference on this occasion and wish the confluence a great success!



Yours Sincerely

Purushottam Chakraborty, Former Senior Professor, Saha Institute of Nuclear Physics, India

Welcome Message

It is an honor and pleasure to write a few welcome notes. Oxide semiconductors, especially, wide-band gap oxide semiconductors, have been including applications that differ from conventional silicon technology and the technological advances that support them. The properties of thin films based on the oxide semiconductors exhibit mechanical, electrical, optical, and magnetic properties. More recently, they have been used in various aspects such as antibacterial properties, which are urgently needed. Their radiation resistance, which will be a success factor in the space business in the foreseeable future, has been attracting very recently. In this talk, we will propose a materials design to tailor the carrier transport, i.e., carrier mobility, which governs the semiconductor properties from the viewpoint of oxygen affinity. In terms of technology, I would like to propose success factors with perspective for the development of deposition systems.

Yours Sincerely

Tetsuya Yamamoto, Kochi University of Technology, Japan

Keynote Speakers

Xiao Hong Nancy Xu
Old Dominion University, United States

Marilena Carbone
University of Rome Tor Vergata, Italy

Thierry Meyer
Ecole Polytechnique Federale de Lausanne, Switzerland

Thomas J Webster
Hebei University of Technology, China

Purushottam Chakraborty
Saha Institute of Nuclear Physics, India

Vladimir Chigrinov
The Hong Kong University of Science and Technology, Hong Kong

Subas Chandra Dinda
Teerthanker Mahaveer University, India

Tetsuya Yamamoto
Kochi University of Technology, Japan

Juntian Qu
Tsinghua University, China

Thank You All...

ABOUT
MAGNUS GROUP

Magnus Group (MG) is initiated to meet a need and to pursue collective goals of the scientific community specifically focusing in the field of Sciences, Engineering and technology to endorse exchanging of the ideas & knowledge which facilitate the collaboration between the scientists, academicians and researchers of same field or interdisciplinary research. Magnus Group is proficient in organizing conferences, meetings, seminars and workshops with the ingenious and peerless speakers throughout the world providing you and your organization with broad range of networking opportunities to globalize your research and create your own identity. Our conferences and workshops can be well titled as 'ocean of knowledge' where you can sail your boat and pick the pearls, leading the way for innovative research and strategies empowering the strength by overwhelming the complications associated with in the respective fields.

Participation from 120 different countries and 2000 different universities/industries/labs have contributed to the success of our conferences. Our first International Conference was organized on Oncology and Radiology (ICOR) in Dubai, UAE. Our conferences usually run for 2-3 days completely covering Keynote & Oral sessions along with workshops and poster presentations. Our organization runs promptly with dedicated and proficient employees' managing different conferences throughout the world, without compromising service and quality.

ABOUT
World Nano 2023

Magnus Group is proud to invite brilliant minds to its prestigious “6th Edition of World Nanotechnology Conference” (WORLD NANO 2023) which will be hosted in a hybrid manner with online and onsite versions at Orlando, Florida, USA during April 24-26, 2023.

The theme chosen for this year is “Nanotechnology: Transcending All Limits by Retrospection of Advances.”

We hope that the scientific programme, which covers a wide range of issues, meets your expectations, and that your participation in the congress allows you to network with colleagues, acquaintances, and recognised experts from across the world. Despite the difficult times we are experiencing, we are hopeful that the hybrid nature of WORLD NANO 2023 will provide an open venue for discussing all aspects of matter at the nanoscale, exchanging ideas, sparking collaborations, and forming new networks. We'll have outstanding keynote speakers, a fine Organizing Committee that will assist you before and during the event, and the Scientific Committee is working on putting together an interesting schedule that will cover all of these fascinating elements of Nanoscience and Nanotechnology. Keynote speakers, oral presentations, poster sessions, discussion forums, and workshops are all part of the scientific gathering. This is a fantastic opportunity to present your research findings to a large audience, foster information sharing, and network in the field of Nanotechnology.

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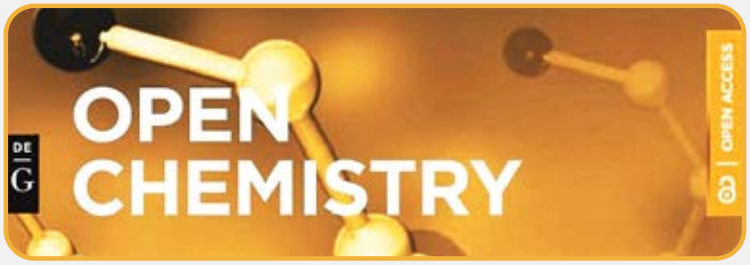

Open Chemistry is a peer-reviewed, open access journal that publishes original research, reviews, and communications in the fields of chemistry in an ongoing way. Our central goal is to provide a hub for researchers working across all subjects to present their discoveries, and to be a forum for the discussion of the important issues in the field.

There are no submission charges. In order to sustain the production of our fully-refereed open access journal, each article accepted for publication in Open Chemistry is subject to Article Processing Charges (APC).

Note: We offer 30% discount on APC for the World Nano 2023 conference participants.

For more details about the journal, please visit: https://www.degruyter.com/journal/key/chem/html

BOOK OF ABSTRACTS

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24-25 APRIL

DAY 01

KEYNOTE FORUM

6TH EDITION OF

WORLD NANOTECHNOLOGY CONFERENCE

13 years of managing the safety of nanomaterials in research laboratories

As the number of Engineered Nano Materials (ENM) used in research increases rapidly, health and safety specialists are continuously faced with the challenge of evaluating the risks involved with these materials. Nowadays there is not enough information about their toxicology and new materials are continuously being developed. Preliminary scientific results indicate that ENM might have a damaging impact on human health, which makes it even more important to have the right mitigation measures in place.

Risk evaluation involves compilation of accurate detailed information from all available sources (SDS, toxicological information etc.). However, ENM often demonstrate properties that differ from the bulk form of the same material, which provides opportunities for new applications but also new possible hazards.

Given the current state of knowledge on ENM, it is likely that it will take years before we know precisely what types of ENM and associated doses represent a real danger to humans and the environment. There is a consensus on applying the precautionary principle to these novel materials until more information is available, and a pragmatic way of applying it is to use a control banding approach. Nevertheless, the uncertainty on the exposure and impact, as well as a cautionary approach, seem to result in a high level of estimated risk requiring high protection measures.

In research and teaching institutions we face a highly versatile environment with large number of laboratories, large cohorts of inexperienced people (students) and highly trained staff with a high turnover.

We will present a practical and pragmatic implementation of a “Nano safety” management system, see Figure 1. The system is based on a control banding method and 13 years of experience, and has been applied to over 120 research labs dealing with ENM. This system is composed of: 1) ENM activity analysis to classify the laboratory into a risk level and 2) The implementation of the adequate preventive and protective mitigation measures that correspond to said risk level. We will conclude by discussing the difficulties, the drawbacks and the success encountered in an evolving and rapidly changing environment.

Thierry. Meyer[1, 2*], E. Buitrago[1, 2], A. Groso[1, 2], A.M. Novello[1]

[1]Chemical and Physical Safety Group, Institute of Chemical Sciences and Engineering, Ecole Polytechnique Federale de Lausanne, Station 6, 1015 Lausanne, Switzerland

[2]Safety Competence Center, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland

Biography

MER Dr. Meyer studied Chemical Engineering at the Swiss Federal Institute of Technology (EPFL), Switzerland and graduated as MS in 1985. He received his PhD degree in 1989 at the same institution. After several years in the chemical industry (Ciba-Geigy, Novartis and Ciba Specialty Chemicals Inc.) as a development chemist, then as head of development and later as production manager, he joined EPFL in 1999 as director of a research group. Since 2005 he is also head of the occupational health and safety at EPFL. He has published more than 100 research articles in SCI (E) journals and 10 books.

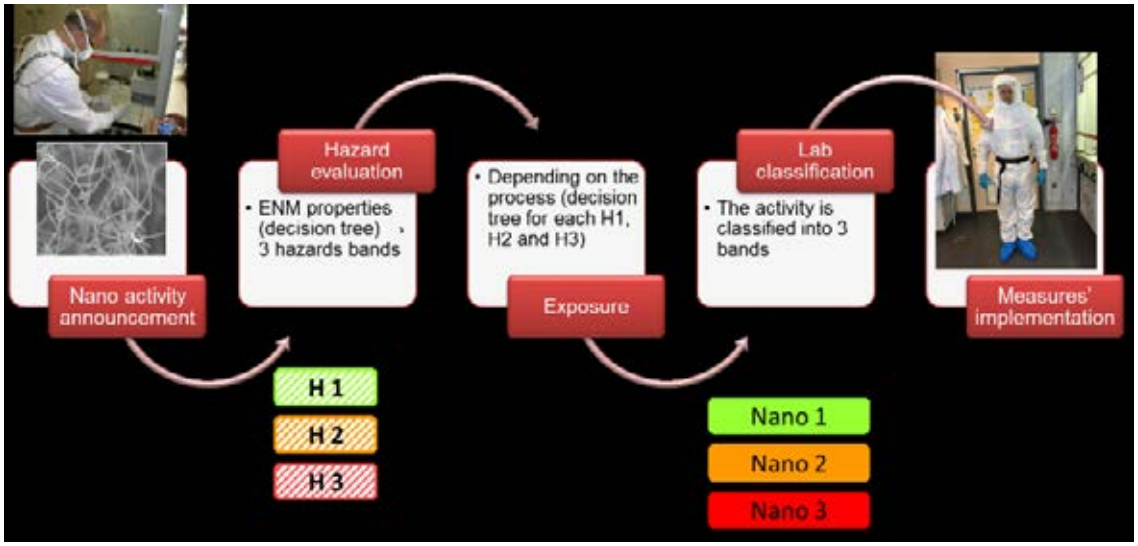

Fig 1. The evaluation process for the nano hazard classification

Improving human health in the clinic: Human nanomedicine

Nanomaterials have been widely tested in vitro and in small order animal studies for decades. Results have shown greater tissue growth, decreased bacteria growth and inhibited inflammation. However, few studies exist examining human tissue response to nanomaterials. This presentation presents a cohort study of nano implants inserted into humans. In particular, one study includes the implantation of nanotextured spinal implants into over 14,000 patients over the past 5 years. Results demonstrated no cases of infections or other implant failures which is significantly better than statistics on conventional spinal implants which have up to 20% failure rates. This study will further explain that nano implants mimic the natural nano texture of bone itself and possess surface energy that can competitively increase the adsorption of proteins known to promote osteoblast (bone forming cells) functions, decrease bacteria functions and limit inflammatory cell functions. Further, this invited presentation will highlight the role that environmentally friendly catalysts are playing in fabricating improved nanoparticles for medical applications. As such, this presentation will cover the few human clinical studies on nano implants showing improved human health.

Audience Take Away Notes

- Why nanomaterials improve tissue growth and decrease infection
- How nanomaterials improve tissue growth and decrease infection
- Real human clinical data using nanomaterials to improve human health

Thomas J. Webster

Hebei University of Technology, China

Biography

Thomas J. Webster's (H index: 114; Google Scholar) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995; USA) and in biomedical engineering from RPI (Ph.D., 2000; USA). He has served as a professor at Purdue (2000-2005), Brown (2005-2012), and Northeastern (2012-2021; serving as Chemical Engineering Department Chair from 2012 - 2019) Universities and has formed over a dozen companies who have numerous FDA approved medical products currently improving human health. He is currently helping those companies and serves as a professor at Hebei University of Technology, Saveetha University, Vellore Institute of Technology, UFPI, and others. Dr. Webster has numerous awards including: 2020, World Top 2% Scientist by Citations (PLOS); 2020, SCOPUS Highly Cited Research (Top 1% Materials Science and Mixed Fields); 2021, Clarivate Top 0.1% Most Influential Researchers (Pharmacology and Toxicology); 2022, Best Materials Science Scientist by Citations (Research.com); and is a fellow of over 8 societies. Prof. Webster has over 1,350 publications to his credit with over 53,000 citations. He is a current nominee for the Nobel Prize in Chemistry (2023).

Materials design of wide-band gap oxide semiconductors

Metal oxides are a group of materials that fulfill a wide variety of application properties or encourage evolution or development of near-future applications. The applications for example, include as follows: Power electronics such as high Ga_2O_3-based High-Electronmobility Transistors (HEMTs) and Field-Effect Transistors (FETs) and optoelectronics such as Vacuum Ultraviolet (VUV) light emitter and Deep Ultraviolet (DUV) Light Emitting Diodes (LEDs); Transparent conductive electrodes for use in touch screen, LCD-TV, organic LED and photovoltaic solar cells; Radiation resistant materials for space industry; Biological and medical applications such as antibacterial agents.

We have been developing a technology which enables high film-deposition-rate such as 170 nm/min, low temperature of less than 250°C and low-substrate-damage growth of thin films to tailor electrical, optical and mechanical properties of highly Transparent Conductive Oxide (TCO) films. The TCO films are based from n-type doped ZnO- and In_2O_3-based films. We have been choosing several types of dopants suitable for achieving oxide films that meet the properties and functionals specific applications require. For achieving reliable solid devices, the use of dopants that have high oxygen affinity compared with host metal atoms is essential. For example, for In_2O_3 films, W and Ce atoms have advantages over the conventional Sn atoms. This will suppress the generation of oxygen vacancies in the vicinity of the substitutional-type dopant sites. On the other hand, note that ionic radii of dopant metal atoms which strongly depend on their charge states and on the coordination numbers play a critical role in controlling the residual strain in doped films. Recently, we reported Ce- and H-codoped In_2O_3 films (ICO: H) with a thickness of 100 nm showing high Hall mobility of 145 $cm^2/(Vs)$. Incorporating ICO:H-based electrodes instead of Sn-doped In_2O_3-based electrodes improved the performance of Si heterojunction solar cells. [2] In addition, we achieve that 5-nm- and 30-nm-thick W-doped In_2O_3 films show Hall mobility of 57.7 and 97.4 $cm^2/(Vs)$, respectively.

Concerning ZnO films that have advantage of high optical visible transparency over In_2O_3 films, Al and Ga atoms having high O affinity as substitutional-type dopants have been reported. In previous work, we succeeded in the fabrication of liquid crystal displays with Ga-doped ZnO-based (GZO) electrodes produced with the conventional production lines. It is easy to realize high carrier concentration GZO films exhibiting heat resistance. Note that Ti-doped ZnO films show excellent performance of the heat resistance. We discuss how to choose the dopants meeting application requirements from theoretical and experimental viewpoints.

Audience Take Away Notes

Tetsuya Yamamoto

Materials Design Center, Kochi University of Technology, Research Institute, Kami-shi, Kochi, Japan

Biography

Tetsuya Yamamoto obtained a Ph.D. degree (Theoretical physics, OSAKA University, Japan, 1997). He has been a Professor, and also Director, Materials Design Center, Research Institute, Kochi University of Technology, 1999 – Present (23 years). Major research concerns materials design and device developments based on oxide semiconductors. Many products with patents codeveloped with industries have been already commercial. Google scholar: h-index 35, i10-index 170 since 1991. He won the prize by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) for his work on ZnO-based TCO films for use in Liquid Crystal Display (LCD)-TV and thin-film solar cells in 2011.

- The audience will be able to choose donor dopants that cause stable and reliable solid state devices utilizing oxide semiconductors
- The audience will understand why doping of the above dopants leads to high carrier transport
- The audience will learn and gain a new look at oxide semiconductors
- The audience will study a film-deposition method that enables us with low-damage to substrate and film and low temperature deposition with very fast deposition rates on substrates with a large size

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24-25 APRIL

DAY 01

SPEAKERS

6TH EDITION OF

WORLD NANOTECHNOLOGY CONFERENCE

Damasceno, B. S.[1,2*], Horta, I. M.[2], Eddy, L. J.[1], da Silva Sobrinho, A. S.[2], Tour, J. M.[1], Pereira, A. L. J.[2], Leite, D. M. G.[2]

[1]Department of Chemistry, Rice University, Houston, Texas, United States
[2]Department of Aeronautics and Mechanical Engineering, Aeronautics Institute of Technology, Sao Josedos Campos, Sao Paulo, Brazil

Fabrication of flash graphene-enhanced gan for surface acoustic waves biosensor applications

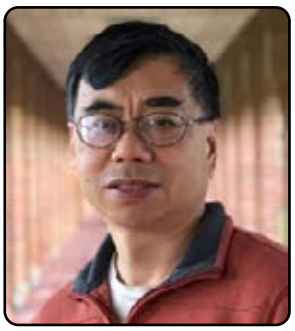
New, accurate and fast biosensors of viruses are being studied as an effort to prevent future virus outbreaks. Although conventional diagnostic methods have been adopted and succeeded, they show drawbacks including lengthy data analyses, high costs and low sensitivity. Graphene-enhanced GaN has the potential to give rise to Surface Acoustic Waves (SAW) biosensors with high sensitivity and accuracy for virus detection, In addition to the possibility of being produced using cheaper and faster routes. Hence, GaN thin film was grown on silicon substrates by reactive sputtering technique to serve as a high acoustic speed piezoelectric base material. After that, boron-doped and undoped graphene powders were synthesized by the flash joule heating method. The doped and undoped Flash Graphene (FG) powders were used to produce an electrically conductive coating with satisfactory adhesive properties atop the GaN surface. The GaN thin film and the doped and undoped FG powders were characterized by Raman, X-ray diffractometry, and X-ray photoelectron spectroscopy. Additionally, the FG/GaN heterojunction was characterized by two-point probe system and nanoindentation. The sputtered GaN thin film had a preferential c-orientation nanocrystalline wurtzite structure. The FG powders exhibited graphene content of 100% with ~1.6% boron doping. The obtained graphene coatings are stable with conductivity ranging from a few kΩ to GΩ, controlled by the concentration ratio by weight of graphene and a polymeric binder. Therefore, preliminary FG/GaN heterojunctions were successfully produced and are being optimized to produce functional SAW biosensors, as evaluated by the frequency response on a network analyzer.

Audience Take Away Notes

- They will learn how to use optimized conditions to grow GaN on cheap and wide use Si wafers
- They will be able to produce a graphene slurry with high concentration of graphene and how to increase the conductivity by changing the ratio concentration between graphene and binder, as well as, by using boron doped graphene to it. By the end, they will learn how to make a good adhesion of this ink in the substrate and what are the prospects of this material
- Using analytical thinking and characterizations techniques to assure the success of the synthesis

Biography

Barbara Damasceno studied Materials Engineering at the Federal Rural University of Pernambuco in Brazil and graduated in 2019. Her Ph.D. research is ongoing in the Department of Aeronautics and Mechanical Engineering at the Aeronautics Institute of Technology. She is developing her research in the group of Prof. Douglas Leite at the Plasmas and Processes Laboratory. She is a Fulbright Visiting Scholar in the Department of Chemistry at Rice University under Prof. James Tour supervision. Her research consists in the development of a SAW biosensor composed by GaN-enhanced graphene to detect viruses.



Yongqiang Wang

Ion Beam Materials Laboratory, Materials Science and Technology Division
Center for Integrated Nanotechnologies, Materials Physics and Applications Division Los Alamos National Laboratory, Los Alamos, USA

Helium irradiation damage effects in nanostructured materials

The mankind is facing an unprecedented challenge between increasingly growing energy demands for economic growth and social sustainability, and the resulting irreversible and detrimental impact on environment. Nuclear energy is considered an essential carbon-neutral energy source to help address this challenge. Fast neutron interactions with materials in advanced fission reactors and fusion devices produce not only atomic displacement damage but also incorporate helium atoms in lattice structure through nuclear reactions. Despite its chemical benignity, the small size of a helium atom combined with its near insolubility in almost every solid makes the helium–solid interaction extremely complex over multiple length and time scales. As a result, helium effects on microstructure evolution and thermo-mechanical properties can have a significant impact on the operation and lifetime of these nuclear systems. This talk aims to first introduce fundamental irradiation damage process, in particular helium effects. Then I will provide a brief update on state-of-the-art irradiation capabilities to study helium effects. Finally, I will present examples of advanced nanomaterials research in mitigating helium impact on thermomechanical properties of materials in radiation extreme conditions. This work was performed in part, at the Center for Integrated Nanotechnologies, an Office of Science User Facility operated for the U.S. Department of Energy (DOE) Office of Science. Los Alamos National Laboratory, an affirmative action equal opportunity employer, is managed by Triad National Security, LLC for the U.S. Department of Energy's NNSA, under contract 89233218CNA000001.

Audience Take Away Notes

- Nuclear energy plays an important role in diverse clean energy sources
- Fundamentals of radiation damage in materials, including helium effects
- Nanostructured materials to control helium bubble growth
- State of the art irradiation capabilities to investigate radiation damage and helium effects in materials

Biography

Dr. Yongqiang Wang is Team Leader for Radiation Science Experimental Team and Director of Ion Beam Materials Laboratory (IBML) at Los Alamos National Laboratory. He published >370 peer-reviewed papers. He co-authored three books: Handbook of Modern Ion Beam Materials Analysis (MRS Publisher 2009); Ion Beam Analysis: Fundamentals and Applications (CRC Press, 2015); and Radiation Damage in Materials: Helium Effects (MDPI Publisher 2020). He currently serves as Editor of Nuclear Instruments and Methods in Physics Research: Beam Interactions with Materials and Atoms (NIM B); and Co-Chair of Biennial International Conference Series on Application of Accelerators in Research and Industry (CAARI).

Shubhangi Shukla[1*], Roger J. Narayan[1]

[1]Joint Department of Biomedical Engineering, North Carolina State University, Raleigh, USA

Square wave voltammetric approach to leptin immunosensing and optimization of driving parameters with chemometrics

Square wave voltammetry serves as an effective analytical means to evaluate antigen-antibody coupling at the solid-liquid interface. Herein, we describe 3- aminopropyltrimethoxysilane (APTMS) induced irreversible immobilization of anti-leptin to micellar gold nanoparticles (AuNPs). Antibodies (Abs) were orthogonally loaded on micellized AuNP assemblies via amino residual groups. The ratio of bound Ab molecules was determined by the Bradford assay. The AuNP/Ab layer modified electrodes with variable antibody surface coverage (~400 ± 55–200 ± 30 Ab/NP) were analyzed in terms of change in backward, net current (Ip) components. The rate of antigen coupling was found to be consistent with the variation in antibody density as well as the binding affinity. The lowest detection limit was observed at the femtomolar level (0.25 fM/mL) over a wide range of antigen concentration (6.2 ng/mL to 0.12 fg/mL). The variables affecting the epitope-paratope interaction were further optimized using a chemometric approach and a Response Surface Methodology (RSM).

Biography

Dr. Shubhangi earned her PhD in Analytical Chemistry at the IIT BHU, Varanasi India in 2019, and post graduated as MS in 2014 from University of Lucknow, India. She then joined the research group of Prof. Roger J Narayan at the Joint department of Biomedical engineering at North Carolina State University, as Postdoctoral fellow. She has published more than 20 research articles in SCI (E) journals.

Dar-Bin Shieh[1, 2, 3*], Fu-Shiuan Shih[3], Pei-Wen Wang[1], Li-Xing Yang[1], Yi-Ching Wang[3]

[1]Department of Dentistry and Institute of Oral Medicine, National Cheng Kung University, Taiwan
[2]Department of Stomatology, National Cheng Kung University Hospital, Taiwan
[3]Institute of Basic Medical Sciences, National Cheng Kung University, Taiwan

Iron containing nanoparticles in ultrafast diagnostics and anti-cancer strategies through modulation of tumor microenvironment and ferroptotic cell death

Iron nanoparticles presented superparamagnetic properties and have been widely applied in magnetic force trapping of cells and molecules to accelerate and ease sample preparation. In addition, iron oxide nanoparticles can be designed to convert Near Infrared (NIR) light to heat thus allowing pyrolysis of samples to obtain genetic materials and to inactivate PCR inhibitors. We utilize such NIR to heat conversion to develop a photothermal qPCR and demonstrated their efficient detection of pathogens in CDI. In addition, Zero valent iron nanoparticles with carboxymethylcellulose shell (ZVI@CMC) showed prominent anti-cancer activity in various cancer types including oral cancer, colorectal cancer, and non-small cell lung cancers while spare the non-malignant cells. ZVI@CMC induced massive intracellular ROS with accumulation of lipid peroxidation, leading to ferroptotic cell death. Immunoblotting and RT qPCR showed that anti ferroptosis protein, the nuclear factor E2 related factor 2 (NRF2) and its targeting antioxidant genes was attenuated by ZVI@CMC and demonstrated that β-TrCP, AMPK, GSK3β, and mTOR were involved in the axis. Moreover, the IC50 dose of ZVI@CMC was able to inhibit angiogenesis and direct macrophages polarization toward antitumor M1 phenotype. Such dose also significantly increased CD8+ T cells and decreased Treg population. Notably, ZVI@CMC inhibited allograft growth of mouse Lewis lung carcinoma and xenograft growth of human lung carcinoma in mice with reconstituted human immune system. In conclusions, this study identified a novel mechanism that ZVI@CMC enhanced inhibition of NRF2 signaling axis leading to ferroptotic cell death in cancer cells while direct tumor microenvironment toward anti-cancer phenotype including modulation of macrophage polarization, reversal of T cells subpopulation and inhibition of angiogenesis.

Audience Take Away Notes

- I will explain how the audience will be able to use what they learned in the future anti-cancer strategy design
- This presentation may inspire the pharmaceutics to design novel effective anti-cancer nanomedicine
- The concept and methodologies in this research could enable other faculty to expand their research or teaching in nanomedicine

Biography

Dar-Bin Shieh studied Dentistry at the National Yang-Ming University, Taiwan and graduated as DDS in 1988. He then joined the research group of Prof. David Kwiatkowski at the department of experimental medicine at Harvard Medical School and in 1991 after finished his clinical training in Taiwan. He received his PhD degree in 1996 from Harvard School of Dental Medicine and served as a research fellow in Brigham and Women's Hospital. After two years fellowship, he obtained the position of an Assistant Professor at the National Cheng Kung University and also join appointed as a session chief in the department of stomatology in NCKU Hospital. In 2018, he was recruited serve as the Deputy Minister of Ministry of Science and Technology in Taiwan and retired after 3 years of service. He was appointed as chair professor in National Cheng Kung University in 2021 and has published more than 130 research articles in SCI(E) journals.

Safia Abdullah R Alharbi [1, 2*], Kazi Jannatul Tasnim[1], and Ming Yu[1]

[1]Department of Physics and Astronomy, University of Louisville, Louisville, KY United States
[2]Department of Physics, College of Sciences, Al Imam Mohammad Ibn Saud Islamic University (IMISU), Riyadh, Saudi Arabia

Design 2D SIC/GeC lateral polar heterostructures for nanotechnology devices

Two-Dimensional (2D) lateral polar heterostructures, constructed by seamlessly stitching 2D polar materials, exhibit unique properties triggered by the in-plane charge transfer between different elements in each domain. Our first-principles study of 2D SiC/GeC lateral polar heterostructures has unraveled their interesting nano-characteristics. The local strain induced by the lattice mismatch leads to an artificial uniaxial strain along the interface. The synergistic effect of such uniaxial strain, the microstructure of interface, and the width of domains modulates the feature of the band gap with an indirect band gap nature in armchair lateral heterostructures and a direct band gap nature in zigzag lateral heterostructures. The band gap monotonically decreases with increasing the width of domains, showing its tunability. Furthermore, the valence band maximum is found mainly contributed from C-2p orbitals located at both GeC and SiC domains, and the conduction band minimum is mainly contributed from Ge-4p orbitals located at the GeC domain, implying that most excited electrons prefer to stay at the GeC domain of the SiC/GeC lateral polar heterostructures. Interestingly, a net charge transfer from the SiC domain to the GeC domain was found, resulting in a spontaneous lateral p-n junction, and there is a net charge redistribution at the interfacial region leading to a built-in electric field which is expected to reduce the carrier recombination losses, implying the promising nanotechnology application for visible light photocatalyst, photovoltaics and water splitting to achieve clean and renewable energy.

Audience Take Away Notes

- The difference between (2D) lateral & vertical heterostructures
- The nano-characteristics of polar heterostructures compared to van der Walls heterostructures
- The promising properties of 2D SiC/GeC lateral polar heterostructures for nanotechnology applications

Biography

Safia Abdullah A. Alharbi studied Physics at the University of Louisville, United states and graduated as MS in 2017. She then joined the CMT research group under supervision of Prof. Ming Yu at the University of Louisville, United states. She received her PhD degree in 2023 at the same institution. She is interested in the field of 2D nanomaterials and has published 3 articles in the peer-reviewed journals. She has also presented her results on several national and international conferences. She has earned two awards for her excellent research outcomes.Safia Abdullah A. Alharbi studied Physics at the University of Louisville, United states and graduated as MS in 2017. She then joined the CMT research group under supervision of Prof. Ming Yu at the University of Louisville, United states. She received her PhD degree in 2023 at the same institution. She is interested in the field of 2D nanomaterials and has published 3 articles in the peer-reviewed journals. She has also presented her results on several national and international conferences. She has earned two awards for her excellent research outcomes.

John Bang[1*], Majemite Iyangbe[1], Srivalli Mukkavilli[2], Jianjun Wei[3], Mahsa Azami[3]

[1]EEGS, North Carolina Central University (NCCU), Durham, N.C., U.S.A
[2]Pharmaceutical Sci, NCCU, Durham, N.C., U.S.A
[3]Nanosciences, UNCG, Greensboro, N.C. U.S.A

Effects of copper nanoparticle-induced reactive oxygen species and carbon nanodots on amyloid beta protein aggregation: Relevance in neurodegenerative diseases

Free radical-mediated beta amyloid protein radicalization, lipid peroxidation and DNA damage are all implicated in neuronal cell damage causing many debilitating neurodegenerative diseases. Alzheimer's disease is the most common form of dementia among those with neurodegenerative illness that have affected more than 24 million people globally. Materials including metals at nanoscale with reducing power have been known to cause free radical generation, which consequently can induce radicalization, miss-folding, and aggregation of beta amyloid (βA) proteins. In this study, we measured the level of protein-DMPO nitrone adducts, a quantitative indicator of free radical production, by using anti-DMPO adduct antibodies at different concentrations of Copper Nanoparticles (CuNP) as a source of reactive oxygen species (ROS). Lyophilized form of βA proteins as well as βA proteins from IMR-32 cells (In Vitro conditions) were tested for their aggregation levels in the presence of CuNP. As a way to identify the protein aggregation sites, Confocal light microscope technique was also introduced. We also evaluated the potential efficacy of applying Carbon Nanodots (CNDs) that has ROS scavenging character as a detoxifying agent. The results indicated that, 1) CuNP carries a potential to be a source for ROS generation that can enhance the aggregation mechanism of βA proteins, 2) βA protein aggregation level is proportional to the concentration of CuNP present in the reaction, 3) βA proteins, both from lyophilized and In Vitro sources, were equally effected by the ROS from CuNP, 4) βA protein aggregates were observed in both cytoplasm and nucleus in Confocal images, and 5) CNDs can prevent βA protein aggregation before and after cell exposure to CuNP. From our study, it is concluded that ROS generation can be a contributing process for βA protein aggregation through a radicalizing process and the effects of ROS on protein aggregation can be reduced or even reversed by the presence of CNDs, a ROS scavenger.

Audience Take Away Notes

- Audience will learn about exposure related potential toxicity issues of nanomaterial in neurodegenerative diseases including Alzheimer's disease
- For those working in the field of environmental/public health, they may be able to use the experimental data as a reference point for conducting similar studies
- The results from this study should be able to provide some insights about the roles of ROS from exogenous sources including engineered nano-metal
- The information about the exposure doses related to CuNP should help design similar types of studies
- The information about LD50 and max threshold levels of reagents used in this study should be benefit others working in neurodegenerative diseases

Biography

Dr. John Bang studied biochemistry (B.S. 1988) and medicine (M.D. 1994/1998) at the University of Illinois at Urbana-Champaign and CAHSU (tropical medicine). He also did a graduate study at the University of Texas at El Paso (Ph.D. in Environmental Sciences and Engineering 2003). He joined North Carolina Central University in 2005 and has been working as a professor since then. His research has been on understanding the behavior of nanoparticles and their effects on both environments and human health, especially cardiopulmonary and neuroscience. During his tenure academic career, he has published more than 40 peer reviewed research journal articles, three book chapters, and given a talk more than 100 times in scientific communities.

Iman Khakpour[1], Borzooye Jafarizadeh[1], Azmal Huda Chowdhury[1], and Chunlei Wang[1*]
[1]Department of Mechanical and Materials Engineering, Florida International University, Miami, FL, USA

Bipolar electrochemistry produced graphene for micro supercapacitor

The development of micro-supercapacitors has attracted considerable interest due to the increasing demand for reliable miniaturized energy storage devices. Among all the desired properties of micro-supercapacitors, high power density, and more importantly, rate capability and high-frequency response are crucial for their future applications. It has been demonstrated that Electrochemical Double-Layer Capacitors (EDLCs) made of highly oriented vertically graphene structure showed the most promising behavior, for being used at high frequencies. Since now, CVD is the only method that is successfully utilized to produce the desired morphology; however, the limitations related to the fabrication process prohibited the production of micro-supercapacitors based on these materials.

In this study, a modified Bipolar Electrochemistry (BPE) method has been successfully developed to produce and deposit high quality reduced graphene oxide on a conductive substrate. This method combines the material production and device fabrication in a simple, controllable, cost-efficient and eco-friendly single-step process. The microstructural study of the deposited material showed the formation of oriented graphene sheets on the substrate. To fabricate the micro-supercapacitor, an interdigitated gold microelectrode arrays was produced by the regular photolithography process and then used as the conductive substrate in the BPE process. The electrochemical study of the fabricated device by Cyclic Voltammetry (CV) and Galvanostatic Charge/Discharge (GCD) confirmed the excellent specific areal capacitance of the device. More importantly, Electrochemical Impedance Spectroscopy (EIS) showed very high-frequency responses, which is promising for AC/DC filter applications. The results will be presented in detail at the conference

Audience Take Away Notes

- This talk will inform the audience with a new way of producing high quality graphene
- Audience dependence on various vendors of graphene can be eliminated since they will be able to synthesize graphene

Biography

Chunlei (Peggy) Wang is a full professor in the Mechanical and Materials Engineering Department at Florida International University. She received her MS (1993) and PhD (1997) in Physics from Jilin University (China). Before joining FIU, she held various research positions at Osaka University (1995-2001) and University of California Irvine (2001-2006). At FIU, her group focuses on the development of micro and nanofabrication methods for building novel micro and nano-structures and synthesizing nanomaterials that have unique structures and useful properties for energy and biological applications. She is a recipient of DARPA Young Faculty Award in 2008. FIU faculty award in research and creative activities (2013) and FIU Kauffman Professor Award (2009). She was a co-founder of Carbon Microbattery Corporation (Enevate Corp), a consultant at Intel Lab (2012), and a guest scientist at Max Planck Institute (2012-2013).

Alaa Saed Abdelmagid Zailouk
Ministry of Tourism and Antiquities, Cairo, Egypt

Nanotechnology in the maintenance of artifacts

The success of any project to protect and preserve artifacts depends on the use of advanced technical sciences, and from this standpoint, this summary deals with one of the most important modern applications used in this field, which is nanotechnology: Methods of maintaining artifacts depend on several axes, namely:

1. Examination and analysis of artifact components.
2. Causes and manifestations of various damages to artifacts.
3. Treating those causes and developing plans to get rid of those causes that lead to the deterioration of the artifacts.

The famous American physicist Professor Richard Feynman stated that it is possible to change the properties of any substance and maximize its features by rearranging its atoms in a way that comes with obtaining unique properties that are completely different from their original features before restructuring them, and it is known that he won the Nobel Prize in Physics in 1965. Thus, the dawn of a revolution titled by the Japanese scientist Norio Taniguchi in 1974 with the title of nanotechnology.

Nanoscience: It is a science that studies the small sizes of particles and is concerned with the study, characterization and application of nanomaterials. Nanoscience relies on separating particles from each other to benefit from all their qualities, as the characteristics and properties of materials change dramatically while they are in the nanoscale than in normal sizes. The word nano is a word derived from the word dwarf and it means all materials that are infinitesimally small Greek Nanos.

Examples of the use of nanotechnology in preserving antiquities include, for example, but not limited to: We find that the ancient Egyptian used nanomaterials in making black inks consisting of nanoscale carbon particles, and it was also found that when nanoparticles of copper are added to silicon polymers, this compound protects stones from microbiological damage. It also has the ability to stop and prevent the growth of microbiological damage as a result of the liberation or release of copper ions to increase the effectiveness of the treatment. Also, when adding these particles to a mixture of tonic materials with pesticides, it gave good results in preventing the formation of biological colonies. This compound also made the stone samples water-repellent. With no changes in the colors of sandstone, marble and plaster.

Nanotechnology is considered a pioneering technology in our world today, as it is considered multi-functional and multi-tasking. In addition to its use in protecting and maintaining antiquities of all kinds, it is also used in exploring environmental hazards, treating pollutants, purifying and desalinating water, as well as in the use of devices, in the field of pharmacy, medical devices, and the field of medicine. Gold granules have been used Nanoparticles in determining the DNA chains of viruses that invade the human body, in addition to that they may be the lethal Weapon of cancer cells and kill them locally inside the human body without any side effects.

Biography

Mr. Alaa Saeed studied archeology at Tanta University, graduated with a Bachelor's degree in 2006, then joined the Egyptian Ministry of Tourism and Antiquities as an inspector of antiquities in 2009 until now, then trained in drawing and recording pottery with the English mission in 2011 under the presidency of Dr. Beni Lop Wilson from Durham University, then he obtained a master's degree in the field of ancient Egyptian antiquities in 2017 then he trained a course entitled (Antiquities between the Original and the Forgery) and now he is a PhD researcher in the same specialty since 2018 until now.

Sadia Afrin Khan[1*], Monique E. Johnson[2], Matthew S. Kalan[1], Antonio R. Montoro Bustos[2], Savelas A. Rabb[2], Ingo H. Strenge[2], Karen E. Murphy[2], Timothy R Croley[1]

[1]Center for Food Safety and Applied Nutrition (CFSAN), Food and Drug Administration, U.S

[2]Chemical Science Division, Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg

Characterization of nanoparticles in silicon dioxide food additives

Food additives are substances intended to become a component or affect the characteristics of food (e.g., emulsifier, stabilizer, thickener, anticaking agent, antioxidant, etc.). Some food additives may have a particle size distribution that extends into the nanoscale range. For example, amorphous silicon dioxide, which is an approved direct food additive (21 CFR 172.480) for use as an anticaking agent may possibly contain nanosized silicon dioxide particles due to the nature of its manufacturing process. However, there are limited data concerning the particle size distribution of silicon dioxide used as a food additive. Therefore, we used multiple analytical techniques to characterize the particle size distribution of six commercially available silicon dioxide food additives. In this work, we used dynamic light scattering to measure particle size distribution, electron microscopy for imaging, and single-particle inductively coupled mass spectrometry (sp-ICP-MS) to measure the concentration of nano-sized materials present in silicon dioxide additives. These results allow the US FDA to gain a greater understanding of the potential for nano-sized particle occurrence in silicon dioxide intended for use as food additives.

Biography

Dr. Sadia Afrin Khan is a research scientist in the Center for Food Safety and Applied Nutrition (CFSAN) at the US Food and Drug Administration. Dr. Khan received her Ph.D. degree in Chemistry from Jackson State University in 2013. Her research interest includes analysis of nanomaterial, nanomaterial-based assay for toxin detection as well as characterization of nanoparticle in food additives. She has over twenty publications in high impact journals and cited no less than 2458 times.

Delia Teresa Sponza

Environmental Engineering Department, Engineering Faculty, Dokuz Eylul University, Izmir, Turkey

Hematite dysprosium oxide (Fe_2O_3–Dy_2O_3) nanocomposites for antibiotic and mıcroorganism removals from surface water

The formation of Fe_2O_3–Dy_2O_3 nanocomposite was confirmed by FTIR, XRD, XPS and ED's analysis. The removal of chloramphenical antibiotic gram negative bacteria and enteroviruses were studied. BET surface area of the Fe_2O_3–Dy_2O_3 nanocomposite was found to be 134 m2 g–1. Antibiotics have been emerged as an issue high concern due to their potential risk for ecosystem and human health. The maximum adsorption capacity for the removals of antibiotic, bacteria and viruses were 403, 399 and 328 mg g1, respectively. The maximum percentage removal of antibiotic was 960% at the adsorbent dose of 0, 76 mg L–1 within 200 min for 100 ppm initial concentration of the antibiotic. The effect of nanocomposites on the removals of bacteria and viruses. The reuse of t Fe_2O–Dy_2O_3 nanocomposite was 93% during 9 months then decreased to 90% and 87%. This exhibited that the recyclability of the Fe_2O_3–Dy_2O_3 composite in water purification and treatment.

Audience Take Away Notes

- I will share my data
- Yes, it does provide 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

Biography

Prof. Dr. Delia Teresa Sponza is currently working as a professor at Dokuz Eylul University, Department of Environmental Engineering. Scientific study topics are; Environmental engineering microbiology, Environmental engineering ecology, Treatment of fluidized bed and activated sludge systems, Nutrient removal, Activated sludge microbiology, Environmental health, Industrial toxicity and toxicity studies, The effect of heavy metals on microorganisms, Treatment of toxic compounds anaerobic/aerobic sequential processes, Anaerobic treatment of organic chemicals that cause industrial toxicity and wastewater containing them, Anaerobic treatability of wastewater containing dyes, Treatment of antibiotics with anaerobic and aerobic sequential systems, Anaerobic and aerobic treatment of domestic organic wastes with different industrial treatment sludges, Treatment of polyaromatic compounds with bio-surfactants in anaerobic and aerobic environments, Treatment of petrochemical, Textile and olive processing industry wastewater by sonication, Treatment of olive processing industry wastewater with nanoparticles and the toxicity of nanoparticles. She has many international publications.

Duncan James Macquarie and Sikirat Kehinde Sheu*
Green Chemistry Centre of Excellence University of York, United Kingdom

Gold nanoparticles as an efficient adsorbent for the removal of heavy metals from aqueous solution

Adsorption of Cu and Ni (II) ion by gold nanoparticles was successfully achieved by synthesizing gold nanoparticle by chemical reduction with sodium citrate tribasic and cysteine as the capping agent. The synthesized nanoparticles were characterized by Fourier Transform Infrared spectroscopy, UV visible spectroscopy, Scanning Electron Microscopy, Powder XRay Diffractometer, Inductively Coupled Plasma mass Spectrometry, Thermal Gravimetric Analysis and porosimetry. The result obtained from Fourier Transform Infrared spectroscopy revealed that there are some appearance and disappearance of some peaks which indicate the formation of gold nanoparticles, the result obtained from Inductively Coupled Plasma Mass Spectrometry revealed that the nanoparticles is 63 percent gold.

The observation from the thermal analysis revealed that the gold nanoparticles are 97% stable at 625^{o}C as it would be expected for gold. The result from Scanning Electron Microscope revealed the structural morphology to be spherical monodispersed and porous, the porosimetry analysis revealed the size of the nanoparticles to be smaller in size and also falls within the nano. The UV visible spectroscopy reveals the information of the synthesized nanoparticles to be suitable for colorimetric sensing of the two metal ions.

The physiochemical study revealed that the colorimetric sensing of cadmium and lead ions by gold nanoparticles at different concentrations ranging from 0.5 -20ppm. The maximum uptake was achieved with 9.8mg/g at 20ppm for Cu(II) ions and 11.82mg/g at 20ppm for Ni(II) ions. The effect of contact time was studied for the optimal concentration for reaction time ranging from 5minutes to 24 hours. The optimal uptake occurs at 1hour and maintains stability till 24 hours reaction time with 4.45mg/g for Cu(II) ion and 7.08mg/g for Ni(II) ions was being observed at 1 hours reaction time and remaining stable till 24hours reaction time for the two ions .The effect of pH (3,6,9 and 12)on the adsorption of Cu(II) by gold nanoparticles revealed that maximum uptake was found at a PH of 9 with uptake of 9.8mg/g while maximum uptake occurs for Ni(II) ions at a pH of 12 with 10.6mg/l The effect of adsorbent dose was also studied at (0.01g,0.03g and 0.05g). The result shows maximum uptake for Cu (II) ion at a dose of 0.01g with uptake of 4mg/g while for Ni(II) ions at 0.01g with uptake of 4.5mg/g Study from effect of temperature (30,60 and 90^{o}C)shows that the maximum uptake for Cu(II) ions occurs at 90^{o}C with maximum uptake of 13mg/l and for Ni(II) ions occur at 90^{o}C with maximum uptake of 15mg/g.

Audience Take Away Notes

- How to synthesize nanoparticles
- Information on the nanoparticle's characterization
- Application of nanomaterial in tackling environmental problem

Biography

She studied Chemistry at the University of Ilorin, Nigeria and graduated as MS in 2018. She joined the research group of Dr. James at the Green Chemistry Centre of Excellence, York, United Kingdom as a PhD student researching on Synthesis, structural characterization and application of Metal Nanoparticles.

Alexander Becker[1], Ines Belhaj*[1], Filipe M. B. Gusmao[1], Biljana Sljukic[1], Miguel Chaves[2], Salete S. Balula[2], Luís Cunha-Silva[2], Diogo M. F. Santos[1]

[1]Centre of Physics and Engineering of Advanced Materials, Laboratory for Physics of Materials and Emerging Technologies, Chemical Engineering Department, Instituto Superior Tecnico, Universidade de Lisboa, Lisbon, Portugal
[2]LAQV-REQUIMTE, Department of Chemistry and Biochemistry, Faculty of Sciences, University of Porto, Portugal

Improved borohydride oxidation kinetics on Au-based MOFs and their suitability as anodes for borohydride fuel cells

Researchers are investigating Direct Liquid Fuel Cells (DLFCs) as alternatives to typical proton-exchange membrane fuel cells because of their higher energy density and ease of storing and transporting liquid fuel. Direct Borohydride Fuel Cells (DBFCs) are of particular interest as they offer a sustainable energy source with their high-power density output and the use of a highly alkaline $NaBH_4$ medium. Ensuring efficient and cost-effective catalysts for DBFCs is crucial for their commercial viability. Metal-Organic Frameworks (MOFs) have demonstrated significant potential as anodic electrocatalysts for the Borohydride Oxidation Reaction (BOR) in DBFCs. However, research should explore various modifications to MOFs, such as the incorporation of alternative metal ions or functional groups, to improve their catalytic efficiency and reduce cost. The present study evaluated the performance of newly developed Au-MOF-based electrocatalysts with different functional groups for DBFCs. Specifically, six MOF-based materials were synthesized and analyzed for their catalytic activity for BOR using cyclic voltammetry and chronoamperometry in alkaline media. MIL-101_Au@NH2 and MOF-808_Au@NH2 were found to be highly effective for BOR, suggesting the enhancement of the catalytic activity from the presence of the –NH2 functional group. The kinetic parameters for BOR with MOF-based electrocatalysts, including activation energy, reaction order, exchanged electrons, and anodic charge transfer coefficient, were determined. The activation energy for BOR was 13.6 kJ mol^{-1} and 15.3 kJ mol^{-1} for MIL-101_Au@NH2 and MOF-808_Au@NH2, respectively. The number of transferred electrons, n, was 7.0 and 3.1 for MIL-101_Au@NH2 and MOF-808_Au@NH2, respectively. This study demonstrates that MOF-based electrocatalysts can enhance DBFCs' performance while offering insight into the potential usage of MOFs in other DLFC types.

Audience Take Away Notes

- They can broaden their knowledge about sustainable energy sources and fuel cell technologies.
- They can explore the potential for DBFCs in various applications, such as powering fuel cell electric vehicles and other devices.
- They can consider the benefits of using sustainable energy sources like DBFCs, and the impact this can have on the environment aligned with their high-power density output.
- They can gain insights into the challenges researchers face in developing efficient, low-cost catalysts for fuel cells and the potential of metal-organic frameworks (MOFs) as anodic electrocatalysts for borohydride oxidation (BOR) in DBFCs.

Biography

Ines Belhaj is a Chemical Engineer with a master's degree, currently pursuing a Ph.D. in the same field at IST, Lisbon University. She joined Prof. Diogo Santos and Vitor Geraldes's group in 2022 to develop electrodes and membranes for direct liquid fuel cells. In addition, Ines has experience as a quality system analyst in the pharmaceutical industry, where she developed strong organizational skills, attention to detail, and team contribution abilities. Ines is highly motivated to excel in her work and continue learning and growing.

BOOK OF ABSTRACTS

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Srivalli Mukkavilli[1*], Majemite Iyangbe[2], John Bang[2]
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Effects of particulate matter-induced reactive oxygen species and carbon nanodots on amyloid beta protein aggregation: Relevance in neurodegenerative diseases

Alzheimer's disease is one of the most common neurodegenerative illness with multiple etiological mechanisms explored. Accumulation of different sizes of beta amyloid (βA) proteins generated from Amyloid Protein Precursors (APPs) is known to induce a plaque formation. In a typical beta-amyloidogenic APP metabolism, about 90 percent of βA proteins are those with 40-amino acids while 42-amino acids make up the rest. Initiation of the plaque formation or aggregation process of related proteins can be induced by various mechanisms. Regardless, the presence of Reactive Oxygen Species (ROS) and free radicals is known to be one of the pathological mechanisms like other common forms of diseases. As a source for ROS and free radicals, we have tested a potential role of the Particulate Matter (PM) collected from residential indoor settings in the aggregation of the lyophilized βA proteins. PM is well known as an inducer of inflammatory process in many biological organisms, and ROS and free radicals from the PM are believed to be the causal agents. In our study, lyophilized forms of βA proteins were used to test their aggregation properties in the presence of indoor PM extracts at different concentrations. The same PM extracts were used as sources of ROS in the presence of anti-DMPO adduct antibodies for assessing the aggregation level of □A protein generated by IMR-32 cells. Radicalized □A proteins were bound by DMPO nitron adduct which was identified by anti-DMPO antibody. Then secondary antibody was used for quantifying purpose through ELISA. The aggregation extent was also visualized by using Con-focal imaging. Results indicated that: 1) PM extracts showed a potential to induce aggregation of lyophilized βA proteins, 2) βA proteins aggregation is proportional to the level of PM exposed, 3) Aggregation extent of the βA proteins in In Vitro settings was consistent with the case of lyophilized proteins, 4) The formation of aggregates was confirmed by Con-focal imaging, and 5) Carbon nanodots have protective effects through ROS scavenging potential. From the results, it is concluded that poor air quality induced by PM exposure, especially chronic exposure conditions, is a potential etiological mechanism of Alzheimer's disease by inducing plaque formation in the brain tissues. The level and the duration of exposure to PM before clinical symptoms start showing would be an area for investigation in the coming years.

Audience Take Away Notes

- Audience will learn about potential impacts of the PMs on aggregation of radicalized βA proteins
- Audience will learn about potential treatment options by using a quantum dot class
- For those working in the field of environmental/public health, they may be able to use the experimental data as a reference point for conducting similar studies
- The results from this study should be able to provide some insights about the roles of any materials as a source of ROS
- The information about the exposure doses related to PM should help design similar types of studies
- The information about LD50 and max threshold levels of reagents used in this study should be benefit others working in neurodegenerative diseases

Biography

Ms. Srivalli Mukkavilli studied Pharmacy in India. She is currently working with a Dr. John Bang's group as a second year graduate student in the Department of Pharmaceutical Sciences at North Carolina Central University. She is currently working on her thesis focusing on the conformational effects on the level of βA aggregate formation by using an Electron Paramagnetic Resonance (EPR) based anti-DMPO adduct antibody detection method. From her study, she hopes to better understand the relative affinity of different βA proteins that can be used for finding a treatment method for AD.

Zuzana Chaloupkova[1*], Katerina Polakova1 and Jan Belza[1]

[1]Catrin, Regional Center of Advanced Technologies and Materials, Palacky University Olomouc, Olomouc, Czech Rebublic

Detection of graphene oxide in single HeLa cells based on MCR-Raman spectroscopy

GO (Graphene Oxide) is a 2D nanomaterial that has attracted attention in many industries such as chemical, electronics and medical in recent years. Due to its unique properties such as strength, hydrophilicity and large specific surface area with the possibility of functionalization, GO is a particularly attractive material in biomedicine as a candidate for use in targeted drug delivery. The aim of this work is to study the presence of graphene oxide in cervical cancer cells by Raman spectroscopy, the fate of GO within a single cell based on mapping and its evaluation by MCR analysis. Raman spectroscopy proved to be a promising method that, together with MCR analysis, provided information on the detection of GO even in a single HeLa cell. Thus, GO can be used as a promising material with potential, for example, for drug delivery inside cancer cells, which can be further investigated for practical applications using Raman spectroscopy.

Audience Take Away Notes

- This work opens up the knowledge for the detection of GO in the cell using MCR-Raman spectroscopy
- The MCR-Raman method offers a promising approach for the determination of GO, its degradation products or the interaction of GO with cellular components
- GO as a promising material with potential, for example, for drug delivery inside cancer cells

Biography

Zuzana Chaloupkova graduated in Biochemistry at Palacky University and in 2013. She received her MSc. In 2014 and joined the BioMed group led by Doc. Ranc in RCPTM (Regional Centre of Advanced Technologies and Materials) in Olomouc. In 2018, she has received her PhD degree in Physical Chemistry at the same institution. During her PhD study, she completed a 3-month internship at the University of Trieste under the supervision of Dr. Fornasaro. Since 2021 she became a junior researcher at CATRIN (Czech Advanced Technology and Research Institute) where she is still working. She is the author of 1 patent, first-author of 5 papers and co-author of other publications.

Sarka Hradilova*[1], Katerina Polakova[1], Serpil Tekoglu[2]

[1]Czech Advanced Technology and Research Institute (CATRIN), Czech Rebublic
[2]Linz Institute for Solar Cells (LIOS), Johannes Kepler University Linz, Linz, Austria

Toxicity of modified pedot thin films

The usage of organic semiconductors in the construction of bioelectronic devices represents a very promising alternative to metal electrode systems and traditional inorganic semiconductors. For these devices, the biocompatibility of the interface between the electronic element and living cells is a critical parameter. Poly (3,4-ethylenedioxythiophene): Poly (styrene sulfonate) (PEDOT: PSS) is probably the most successful conductive polymer in terms of practical application. It has many unique properties, such as excellent optical transparency in the visible light range, high electrical conductivity, and good physical and chemical stability in air. However, the issue of long-term biocompatibility of PEDOT: PSS is not completely resolved. Therefore, new ways to improve biocompatibility are constantly being sought. DNA biofunctionalization, for example, seems promising.

In our study, we monitored and compared the toxicity of PEDOT: PSS, PEDOT: DNA and polypyrrole: DNA (PPy: DNA) films deposited on a glass substrate on the NIH3T3 mouse fibroblast cell line. We focused on the morphological changes of cells after contact with the film observable in the microscope and on their viability determined by measuring the metabolic activity of cells by MTT test, as well as on live/dead viability kit with fluorescent labelling on a cytometer. The data obtained show that the PEDOT: DNA and PPy: DNA combination represents a promising way to preserve the benefits of the polymer while increasing biocompatibility to living cells.

Audience Take Away Notes

- The MTT test is not suitable for colored samples
- Flow cytometry solve this problem
- PEDOT is excellent semiconductor, but long-term biocompatibility in not so excellent
- Surface modification can improve biocompatibility

Biography

Dr. Hradilova studied Analytical chemistry at Palacky University, Czech Republic and graduated as MS in 1997. She then joined the research group of Prof. Weigl at Immunology department, Faculty of Medicine, Palacky University in Olomouc, Czech Republic. She received her PhD degree in 2003 at the same institution. She worked here as a junior researcher and lecturer until 2012. She spent several months at University of Wolverhampton, Great Britain. Since 2012 she works in Czech Advanced Technology and Research Institute (CATRIN) in bio-med research group. Her area of interest is the measurement of nanomaterial toxicity.

Ludmila Zarska[1]*, Elena Giusto[2], Darren Fergal Beirne[3], Arianna Rossi[2,4], Giada Bassi[2,5], Andrea Ruffini[2], Monica Montesi[2], Diego Montagner[3], Vaclav Ranc[1,6], Silvia Panseri[2]

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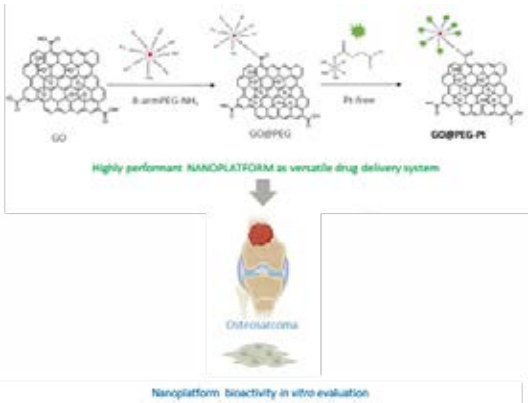
Novel 2D carbon based nanoplatforms for targeted drug delivery

The biomedical applications of graphene-based materials, including drug delivery, have grown rapidly in the past few years. Graphene and graphene oxide (GO) have been extensively explored as some of the most promising biomaterials for biomedical applications due to their unique properties: two-dimensional planar structure, large surface area, chemical and mechanical stability, superb conductivity and good biocompatibility. These properties result in promising applications for the design of advanced drug delivery systems and delivery of a broad range of therapeutics. In this study, we aimed to create and characterize a GO-based 2D nanoplatform that was functionalized with highly branched 8-arm polyethylene-glycol (PEG). The PEG functionalization helped to decrease the toxicity of the GO flakes and increase their loading capacity with cisplatinum (Pt) drug. We evaluated the anticancer effects of this GO-based 2D nanoplatform in osteosarcoma cell lines.

In this study, 85% of the GO flakes reached an average lateral size of 130 nm before PEGylation. GO@PEG-Pt showed high stability at two different temperatures (pH 7.4) and the Pt loading efficiency of GO@PEG nanoplatform reached LE=64%, for non-PEGylated GO LE=10%. Unloaded GO@PEG showed no significant toxicity and the bioactivity of GO@PEG-Pt showed an obvious dose-dependent decrease in cellular metabolic activity in osteosarcoma cell lines U2, SAOS and MG63 tested in both GO@PEG-Pt compared to cells containing only Pt. At a concentration of 30 μM, the GO@PEG nanoplatforms carrying Pt showed a significant decrease in cell viability compared to the group without Pt, suggesting that the use of GO@PEG nanoplatforms could be a promising approach for treating osteosarcoma with Pt. These findings confirm that the GO@PEG-based nanoplatform is a promising nano-delivery system, consistent with other studies that demonstrate the lack of toxicity associated with GO@PEG, even at higher concentrations in vivo. Therefore, GO@PEG nanoplatforms have the potential to be administered to patients without adverse effects.



Audience Take Away Notes

- Study shows the effect of PEGylation for drug loading
- Branched 8-arm PEG was used for PEGylation, which brings many advantages compared to linear types of this polymer
- This study provides the preparation and characterization of a GO@PEG-Pt nanoplatform tested on osteosarcoma cell lines

Biography

Dr. Ludmila Zarska studied Biophysics at Palacky University, Czech Republic, where she received her PhD degree in 2022 also. During her PhD studies she participated in five internships - The first at the University of Milan (Dr. Tommaso Santaniello). A six-month internship at the University of Milan (Prof. Cristina Lenardi) and Foundation UNIMI – Filarete. A three-month internship at the Department of Inorganic Chemistry, Charles University, CZ (Prof. Jiri Mosinger). A four-month internship at CNR-ISTEC Institute of Science and Technology of Ceramic Materials in Faenza, Italy (Dr. Silvia Panseri). One year she worked at the Institute of Macromolecular Chemistry of the Academy of Sciences of the Czech Republic in Prague (group of Biological models with a specific specialization in polymer systems for tissue engineering). She is author and co-author of 8 publications.

Haruna M. S, Ezeanyanaso C. S*, Hamza A. M
National Agency for Science and Engineering Infrastructure, Idu, Abuja, Nigeria

Effects of erbium nanoparticles on luminescence properties of amorphous nano silicate borotellurite glasses

Four series of rare earth doped borotellurite silicate glass were prepared by melt quenching method. The first and second series are a quaternary erbium oxide and erbium oxide nanoparticles doped glass with chemical composition $\{[(TeO_2)_{0.8}(B_2O_3)_{0.2}]_{0.8}(SiO_2)_{0.2}\}_{1-y}(RE)_y$, y= 0.01, 0.02, 0.03, 0.04, 0.05 molar fraction and RE = Er_2O_3 /Er_2O_3 NPs, while the third and fourth series are multicomposition $[\{[(TeO_2)_{0.8}(B_2O_3)_{0.2}]_{0.8}(SiO_2)_{0.2}\}_{0.99}(Ag_2O)_{0.01}]_{1-y}(RE)_y$ where y = 0.01, 0.02, 0.03, 0.04, 0.05 molar fraction. This research proposes to extract nano silica from the coconut shell and use it to synthesize a series of selected chemical composition of borotellurite silicate glasses doped with different concentration of Er_2O_3 nanoparticles (NPs) and doped with Ag_2O in order to study their effects on the physical, structural, optical and thermal properties. This will go a long way in turning waste into wealth. Addition of Ag_2O into the glass composition modifies the optical properties of the glass system. A novel type of glasses containing rare earth ions and silver ions has recently emerged and already attracted significant attention, the reason for such interest lies in the efficient enhancement of the fluorescent properties in rare earth doped glasses when appropriate silver ions is introduced to it. Results of X-Ray Diffraction (XRD) confirmed the amorphous nature of the glass. The X-Ray Fluorescence (XRF) verified the achievement of 48.6% of silicate from coconut shell. Fourier Transform Infrared (FTIR) has revealed the basic structural units such as TeO_4, TeO_3, BO_4, BO_3, Si-O-Si and O-Si-O in the glass system. The presence of erbium nanoparticles in the second and fourth series was verified from Transmission Emission Microscopy (TEM) and the size of the nanoparticles were recorded within the range of 25 – 28 nm and 41 – 50 nm. The differential scanning calorimetry (DSC) measurements indicate a good thermal stability of borotellurite silicate glasses with the values of T_s>100^oC,, and the transition temperature, T_g in all the glass series are found to increase from 437 to 511 ^oC, 447 to 498^oC, 452 to 482^oC and 469 to 495^oC with the increasing dopants concentrations in all the four glass series.

Keywords: Rare earth, Laser, Borotellurite, Glass, Luminescence, Coconut shell.

Audience Take Away Notes

- How to extract nano silicate from coconut shell
- The use of the extracted silicate for glass fabrication
- Application of the fabricated glass in solid state materials

Biography

Dr. Mrs. Chika Scholastica Ezeaayanaso studied Industrial Chemistry at the Nnamdi Azikwe University, Awka, Nigeria and graduated with BSc in 2010. She proceeded for M.Sc at the same University and graduated with M.Sc Industrial Chemistry in 2013. She holds a Doctoral Degree in Chemistry with specialization in Analytical Chemistry and Renewable Energy from Ahmadu Bello University Zaria. She is currently a Deputy Director and head- Research and Development Unit, National Agency for Science and Engineering Infrastructure, Abuja, Nigeria. Dr. Mrs. Chika also holds distinction in “Diploma in Nutrition” from Shaw Academy, London practical professional online education. She has published over 40 research articles in SCI (E) journals with 25 conference papers and some technical reports in book of proceedings. Dr. Mrs. Chika is a Fellow Institute of Chattered Chemists Society of Nigeria, Fellow Chemical Society of Nigeria and a Member Polymer Institute of Nigeria.

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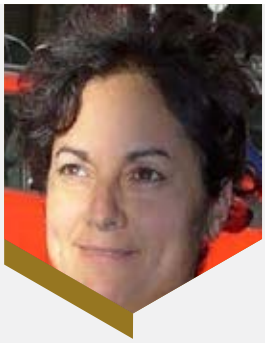
ZnO nanoparticles: Eco-frienldy synthesis, functionalizations and applications

ZnO nanoparticles (NPs) are extensively used for many applications, due to their properties such as wide direct-band-gap, high exciton binding energy, high UVA and UVB optical absorption, piezoelectricity, intrinsic fluorescence as well as their biocompatibility. The achievement of ZnO-NPs using eco-friendly conditions is of outmost importance in the perspective of an ecological transition and circular bioeconomy. Synthetic strategies will be analysed, aiming at tuning the structural, morphological and spectroscopic properties, to mould target application. In this framework, procedures were optimized, using shear precipitation methods in aqueous solutions and at temperatures as low as 40°C, during synthesis and drying phases, without any additional treatments. Morphology oriented, innovative synthesis of the ZnO-NPs were pursed using non-toxic, newly planned deep eutectic solvents (DES). Further functionalization was carried out to tailor ZnO properties towards specific applications. Salinization procedures were set out to enhance the ZnO fluorescence response and to create a link with chlorinated pesticide for sensing purposes. Detection of penconazole was achieved as decreasing fluorescence signal of APTMS-coated ZnO-NPs as a function of increased concentration, with a LOD of 0.1 ppm. Low temperature one-step coating of ZnO-NPs with mimetic molecules ensured the achievement of integrated systems for soil priming, allowing better growth and well-being of test plants, such as *vicia faba*.

Audience Take Away Notes

- Synthetic strategies, finalized to target applications
- Green synthesis as a pathway to ecological transition
- Use of innovative synthetic tools



Marilena Carbone

Department Chemical Science and Technologies, University of Rome Tor Vergata, Via della Ricerca Scientifica, 1, 00133 Rome, Italy

Biography

Prof. Marilena Carbone has MS in Chemistry and a PhD in Materials Science from the University of Rome Sapienza, Italy. She has been awarded the International Association of Advanced Materials Medal in 2023. She is Member of German Institute for Risk Assessment - Tattoo Inks, of the Italian Chemical Society - Inorganic Chemistry, of the American Chemical Society, and is in the Top 2% scientists in 2021 by Stanford University. She is in the International Editor Board of the Journal of King Saud University Science, and in the editorial boards of Applied Sciences, Crystals and International Journal of Molecular Science by mdpi. She is currently Associate Professor at the University of Rome Tor Vergata, Italy, where she leads the group Startnetics. She has published more than 120 papers in SCI journals.

New nanobiotechnology for real-time imaging of single live cells

Single cells are building blocks of all living organisms. Understanding of functions of individual live cells and their communications is essential to rationally design effective diagnosis and therapy. New tools for detecting and targeting specific individual cells would revolutionize disease diagnosis and treatments. Current tools are unable to real-time study and control molecular machineries of single live cells with adequate quantitation, spatial and temporal resolutions and over an extended period of time. We have pioneered the development of a set of powerful new nanobiotechnologies, including photostable single plasmonic nanoparticle imaging probes, single molecular assays, Single Molecule Nanoparticle Optical Biosensors (SMNOBS) and Far-Field Photostable Optical Nanoscopy (PHOTON). We have demonstrated that these new tools can overcome the drawbacks of fluorescence-based imaging platforms for dynamic, single molecule and multiplexing imaging of single live cells with superior temporal and spatial resolutions and over a desired extended period of time (hours, days, weeks). We have used these new tools to real-time study: (i) Molecular cascades of signaling transduction pathways of single live cells, (ii) Molecular mechanisms of multidrug resistance of single live cells, (iii) Efficacies of individual drug nanocarriers, and (iv) Native environments of developing embryos. In this keynote presentation, I will describe these new nanobiotechnologies and their innovative biomedical applications. The work has been supported by NIH and NSF.

Audience Take Away Notes

- The conferees will learn how to synthesize and characterize nanoparticles and single molecular nanoparticle biosensors, and related publications and updated results
- The conferees will learn how to use a set of powerful nanobiotechnology that we have developed for biomedical applications, especially for real-time imaging of single live cells

X. Nancy Xu*, Preeyaporn songkiatisak, Pavan kumar cherukuri, Martha s. Johnson, and Tao huang

Department of Chemistry and Biochemistry & Department of Electrical and Computer Engineering (Biomedical Engineering), Old Dominion University, Norfolk, USA

Biography

Dr. X. Nancy Xu is an elected AAAS Fellow and Professor of Biomedical Engineering, Biomedical Sciences, Biochemistry, and Chemistry at Old Dominion University. She has pioneered the development of a set of powerful new nano biophotonics tools for biomedical applications, and has consistently published her work in high impact peer-reviewed journals. Dr. Xu is especially well recognized for her pioneering work in single nanoparticle optics, nano optical biosensors, single molecule detection and single live cell imaging and has received several prestigious national awards, including Nano50 Innovator Award and Nano50 Technology Award, Finalist of NIH Follow That Cell Challenge, ACS Roland F. Hirsch Award and AAAS Mentor Award. Her profile is at www.odu.edu/~xhxu.

Metal quantum-dots in glasses for nanophotonics

Technology has made great advances in electronic device-speed, but optical devices operate in the time-domain unreachable by electronics. Optical devices have no competition in the time domain less than 1 picosecond. Photonic devices can switch and process light signals without converting them into electronic form. Major advantages of these devices are speed and conservation of bandwidth. Switching is performed through changes in refractive index of the material that are proportional to the light intensity. This particular feature is the result of third-order dielectric susceptibility, $\chi(3)$, or "optical Kerr susceptibility", which is related to the nonlinear part of the total refractive index. Future prospects in photonic switching and information processing critically depend on the progress towards improved photonic materials with significantly enhanced Kerr susceptibilities. Optically isotropic materials like silica glasses that have inversion symmetry intrinsically possess some third-order optical nonlinearities at $\lambda = 1.06\mu m$. This, combined with extremely low absorption coefficient of silica glasses, allows all-optical switching between two waveguides embedded in a silica fibre simply by controlling the optical pulse intensity. Plasmonic nanoparticles in dielectric media lead to the generation of surface-plasmons in the neighbourhood of dielectric surfaces, resulting in a local evanescent field that experiences dielectric confinement. This field affects the coherent oscillation of dipoles in the conduction band thus enhancing the effective third-order nonlinearity. The strength of the nonlinearity is influenced by controlling the "Surface Plasmon Resonance" (SPR) band by tuning the size and shape of the nanomaterials. The incorporation of metal nano-colloids in glasses have been found to induce desired third-order optical non-linearities in the composite at wavelengths very close to that of the characteristic Surface Plasmon Resonance (SPR) of the metal clusters. Ion implantation is a potential method for inducing colloid formation at a high local concentration unachievable by chemical doping or melt-glass fabrication process and for confining the nonlinearities to specific regions in various host matrices. Metal-ion induced colloid generation in bulk silica glasses has shown that these nanocluster–glass composites under favourable circumstances have significant enhancement of $\chi(3)$ with picosecond to femtosecond temporal responses. The extraordinary achievements in developing such novel photonic materials have opened the way for advances in photonic devices, such as all-optical switching, coupled waveguides as a directional coupler, etc. The talk will address on the ion-beam synthesis of metal-glass nanocomposites for photonic applications.

Purushottam Chakraborty

Former Senior Professor Saha Institute of Nuclear Physics
Kolkata, India

Biography

Purushottam Chakraborty, a Former Senior Professor of Physics, Saha Institute of Nuclear Physics, Kolkata, India and a Former Adjunct Professor of Physics, University of Pretoria, South Africa is considered as one of the leading experts in Materials Science and Materials Analysis using Ion Beams. He was awarded the "Most Eminent Mass Spectrometrist of India" and conferred the "Gold Medal" by the Department of Atomic Energy (DAE), Government of India for his outstanding contributions in Secondary Ion Mass Spectrometry (SIMS). He received "Premchand Roychand Scholarship (PRS)" and "Mouat Medal" of Calcutta University. Prof Chakraborty's research areas include: Atomic Collisions in Solids, Ion-Beam Modifications and Analysis, Secondary Ion Mass Spectrometry (SIMS), Low-dimensional Materials, X-UV optics, Nonlinear Optics, Photonics, Plasmonics, etc. Prof Chakraborty indigenously fabricated an RF-Quadrupole Mass Spectrometer for the first time in India for working on Atomic Collisions in Solids. His "MCsn+ molecular-ion based SIMS" is considered to be innovative for compositional analysis of nanostructured materials. His work on the fabrication of Layered

Synthetic Microstructures (LSM)' is recognized as a pioneering contribution in the "Realization of Optical Devices for the Extreme Ultraviolet to Soft X-rays". His works on "Metal-Glass Nanocomposites" have led to the remarkable achievements in the development of novel photonic materials. Prof Chakraborty worked at FOM-Institute in Netherlands, ICTP and Padova University in Italy, Laval University in Canada, Osaka Electro-Communication University in Japan, University of Pretoria in South Africa, Pontifical Catholic University of Rio de Janeiro in Brazil, etc. He delivered lectures at Imperial College in London; Maria Curie-Skłodowska University and Polish Academy of Sciences in Poland; Vanderbilt University, IBM T J Watson Research Centre, Rutgers University, Jackson State University, Furman University, Yale University in USA; Bielefeld University, Friedrich Schillar University, Kaiserslautern University in Germany; University of Western Australia, Newcastle University Australia; Osaka Electrocommunication University, Kyoto University, SPring-8, Nagoya Institute of Technology in Japan; National Taiwan University in Taiwan; Witwatersrand University, i-Themba Labs for Accelerator Sciences, Nelson Mandela University in South Africa; Asian Institute of Technology in Thailand, TIFR, IISc, IITs, Tezpur University, in India, etc. Prof Chakraborty has delivered invited lectures at more than 140 international conferences across the globe and published more than 130 scientific papers including review articles, book chapters, etc. Prof Chakraborty edited a book on "Ion-beam Analysis of Surfaces and Interfaces of Condensed Matter Systems" (Nova Science Publishers, New York, USA) and Journal of Physics – Conference Series (UK). He is the Editor of "Photonic Materials", as a Section of the "Encyclopedia of Materials: Electronics" (To be published by Elsevier Science). He is editing a book "Nanomaterials for Sensing and Labelling Applications" (Springer, Germany) Prof Chakraborty is a Fellow of the Indian Chemical Society and West Bengal Academy of Science and Technology.

Nano-technology based formulations: A revolution in drug targeting

Micro to Nanotechnology based formulations found to play a promising option to develop precise drug targeting. Controlled drug delivery dominated over the conventional drug delivery systems in the sense to alter the pharmacokinetic and pharmaco-dynamic parameters of the active therapeutic moieties by adopting novel drug delivery technology or by modifying the molecular structure and/or physiological parameters of the drug through a selected route of administration.

For example: Ionotropic gelation technique was used to entrap aceclofenac into algino-pectinate bioadhesive microspheres as a potential drug carrier for the oral delivery of this anti-inflammatory drug3. Microspheres were investigated *in-vitro* for possible sustained drug release and their use *in-vivo* as a gastroprotective system for aceclofenac. Polymer concentration and polymer/drug ratio was analyzed for their influence on microsphere properties. The microspheres exhibited good bioadhesive property and showed high drug entrapment efficiency. Drug release profiles exhibited faster release of aceclofenac from alginate microspheres, whereas algino-pectinate microspheres showed prolonged release.

Within decade it has been observed that the development of drug delivery platform is shifting towards nanotechnology-based formulations for drug targeting. Now nanomedicine concept dominates over micro-encapsulation techniques in designing targeted and controlled release drug delivery systems. Nanomedicine is the application of nanotechnology to health care. It has potential impact on the easy and reliable diagnosis, monitoring and treatment of disease. There are lot of research potentials in the field of nanoparticulate systems to be utilized in the drug delivery and drug targeting. Particulate systems like nanoparticles have been used as a physical approach to alter and improve the pharmacokinetic and pharmaco-dynamic properties of various types of drug molecules. They have been used in-vivo to protect the drug entity in the systemic circulation, restrict access of the drug to the chosen sites and to deliver the drug at a controlled and sustained rate to the site of action.

Nanoparticles may be because of its size and functionalization characteristics able to penetrate and facilitate the drug delivery through the barrier. There are number of mechanisms and strategies found to be involved in this process, which are based on the type of nanomaterials used and its combination with therapeutic agents, such materials include liposomes, polymeric nanoparticles and non-viral vectors of nano-sizes for CNS gene therapy, etc.

Subas Chandra Dinda

Department of Pharmaceutics,
College of Pharmacy,
Teerthanker Mahaveer
University, Moradabad, India

Biography

Dr. Subas Chandra Dinda, who did his Master's degree in Pharmaceutical Technology from Andhra University, India in 1999 and Ph.D. in Pharmacy from Jadavpur University, India in 2008, serving at present as Professor & Head, Department of Pharmaceutics, Teerthanker Mahaveer University, India is found to be having a wide research experience in the frontier of Drug Delivery and Drug Targeting Research covering the area of design and development of Matrix systems, Floating Drug delivery systems, Muco-adhesive microcapsules, and Nano-particle based formulations. He explored several poorly bio-available drugs through muco-adhesive as well as nano-particle based dosage forms and found to be very effective through oral route. He also actively involved in guiding the scholars in the field of Drug Delivery System as well as interdisciplinary research covering the area of Drug Synthesis and Herbal Drug Research under the joint collaboration with the teachers from other University

Different drug delivery systems such as liposomes, microspheres, nanoparticles, nono-gels and nono-biocapsules have been used to improve the bioavailability of the drug in the brain, but microchips and biodegradable polymeric nanoparticulate careers are found to be more effective therapeutically in treating brain tumor. The physiological approaches also utilized to improve the transcytosis capacity of specific receptors expressed across the BBB. It is found that the low-density Lipoproteins Related Protein (LPR) with Engineered Peptide Compound (EpiC) formed the platform incorporating the Angiopep peptide as new effective therapeutics. The lipid-based formulations comprise nano-emulsions, Solid-Lipid Nanoparticles (SLNs), Nano-Structured Lipid Carriers (NLCs), liposomes, and niosomal systems, etc. have found more promising antitubercular activity as its intended for targeted drug delivery especially to the infected part. Further mannosylation of liposomes offers tremendous results in TB chemotherapy as it directly binds to mannose receptors available on the surface of alveolar macrophages resulting mycobacterium destruction. SLNs and manosylated SLNs are the advanced form of the lipid formulations, which found to enhance the drug uptake at the infected organ and show significant in vivo anti-tubercular activity with reduced toxicity.

Recently it has been found that the use of nanotechnology in the field of pharmaceutical biotechnology helps in improving the drug delivery strategy including the kinetics and therapeutic index to solve the delivery problems of some biotech drugs including the recombinant proteins and oligonucleotides. Use of nanotechnological based formulations and nanomaterials are increasing day-by-day in wide range covering a broad typology of applications, from design and development of targeted drug delivery systems, manufacturing of pesticides, domestic appliances, textiles, to bioremediation engineering. There are therefore concerns about the environmental risks or bioaccumulation related issues that may arise particularly resulting from the application of drug loaded nano-carriers or effect of pesticides that reach the natural ecosystems.

as well. To date some of his research finding claimed patents and published in more than hundreds of peer reviewed journals for the benefit of scientific community. He is serving as reviewer of many journals including ELSEVIER, SPRINGER, and SCIENCE DIRECT publications. To his credit he supervised/awarded more than 22 Ph.D candidates in the field of pharmaceutical sciences for the professional development and having a vast administrative experience in establishing the new pharmacy institutions as well as designed new pharmacy course curricula as the chairperson of Board of Studies/Council for the development of pharmaceutical sciences at Berhampur University in India as well as Mekelle University in Ethiopia.

Photoalignment and photopatterning nanosize azodye layers for new liquid crystal devices

Photoalignment and photopatterning has been proposed and studied for a long time. 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 azodye nanolayers 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. 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 azodye nanolayers. 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; (iii) LC lenses; (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.

Acknowledgments

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Vladimir G. Chigrinov

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

Nanjing Jingcui Optical Technology Co., LTD, Nanjing, China

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 317 journal papers, more than 668 Conference presentations and 121 patents and patent applications including 36 US patents in the field of liquid crystals since 1974. He got Excellent Research Award of HKUST School of Engineering in 2012. He obtained Gold 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 Slottow Owaki Prize of SID in 2018. He is 2019 Distinguished Fellow of IETI (International Engineering and Technology Institute).

Since 2018 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. Since March 2022 he is a Fellow of National Academy of Technology for his contributions to Information Electrical and Electronic Research.

In-situ opto-electro-mechanical characterization of semiconductor nanowire using sem-based nano manipulation technique

In the 21st century, nanomaterials play an important role in the field of science and technology and have a significant impact on various fields of the national economy. Among them, one-dimensional semiconductor nanowires are widely used in nano-optoelectronics (such as nano-photoconductors), new-generation electronic devices (such as nano-FETs), energy conversion (such as nanogenerators) and sustainable energy (such as nano-solar cells) due to their superior physical and chemical properties, optical properties, high-strength mechanical properties and high-performance electrical properties. In order to improve the comprehensive performance of applications equipped with semiconductor nanowires in these important fields, it is essential to accurately characterize their advanced opto-electromechanical coupling properties by experimental methods. In this talk I will give a brief introduction of my investigation regarding this topic.

Although various conventional experimental techniques (such as Atomic Force Microscopy (AFM) and Micro Electro Mechanical Systems (MEMS)) have been used in the *in-situ* characterization of the mechanical and electrical properties of semiconductor nanowires, it's difficult to apply them in the complicated three-field coupling optical-electromechanical characterization. Compared with traditional characterization techniques, in recent years, the emerging SEM nanomanipulation technology combines the advantages of nanoscale spatial resolution and nanoscale positioning accuracy, which can achieve more precise, intuitive and real-time in-situ characterization of nanomaterials. However, as key technologies in the fields of precision equipment, nanomaterials characterization and integrated circuit manufacturing, nanomanipulation technology and scanning electron microscopic imaging technology are still listed as the "bottleneck" technologies that restrict industrial development. However, it is still quite challenging to apply SEM-based nanomanipulation technology to *in-situ* opto-electromechanical characterization of semiconductor nanomaterials, many difficulties and challenges still exist.

Facing above problems and challenges in the field of opto-electromechanical characterization of semiconductor nanowires, as well as the application bottleneck of SEM nanomanipulation technology, this talk will introduction the establishment of the first *in-situ* SEM-based nanomanipulation system for coupling opto-electromechanical characterization of semiconductor nanowires, which is expected to have theoretical and practical significance for revealing the complex coupling properties of semiconductor nanomaterials and providing crucial fundamental experimental data the optimization of optoelectronic devices.

Juntian Qu

Shenzhen International Graduate School, Tsinghua University, Shenzhen, China

Biography

Dr. Juntian Qu received the B.Eng. and M.Eng. degrees in automatic control theory and engineering from Northeastern University, Shenyang, China, in 2012 and 2014, respectively, and the Ph.D. degree from McGill University, Montreal, Canada, in 2019, in mechanical engineering. From 2017-2019, he was the Visiting Research Fellow in University of Toronto. He was the Shuimu Postdoctoral Fellow and Assistant Research Fellow with the Department of Mechanical Engineering, Tsinghua University from 2019-2021. Now he is the Assistant Professor with Shenzhen International Graduate School of Tsinghua University. He has published more than 30 research articles in SCI (E) journals.

Audience Take Away Notes

- Basic introduction and background knowledge of semiconductor nanowires
- Merits of advanced nanomaterials
- Development of the first in-situ SEM-based nanomanipulation system for coupling opto-electromechanical characterization of semiconductor nanowires

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Raymond C. Jagessar
Department of Chemistry, University of Guyana, Georgetown, Guyana

Nanotechnology in medicine

Nonotechnology has been a rapidly growing field of advanced science in recent times. Nanotechnology has found many applications in treating infectious diseases induced by viruses, bacteria, protozoan, fungi etc. Nanoparticles are effective against a virus, since a virion is of the same dimension as a nanoparticle. Nanoparticles can attach to SARS COV-2 viruses, disrupting their structure and so kill the virus. A low risk solution using antibody modified bismuth nanoparticle, in combination with an X-ray dose equivalent to a chest X-ray specifically, has been shown to kill the common bacterium *Pseudomonas aeruginosa* in a set up designed to resemble a deep wound in human tissue. Heparin functionalized nanoparticles have been use for targeted delivery of anti-malarial drugs. Heparin is abundant and cheap, compared to treatments that involve antibodies, an important consideration, since malaria is most common in developing countries. A bone repairing nano-particle paste has been developed that promises faster repair of fractures and breakages. DNA containing two growth genes is encapsulated inside synthetic calcium phosphate nanoparticles. Many medicinal endeavours have seen the use of Nanotechnology. These and other more recent advances in nanotechnology will be presented at this conference.

Keywords: Nanotechnology, Nanoparticles, SARS-COV-2-VIRUS, Pseudomonas aeruginosa, Heparin, calcium phosphate nanoparticles, Scanning Tunneling

Audience Take Away Notes

- Most of the audience are nanotechnologists and thus can incorporate part of my research in their work or apply them to their work
- The audience will be more knowledgeable at work in nanotechnology. This research faculty can use part of my research to expand their research. However, they must reference my work. Yes it provides a practical solution to a problem that could simplify or make a nanotechnologist designer's job more efficient
- Yes, it will improve the accuracy of a design, or provide new information to assist in a design problem

Biography

Prof. Raymond C. Jagessar obtained his BSc (distinction) in Chemistry/Biology from the University of Guyana (1991) and was assistant lecturer in the Department of Chemistry from (1991-1992). He obtained his PhD from the UK in 1995. He held three Post-Doctoral Research Fellowships (PDF) at the University of South Carolina (USA), Wichita State University (USA) and the University of the West Indies during the period, 1996-1999. He has several international awards; amongst them are Chartered Chemist, CChem and Fellow of the Royal Society of Chemistry, FRSC, UK, Research Grants and recently, one of the awardees of the Guyana Innovation Prize, 2021. His research interests are broad, covering the spectrum of Pure and Applied Chemistry, Chemical Biology and Pharmaceutical Chemistry. He has published over 100 research articles, five book chapters and one book and presented at many conferences, locally and internationally. He is currently Professor in Chemistry (Organic and Inorganic) at the University of Guyana (South America), Fellow and President of the Caribbean Academy of Sciences.

Oliwia Metryka[1*], Daniel Wasilkowski[2], Agnieszka Mrozik[2]

[1]Doctoral School, University of Silesia, Katowice, Poland

[2]Institute of Biology, Biotechnology and Environmental Protection, Faculty of Natural Sciences, University of Silesia, Katowice, Poland

Impact of metallic nanoparticles on the regulation of antioxidant gene expression in escherichia coli, bacillus cereus and staphylococcus epidermidis strains

The widespread use of nanomaterials for consumer and industrial purposes is due to their unique physicochemical and biological properties. Inorganic nanomaterials, including metallic Nanoparticles (NPs), have received much attention in the past decade due to their antimicrobial properties and non-specific targeting of treated microorganisms. With the increasing use of engineering nanomaterials in various areas of life, there is a risk of their uncontrolled release into the environment and exposure of living organisms to their potentially toxic effects. The dynamic appearance of a newer range of nano-products sometimes exceeds the identified risks associated with their presence in the natural environment and thus can negatively affect living organisms, including microorganisms. Although the mode of their action on bacterial cell processes is widely studied, many issues in this field remain unexplained and are the subject of ongoing scientific debate. Metallic NPs present specific antimicrobial properties that directly affect many cellular processes. Among them, the induction of oxidative stress has been proposed as the primary toxicological effect. The generation of reactive oxygen species and their synergistic effect with NPs could alter microbial cells' defence system, affecting the activity of antioxidant enzymes, including catalase, peroxidase and superoxide dismutase. However, as there is limited data on the impact of NPs on the expression of genes encoding antioxidants and the function of their secondary molecular proteins, research on bacterial antioxidant defense systems is crucial and worth pursuing. Therefore, this study aimed to evaluate the effect of AgNPs, CuNPs, TiO_2NPs and ZnONPs on the expression level of selected genes encoding antioxidant-like proteins in three reference bacterial strains: *Escherichia coli*, *Bacillus cereus* and *Staphylococcus epidermidis*. Additionally, the changes in the antioxidant catalytic profiles for catalase, peroxidase and superoxide dismutase were assessed and compared with the designated gene expression profiles. The obtained data revealed that all tested NPs altered the gene expression of chosen proteins and the functioning of antioxidant enzymes. The observed changes depended exclusively on the type of NPs and studied microorganisms. In general, it was determined that the exposure of bacterial cells to AgNPs, CuNPs, TiO_2NPs and ZnONPs resulted in the up- regulation of studied genes, which was correlated with increased antioxidant activity. The most significant differences between transcriptional and catalytic profiles were established for peroxidase and catalase-like proteins. Furthermore, recognized modifications in bacterial molecular processes indicate a ready response to protect cells against stress caused by NPs.

Audience Take Away Notes

- The presented outcomes are novel and beneficial for science because data in this field is still very limited. Therefore, performed experiments are the basis for expanding research in a given area
- A set of readily available and reproducible research methods will be provided
- The obtained findings will provide new information about nanoparticles' biological activity on the functioning of bacterial cells. Such data can be utilized in designing new nanomaterials, taking into account their safe use

Biography

MSc Oliwia Metryka is a PhD student at the Doctoral School at the University of Silesia, Poland. She studied Biotechnology at the Institute of Biology, Biotechnology and Environmental Protection, University of Silesia, Poland and graduated with an MSc in 2019. During her master's thesis, she studied the effect of copper nanocomposites on oxide matrices on selected bacterial strains. These studies inspired her to undertake further multifaceted research as part of her PhD. She has published five articles in highly regarded journals and she had the opportunity to present the published results at many prestigious international conferences.

Ishika Nag
Seminole State College, Sanford, FL, USA

Development of an engineered face mask with optimized nanoparticle layering for filtration of air pollutants and viral pathogens

During the COVID-19 pandemic, face masks have become a critical part of the personal protective equipment for front-line workers and the public, resulting in an acute shortage of effective and affordable masks. Recent studies also indicate a strong correlation between ambient air pollution and COVID-19 cases. Air pollution from particulate matter less than 2.5 microns (PM2.5) is a significant contributor to cardiovascular and respiratory diseases. This work outlines the development of an engineered face mask with an optimized layering of nanoparticles to filter PM2.5 and viral pathogens. Furthermore, the objective is to develop a cost-effective solution for face masks that are reusable and clinically safe. The nanoparticles were selected based on their filtration, virucidal and non-toxic properties. Particle Filtration Efficiency (PFE) was tested with PM2.5 from incense sticks measured by laser particle detectors. Virus Filtration Efficiency (VFE) was tested using nebulized NaCl particles as a virus surrogate. Both PFE and VFE improved by ≈140% with nanoparticle coatings. The filtration efficiency was independent of the source of PM2.5, demonstrating versatility. PFE for engineered masks, with dual-layer nanoparticle coatings, initially declined but was restored by recharging the mask. The nanoparticle retention efficacy, improved by 70% with the dual-layer coating, was well within the permissible exposure limits per OSHA standards. An accelerated durability test demonstrated ≈95% effectiveness maintained over 4 equivalent days of wear. This rechargeable and multi- purpose mask can be effective in polluted cities, in fire-prone areas and can protect people against the deadly effects of viruses in a cost-effective way.

Audience Take Away Notes

- The application of nanomaterials in a safe way on human respiratory masks
- A dual-purpose mask for air pollution abatement and virus prevention
- An optimized application method of nanoparticles onto a face mask
- A cost-effective way to convert a regular surgical mask into a safe and more effective mask
- A rechargeable face mask concept to reduce plastic pollution

Biography

Ishika is a dual-enrolled high-school student at Seminole State College and the University of Central Florida. Ishika has three journal publications and has two patents pending. Her work has won several awards including a grand award at the International Science and Engineering Fair, the Sigma-Xi Interdisciplinary Award in Environmental Challenges, the Sustainable Earth Innovation Award from Arizona State University, and a grant from the National Science Foundation. In addition, she has founded an Engineering Club for under-represented kids at the local Boys & Girls Club, where she inspires and motivates the kids into STEM education through hands-on learning experiences.

Alvard Ter Karapetyan
Vardanants Center for Innovative Medicine, Armenia

Towards quantitative perfusion MRI of the lung in COPD: The problem of short-term repeatability

Purpose: 4D perfusion Magnetic Resonance Imaging (MRI) with intravenous injection of contrast agent allows for a radiation-free assessment of regional lung function. It is therefore a valu- able method to monitor response to treatment in patients with Chronic Obstructive Pulmonary Disease (COPD). This study was designed to evaluate its potential for monitoring short-term response to hyperoxia in COPD patients.

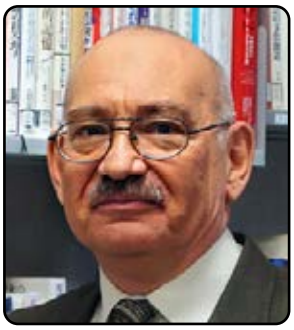
Materials and methods: 19 prospectively enrolled COPD patients (median age 66y) underwent paired dynamic con- trast-enhanced 4D perfusion MRI within 35min, first breathing 100% oxygen (injection 1, O_2) and then room air (injection 2, RA), which was repeated on two consecutive days (day 1 and 2). Post-processing software was employed to calculate Mean Transit Time (MTT), pul- monary blood volume (PBV) and Pulmonary Blood Flow (PBF), based on the indicator dilu- tion theory, for the automatically segmented whole lung and 12 regions of equal volume.

Results: Comparing O_2 with RA conditions, PBF and PBV were found to be significantly lower at O_2, consistently on both days ($p<10-8$). Comparing day 2 to day 1, MTT was shorter by 0.59 ±0.63 s ($p<10-8$), PBF was higher by 22±80 ml/min/100ml ($p<3¤10-4$) and PBV tended to be lower by 0.2±7.2 ml/100ml ($p = 0.159$) at both, RA and O_2 conditions.

Conclusion: The second injection (RA) yielded higher PBF and PBV, which apparently contradicts the established hypothesis that hyperoxia increases lung perfusion. Quantification of 4D perfu- Sion MRI by current software approaches may thus be limited by residual circulating contrast agent in the short-term and even the next day.

Biography

Alvard Ter-Karapetyan is from Vardanants Center for Innovative Medicine, Armenia. Scientist at the Department of Diagnostic and Interventional Radiology at the University Hospital Heidelberg performed a research experiment on Lung MRI, being Quantitative Perfusion MRI of the Lung in COPD. The Problem of Short-Term Repeatability, first author of the scientific article in 2017.



Michael I. Tribelsky
Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia

New effects at resonant light scattering by nanoparticles

A brief survey of the recent accomplishments of the author in the old problem of light scattering by small particles is given. It is shown that in certain cases, the scattering has very little in common with the conventional Rayleigh case. New, counterintuitive effects are pointed out, inspected, discussed, and classified, especially those related to violating the quasi-static description of the scattering occurring at the action of (ultra) short laser pulses. Among them are anomalous scattering; Fano resonances; giant electromagnetic field concentration near the scattering particle and inside it; tunable scattering diagrams; etc. These effects provide a unique opportunity to tailor and control the radiation patterns at the essentially subwavelength scales and open the door to new nanotechnologies as well as to the design and fabrication of a new generation of nano devices, including multifunctional ones.

Audience Take Away Notes

- The discussed results make physical grounds for creating new nanotechnologies and nano devices
- The discussed results contribute to a better understanding of the fundamentals of light scattering. They may be employed to enhance the curriculum of physical and engineering departments and provide new information to assist in designing a new generation of nano devices

Biography

Michael I. Tribelsky received his MS from Lomonosov Moscow State University in 1973, a Ph.D. from Moscow Institute of Physics and Technology in 1976 and a Dr. of Sci. (habilitation) from Landau Institute in 1985. He received numerous National and International awards: Leninsky Komsomol Prize (1979); COE Professorship, the University of Tokyo (2006, 2008) and Kyushu University (2007), Japan; Honorary Ph.D., Yamaguchi University, Japan (2016), etc. Now he heads a laboratory at Lomonosov Moscow State University. His field is theoretical and mathematical physics. Presently, his interest lies in sub wavelength optics. He is the author of several books, book chapters, review articles and more than 100 research papers.

Abhishek Ranade

Department of Chemical Engineering, Indian Institute of Science, Bengaluru, Karnataka, India

Flexible hydrogen leak detectors

Hydrogen is one of the possible replacements for fossil fuels in the future. However, appropriate safety barriers are required due to hydrogen's high flammability and diffusivity. One such barrier is a flexible detector for hydrogen leaks. Commercially available detection tapes can be wrapped around hydrogen-carrying equipment such as pipe flanges or valves. The tape enables detection of hydrogen leaks by changing color. Such tapes require visual observation to detect leaks and camera-based observations are prone to errors due to blindspots. In contrast, chemiresistive hydrogen detectors can continuously read the detector output and signal an alarm accordingly. Palladium (Pd) is commonly used in the fabrication of chemiresistive sensors due to its high selectivity towards hydrogen. Under ambient conditions, palladium can absorb hydrogen to form a hydride, which has a higher resistance than pure palladium. This increase in resistance is indicative of the presence of hydrogen. Thus, a flexible chemiresistive leak detector can signal the presence of hydrogen without depending on visual observation. Detectors having faster responses enable early leak detection, thereby decreasing the risk of accidents. Palladium nanostructures have exhibited very fast response times and therefore have been widely studied in this regard. Thin polymer sheets, like polyimide, have excellent dielectric properties and excellent heat resistance. Large-area polyimide substrates are also commercially available at a low cost, thereby being useful as a substrate material for flexible leak detectors. In this work, electrically conductive Pd nanostructures were deposited on polyimide, using aluminium foil and a Pd salt solution as the sole precursors. This fabrication approach is a bottom-up process performed under ambient conditions. The detectors could repeatedly respond and recover to step-changes in hydrogen concentration, with nitrogen as the carrier gas. However, the detector response and recovery became slower with an increasing number of exposure cycles (t_{90} ~ 40 s @ 3.6% H_2). This change is attributed to the □ □ □ phase transitions of the palladium hydride creating mechanical stresses in the Pd lattice. Alloying Pd with other metals is one strategy to mitigate this phase transition, e.g., Pd-Pt nanostructures have been shown to exhibit faster responses in comparison to Pd. Therefore, Pd-Pt nanostructures were deposited on polyimide by simply modifying the precursor solution. These bimetallic nanostructures exhibited faster response times (t_{90} ~ 40 s @ 3.6% H_2) than the monometallic Pd nanostructures. While testing in air, the oxygen molecules interact with Pd to form Pd-O, resulting in decreased sensitivity and longer response times. In this talk, I will describe how these challenges were overcome and analyze the results of hydrogen leak detection tests.

Audience Take Away Notes

- This metal deposition method could be used in other areas, such as catalysis, where Pd and Pt are utilized. A study has also shown that aluminium coupled with activated carbon could be used as a reducing agent for recovering heavy metals such as Co^{2+} and Ni^{2+} from wastewater [Choi, S., Jeon, S., Park, I., Ito, M., & Hiroyoshi, N. (2021). Enhanced Cementation of Co^{2+} and Ni^{2+} from Sulfate and Chloride Solutions Using Aluminum as an Electron Donor and Conductive Particles as an Electron Pathway. Metals, 11(2), 248].

- The underlying cause for deposition of Pd could be examined in detail and possibly applied to other metals as well
- The method developed in this work utilizes relatively less expensive chemicals and is carried out under ambient conditions compared to other techniques such as lithography.

Biography

Abhishek Ranade studied Chemical Engineering at the Birla Institute of Technology and Science, Pilani, and graduated with a BE (Hons) degree in 2016. The same year, he joined the Department of Chemical Engineering at the Indian Institute of Science, Bengaluru. Under the guidance of Prof. S. Venugopal, he worked in the field of developing hydrogen gas leak detectors. After completing his MS in 2018, he has continued as a Ph.D. student in the same field.

Mounamukhar Bhattacharjee[1]*, Lopamudra Roy[2]*

[1]Department of Clinical Studies Trail & Projection Unit, ICMR Headquarters, India

[2]Department of Pharamacology, Apeejay Stya University. Gurugram, Haryana, India

A comparative safety and efficacy study on patients with acute uncomplicated bacterial tonsillitis: Co-amoxiclav, cefpodoximeproxetil, and levofloxacin

Objective: Our main aim is to assess relative efficacy and safety of co-amoxiclav (amoxicillin/clavulanic acid), cefpodoximeproxetil and levofloxacin monotherapy for the treatment of acute, uncomplicated bacterial tonsillitis.

Methods: As this was a prospective, open-label, parallel-group study of 90 patients with acute uncomplicated bacterial tonsillitis were randomly assigned to one of three treatment groups: Co-amoxiclav 625 mg thrice daily, cefpodoximeproxetil 200 mg twice daily, or levofloxacin 500 mg once daily for five days. Subjective clinical improvement at the conclusion of therapy was used to measure effectiveness. Adverse occurrences were monitored throughout the trial duration to ensure safety.

Results: On days 3 and 7, co-amoxiclav, cefpodoximeproxetil, and levofloxacin all had similar clinical responses; however, on day 5, levofloxacin had a much lower cure rate but a greater improvement rate than co-amoxiclav and cefpodoximeproxetil. At week 1, the bacterial responses were comparable in all three groups. All of the medications were well tolerated, with just a few self-limiting side effects.

Conclusions: In cases of acute, simple bacterial tonsillitis, co-amoxiclav, cefpodoximeproxetil, and levofloxacin all demonstrated equivalent clinical and bacteriological cures along with favourable safety profiles.

Keywords: Acute uncomplicated bacterial tonsillitis, bacteriological response, Antibiotics.

Shubhangi[1*] and Marshal Dhayal[1]

[1]Nano-Cellular Medicine and Biophysics Laboratory, School of Biomedical Engineering, Varanasi, Uttar Pradesh, India

[1]Nano-Cellular Medicine and Biophysics Laboratory, School of Biomedical Engineering, Varanasi, Uttar Pradesh, India

Syntheses of substrate-assisted MOFs with tunable characteristics for use as biological applications' platforms

Metal Organic Frameworks (MOFs) are hybrid materials that have been studied extensively since a long time now. The reason owing to their popularity lies in their structural flexibility and relatively high thermal and chemical stability. They have a porous 3-D structure with metal atom at the corners being linked with a ligand moiety, giving them a distinct topology and a flexible pore size. These materials have potent applications in gas adsorption, heterogeneous catalysis and biosensors. However, many of their applications in the field of biological sciences have not been realized to their complete potential yet.

Objective: To optimize (Zeolitic Imidazolate Framework) ZIF MOF syntheses using different solvent systems to obtain precise morphology for possible applications in biomedical engineering as application platforms. We have reported the formation of ZIF on the surface of varied substrates and have tried to deduce the time-dependent changes which are observed in its crystal morphology at specific temperature parameters. We have optimized ZIF synthesis using two different solvent systems methanol and DMF and have tried their various combinations to obtain highly desirable perfect sod morphology of crystals. The synthesized MOF on substrate have then been explored for their potential as biological platforms. The crystalline structural of ZIF and its localized assembly has been investigated by varying different process parameters be it changing different chemical environments from the nucleation stage or change in temperature and solvent conditions. A correlation amongst crystalline structure variation and the dimensions of their localized assemblies have been investigated through X-Ray diffraction and scanning electron microscopic studies. The study outcome indicates that the initial variation in chemical environment had relatively less influence in dictating their crystallinity however; it can significantly change morphology of ZIFs. The synthesized MOF on substrate have then been explored for their potential as biological platforms. Through this study, we have tried to deduce the morphological evolution of ZIF-8 MOF, synthesized at high temperatures as a function of reaction time, when grown with/without substrate. A time-dependent change in crystal morphology as well as crystal size is clearly visible with best results obtained at a much shorter time than that reported in previous literatures. The optimized MOF growth parameters have been successfully devised for usage in biological applications including biosensor development.

Audience Take Away Notes

- The presentation would enhance knowledge of audience regarding MOFs and their precise syntheses
- They would know about the role of synthesis parameters in MOF crystal growth and attained morphology
- These results would simplify hydrothermal ZIF synthesis which can be adopted by future researchers to incorporate this MOF class for a variety of applications

Biography

Shubhangi studied Biotechnology at the Lovely Professional University, India and graduated as BTech in 2017. She then studied Chemistry at the National Institute of Technology (Kurukshetra), India and post graduated as M.Tech in 2019. Later, she joined the research group of Dr. Marshal at the Indian Institute of Technology, IIT BHU for pursuing Ph.D. in the field of development of electrochemical biosensors. She has published 2 research articles, one review article in SCI/Scopus indexed journals and has been granted an Indian patent in 2022.

Raymond C. Jagessar
Department of Chemistry, University of Guyana, Georgetown, Guyana

Nanotechnology and nanomaterials

Nanotechnology has been a rapidly growing field of advanced science at the inception of this century. Nanotechnology of advanced materials, polymers, principally revolves around endeavours to design and synthesise materials at a sub-atomic level to accomplish alluring properties and applications at a naturally visible level. Nanomaterials science and nanotechnology can be used for the advancement of technologies, ranging from communication and information, health and medicine, personal protective equipment, future energy, environment and climate change to transport and cultural heritage. Nanomaterials will lead to a new approach to manufacturing materials and devices. Faster, efficient computers, advanced pharmaceuticals, controlled drug delivery to treat cancer and other diseases biocompatible materials, nerve and tissue repair, crackproof surface coatings, better skin care and protection, more efficient catalysts, better and smaller sensors, even more efficient telecommunication. In a remarkable demonstration of the extreme limits of nanoscale engineering, researchers have used the tip of a scanning tunnelling microscope to cleave and form selected chemical bonds in a complex molecule. Carbon nanotubes have been used for effective delivery of therapeutic agents to treat cancer and eradicate SARS COVID-2 virus. Nanoparticles can attach to SARS COV-2 virus, disrupting their structure and so kill the viruses. These and other more recent advances in nanotechnology will be presented at this conference.

Keywords: Nanotechnology, Nanoparticles, Pseudomonas aeruginosa, Heparin, calcium phosphate nanoparticles, Scanning Tunnelling

Audience Take Away Notes

- Most of the audience are nanotechnologists and thus can incorporate part of my research in their work or apply them to their work
- The audience will be more knowledgeable at work in nanotechnology. This research faculty can use part of my research to expand their research. However, they must reference my work. It provides a practical solution to a problem that could simplify or make a nanotechnologist designer's job more efficient? Yes, it will improve the accuracy of a design, or provide new information to assist in a design problem

Biography

Prof. Raymond C. Jagessar obtained his BSc (distinction) in Chemistry/Biology from the University of Guyana (1991) and was assistant lecturer in the Department of Chemistry from (1991-1992). He obtained his PhD from the UK in 1995. He held three Post-Doctoral Research Fellowships (PDF) at the University of South Carolina (USA), Wichita State University (USA) and the University of the West Indies during the period, 1996-1999. He has several international awards; amongst them are Chartered Chemist, CChem and Fellow of the Royal Society of Chemistry, FRSC, UK, Research Grants and recently, one of the awardees of the Guyana Innovation Prize, 2021. His research interests are broad, covering the spectrum of Pure and Applied Chemistry, Chemical Biology and Pharmaceutical Chemistry. He has published over 100 research articles, five book chapters and one book and presented at many conferences, locally and internationally. He is currently Professor in Chemistry (Organic and Inorganic) at the University of Guyana (South America), Fellow and President of the Caribbean Academy of Sciences.

Laura Elena Muresan[1*], Florina Stefania Rus[2], Ioana Perhaita[1], Lucian Barbu-Tudoran[3], Gheorghe Borodi[3]

[1]"Raluca Ripan" Institute for Research in Chemistry, "Babes-Bolyai" University, Cluj-Napoca, Romania

[2]National Institute for Research and Development in Electrochemistry and Condensed Matter, Timisoara, Romania

[3]National Institute for Research and Development of Isotopic and Molecular Technologies, Cluj-Napoca, Romania

Effect of Cu^{2+} on the optical properties of zinc oxide-based phosphors prepared in different synthesis conditions

Generally, Zinc Hydroxides (ZH) and Zinc Hydroxy Carbonates (ZHC) are used for the preparation of ZnO nanoparticles as well as for different functional materials such as thin films, nanocomposites, or inorganic-organic hybrid compounds. Also, due to their strong luminescent characteristics, ZH and ZHC are good candidates for sensing, imaging, drug delivery or optical-electrical display. A green luminescence can be obtained by intercalation of different organic species into $Zn(OH)_2$ layers while a strong blue emission is observed for $Zn_4CO_3(OH)_6 \times H_2O$ prepared in hydrothermal conditions. The luminescence of ZH and ZHC is barely studied and is attributed on exciton- exciton collision processes, intrinsic defects, and surface defects, formed during the synthesis stage. The origin of purple-blue emission in zinc hydroxy-carbonate compounds is still not completely clarified and is little studied. On the other hand, the luminescent response of ZH and ZHC as a result of interaction with Cu^{2+} have not been studied. Due to the high defect surface states of ZHC and ZH, Cu^{2+} may easily interact with different active species to form shallow and deep defects fact that can influence the optical properties. In this work, various luminescent zinc hydroxy-carbonate compounds were prepared by precipitation using different precipitating agents such as LiOH, NH_3, Na_2CO_3 and $(NH_4)_2CO_3$. Based on various investigation techniques (XRD, SEM, FTIR, BET, PL, and UV-Vis) the strong connection between Zn^{2+} concentration, pH evolution, morpho-structure and optical properties of ZH, ZHC is discussed. Moreover, understanding the hydrolysis and generation of hydroxy-compounds may provide information on controlling the composition and morphology of ZnO-based nano-materials produced via wet chemical processes. The spherical particles of zinc hydroxy-carbonate compounds ranging between 5 nm and 20 nm, exhibits a strong tendency to form layered or spongy aggregates. BET investigations show that the porosity is distributed either at the surface (ZH) or in the depth of the particles (ZHC) and the specific surface area of samples varies between 15 m^2/g and 55 m^2/g. The effect of various amounts of Cu^{2+} on optical properties of samples is discussed. Luminescent studies confirm that interaction with Cu^{2+} leads firstly to enhancement and then to quenching of the purple-blue emission of samples while, the energy band gap decreases due to the apparition of new acceptor - donor levels in the optical band gap. A mechanism is proposed to explain the luminescent behaviour of the samples.

Acknowledgement: This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2021-2421, within PNCDI III.

Audience Take Away Notes

- About a facile, low-cost synthesis route for the preparation of luminescent zinc-based compounds
- Importance of the preparative conditions on the morpho-structure of nanomaterials
- Understanding the nature of various luminescent centers and their interaction
- Role of Cu^{2+} in generating shallow and deep defects in zinc-based compounds

Biography

Laura-Elena Mureşan studied chemistry - physics at Babes Bolyai University, Cluj Napoca, Romania and after graduating, joined the inorganic research group at the Raluca Ripan Institute for Research in Chemistry, Romania, following in the same time the doctoral studies. She received the PhD degree in 2005 with the thesis entitled, Rare-earth doped luminescent materials. She currently works at the same institution, as senior researcher with more than 20 years' experience in material science. The main research field is focused on the synthesis and characterization of luminescent materials for different applications. The research activity is disseminated in various international journals (77 papers) and 6 patents.

Liudmila B. Boldyreva
National Research Nuclear University, Moscow, Russian Federation

The physical process determining the action of some metal nanoparticles on DNA and RNA of biological system

Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) (together with protein) are the main macromolecules that are contained in cells of all living organisms and play important role in coding and regulation of functioning of genes. Both DNA and RNA consist of long strands in which every link is called the "nucleotide". The sequence of links in the strand determines the genetic information code. DNA exists in the form of double helix consisting of two separate molecules. The RNA molecules, in the average, are shorter than DNA molecules and, in general, they are single - stranded molecules (see Figure 1).

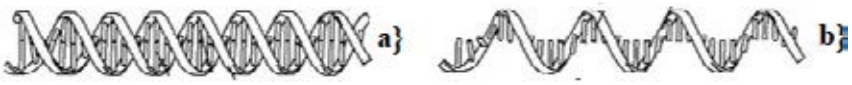


Figure 1. The structures of DNA-molecule (a) and RNA-molecule (b).

One of the methods of influencing DNA and RNA is to change their form, for example, to deform and even unwind their helical forms. This effect can be performed by spin supercurrent.

The spin supercurrent is distinct from other physical processes, most notably, in that it transforms angular momentum. The action of spin supercurrent is aimed at equalizing the spin's characteristics of the interacting objects and, consequently, as a result of its action a change in the form of interacting objects may take place. Spin supercurrent emerges between any objects having spin, independent of shielding these objects by electromagnetic and molecular screens.

The effectivity of spin super current's action is maximal if the interacting objects having complex structures are in ultra-low doses. Consequently, metallic nanoparticles having complex crystal structure (for example, fullerenes and dendrites) may be such objects (see Figure 2).

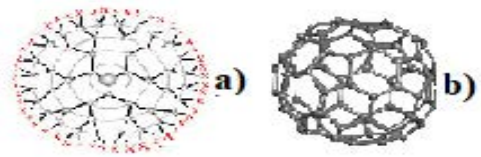


Figure 2. Schematic images of metallic nanoparticles. (a) Molecule of dendrimer, it contains atoms of fluorine and carbon; (b) Molecule of fullerene composed of coordinated carbon atoms.

It is an experimental fact that 3D nanoparticles, which are spiral shaped, deform and even unwind the spiral when penetrating a DNA molecule. One example of such 3D nanoparticle is fullerene; computer simulations have shown that fullerenes, namely, spherical C60 molecules, are potentially dangerous to DNA molecules. Another example of influence on a DNA molecule is dendrimer: 3D and higher generation dendrites have a form which is similar to a sphere.

As shown in, the spin supercurrent emerges between virtual photons (having precessing spin) created by quantum objects constituting DNA and RNA, on the one hand, and nanoparticles, on the other hand; the schema of interaction is given on Figure 3.

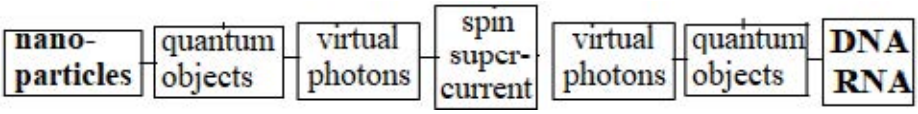


Figure 3. The schema of interaction of nanoparticles and DNA and RNA.

Audience Take Away Notes

- The audience will be able to use what they learn in the theoretical study of properties of nanoparticles
- The audience will be able to use what they learn in the experimental study of properties of nanoparticles
- The audience learns the peculiarities of action of spin super current on biological systems

Biography

Liudmila B. Boldyreva has graduated from the National Research Nuclear University "MEPHI", Moscow, Russia. There she has defended a dissertation on processing results of physical experiments. For 40 years She has been studying the properties of the physical vacuum. The results have been published in 3 books, more than 40 papers in various journals and proceedings of a number of international conferences. She read papers on physics and biophysics and stay up-to-date with the latest developments in these branches of science.

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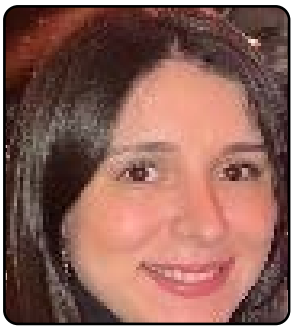
Harnessing Fe_3O_4 nano-sensor for detecting epinephrine in buff orpington rooster and rhodes island white broiler

This study presents findings resulting from the detection of epinephrine (EP) in real samples from chickens using Fe3O4-modified Screen-Printed Silver Electrodes (SPSE). The UV-visible spectroscopy, Fourier-Transform infrared spectroscopy (FT-IR), Transmission Electron Microscopy (TEM), and Scanning Electron Microscopy (SEM) were used for characterizing iron oxide (Fe_3O_4) nanoparticles prior to the modification of the SPSE. Results show a corresponding rise in the oxidation peak current (IAP) of EP with an increase in EP's concentration and the scan rate (25-400 mV s^{-1}). Using Square Wave Voltammetry (SWV), a detection limit of 19.3 µM (S/N=3) over a linear range of 9.99-60.9 µM was obtained. Simultaneous detection of EP in the presence of ascorbic acid was also obtained at this electrode. The fabricated sensor used to detect EP in the blood serum, breast muscle, kidneys, spleens, and livers of chicken species, namely Buff Orpington Rooster (OR) and Rhodes Island White broiler (RIWB), produced better recovery.

Keywords: Chicken, Epinephrine, Nanoparticles, Screen-print Electrode, Square wave voltammetry

Biography

Omolola Esther Fayemi is a Professor of Analytical Chemistry and postgraduate coordinator in the department of Chemistry, at North-West University, Mafikeng, South Africa. Her expertise in the synthesis, characterization and application of nano-based materials through both chemical and green-mediated synthesis. The synthesized nanomaterials are applied in electrochemical sensors for biological and environmental analytes and for wound dressing. She has published more than 80 research works in accredited journals, and her research outputs are recorded by Google Scholar and ResearchGate.



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Atypical retinoid ST1926 nanoparticle formulation development and therapeutic potential in colorectal cancer

Cancer represents a major public health and economic burden, being the second leading cause of death worldwide. Despite recent advances in cancer therapy, anti-cancer drug development remains a challenging field due to several hurdles faced along the process. The use of nanotechnology provides effective drug delivery, enhanced stability, bioavailability, and permeability thereby minimizing drug dosage and toxicity. Nanoparticle (NP) formulations in drug delivery have been applied successfully in various cancer models and in the clinic.

We have previously shown that the adamantyl retinoid ST1926 displays potent anti-tumor and apoptotic activities in colorectal cancer in vitro and in vivo models. However, ST1926 is limited by its low bioavailability and increased glucuroconjugation which resulted in it being halted in phase I clinical trials in cancer patients. Therefore, we developed ST1926-NPs and assessed their efficacy in colorectal cancer models. ST1926-NPs were produced using Flash Nano Precipitation with the amphiphilic diblock copolymer polystyrene-b-ethylene oxide and cholesterol as a co-stabilizer. ST1926 was formulated into NPs with a drug to polymer mass ratio of 1:2 providing a stable formulation for one week. Dynamic light scattering has shown that the contin ST1926-NP diameter was 100 nm, with a polydispersity index of 0.245. Using the MTT cell viability assay, ST1926-NP exhibited potent anti-growth activities as the naked ST1926 in the human colorectal cancer HCT116 cells, at low micromolar concentrations. Future studies will be performed to study the anti-tumor activities and mechanism of action of ST1926-NPs in a colorectal cancer xenograft mouse model and to detect the compound and its glucuroconjugated form in the plasma of mice. Our research will support the use of ST1926-NP formulations in enhancing the stability and bioavailability of ST1926 in colorectal cancer and its further development in the clinic.

Audience Take Away Notes

- The audience will learn about the use of Flash Nano precipitation to formulate stable nanoparticles
- This work will provide further insight into the benefits of using nanoparticle based delivery systems to improve the therapeutic efficiency of drugs including ST1926 which was previously halted in clinical trials
- This research can pave the way for the clinical development and use of ST1926 in the clinic in the future

Biography

Sara Assi is a PhD candidate at the American University of Beirut (AUB) in Lebanon. She graduated with a Bachelor of Science in biology from the Lebanese American University. She then joined AUB to pursue a Master of Science degree in biology. After that, she worked on an interdisciplinary project between the chemical engineering, cell biology, and surgery departments at AUB which motivated her to pursue a PhD in biomedical engineering. She then joined the research group of Dr. Walid Saad and Dr. Nadine Darwiche to work on her PhD project.

Sharda Sundaram Sanjay
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Nanotechnology's useful applications in the food industry

Food is the most crucial component of survival after air and water. A growing lack of agricultural land is a result of the growth in world population. We are all aware that nanotechnology is the study of exceptionally small materials, and researchers have started to consider how this can affect the food industry. The term "nano-food" describes products that have been produced, packed, or processed using nanotechnology techniques. Food processing, food packaging, the production of functional foods, food safety, the detection of pathogens that cause foodborne illness, and the designing novel sensing and food packaging techniques are all areas where nanotechnology has the potential to assist the food industry. These new technologies could help with challenges that have plagued the food industry for years, like extending shelf life, cutting waste, assessing safety, and raising food quality. These are only a few of the various potential applications for nanotechnology that have emerged as a result of the growing need for nanoparticles in the fields of food science and food microbiology, which deal with nanomaterials and nano-systems that are typically smaller than 100 nanometres. The most often employed nanomaterials in consumer products include silver nanoparticles (AgNPs), titanium nitride nanoparticles, nano-titanium dioxide (TiO_2), nano-silicon dioxide (SiO_2: nanoclay), and nano-zinc oxide (ZnO). These nanoparticles are useful supplements for food packaging. Furthermore, nano-antioxidants successfully demonstrate their redox chemistry capabilities and become physiologically active, making them a fantastic additive to improve food quality. The benefits and prospective uses of nanotechnology have prompted many questions, but toxicological issues have also sparked some doubts about the risks to human health and the environment. Future research should concentrate on the secure application of nanotechnology in the food business as well as any possible consequences.

Audience Take Away Notes

- The audience will learn about the numerous applications of nanotechnology in food products. Additionally, they will come across the toxicological problems that could endanger both human and environmental health.
- This will undoubtedly assist the research fellows and other academics by offering a workable solution to their issues and will increase a concepttual ideas or offer fresh data to help with a design issue

Biography

Dr. Sharda Sundaram Sanjay has done M.Sc (Analytical Chemistry) and acquired D.Phil. degree from University of Allahabad, India. Working on : (i) Mixed ligand complexes. And (ii) Synthesis, Characterization and functionalization of nanomaterials. Completed successfully a major research project entitled, “Synthesis , characterization of functional Nano-particles with special reference to their stimulatory action on living cells and hormones”. Authored 2 books on Nanotechnology, many papers and book chapters published in National & International Scientific publications. Delivered many invited talks were delivered in National and International conferences, seminars, workshops and webinars organised by various national and Internationally reputed institutions. Life Member of many reputed scientific associations. Presently Associate Prof. in Chemistry department of ‘Ewing Christian College, An Autonomous PG College of University of Allahabad.

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Unconventional quasiparticle dynamics in nickel nanoparticles

Nanoscale metallic nanoparticles (NPs) are of special interest for exploring their novel electronic and thermal transport properties at nanoscale. It is because they may have insulating matrix or surfactant/s as well as collective and correlation-driven effects between the NPs producing novel properties relative to bulk counterpart. The transport properties of NPs mainly depend on competition of mean energy level spacing, Coulomb charging energy for a single particle and tunnel energy associated with the inter-particle coupling. We investigated the electrical and thermal transport properties of compacted nickel NPs with crystallite size from 23.1±0.3 to 1.3±0.3 nm. They exhibit an evolution of metal to insulator transition, change in the conduction type from n- to p-type, anomalously large Lorenz number, colossal Seebeck coefficient of 1.87±0.07 mVK^{-1}, and ultralow thermal conductivity of 0.52±0.05 $Wm^{-1}K^{-1}$ at 300 K as the crystallite size drops. The electrical resistivity analysis reveals a dramatic change in the electronic excitation spectrum indicating the opening of an energy gap, cotunneling and Coulomb blockade of the charge carriers. Seebeck coefficient shows transport energy degradation of charge carriers as transport level moves away from the Fermi level with decrease in crystallite size. The Lorenz number rises to about four orders of magnitude in the metallic regime with decrease in crystallite size, and shows a vivid violation of the Wiedemann–Franz law. Such an observation provides the compelling confirmation for unconventional quasiparticle dynamics where the transport of charge and heat is independent of each other. Therefore, these NPs provide an intriguing platform to tune the charge and heat transport, which may be useful for thermoelectrics and heat dissipation in nanocrystal array-based electronics.

Audience Take Away Notes

- The audience will be able to learn the novel electrical and thermal properties associated with unconventional quasiparticle dynamics in nickel nanoparticles
- They can plan for similar experiments with the change in the type of surfactants to prepare the nanoparticles and investigate such properties
- They may not be necessarily the same as to what we have observed since the surfactants also have unique influences on such properties
- Similar approach can be followed in the metal nanoparticles to check for similar properties or completely unique properties and so on. Therefore, other faculty members can follow this research to expand their research or teaching, and this will help the audience in their jobs
- This research does provide a practical solution to a problem that could simplify or make a designer's job more efficient like implementation of making a new thermoelectrics

Biography

Dr. G. S. Okram did his PhD from Indian Institute of Technology, Bombay (1995), India. He worked at number of research institutes including National Institute of Materials Science, Tsukuba, Japan (1996-98) before joining the present institute in 2001. He is now Scientist G, and has guided 4 PhD, 6 MPhil, 4 M Tech, 54 MSc and 5 BSc project students, delivered over 89 invited lectures at different national and international conferences, reviewed several journal papers, published over 155 peer-reviewed journal papers and 116 conference proceeding presentations with 2306 times citations with main interest in nanoscale materials.

Rehana Badar[1, 2*] Asma Ahmed[1], Mehmooda Munazir[4], Kashf Mehmood[2], Rafia Mehmood1 Farzana Bashir[3] Shamma Firdous[3] and Mafia Shafique[3]

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Anti-fungal efficacy of ZnO nanoparticles against ustilago tritici

Human population is increasing day after day and is expected to reach 9 billion by 2050, therefore the need and demand for food production is also increasing. Wheat is the one of most important and basic staple food worldwide. With this continuously increasing human population the demand for food production is also increasing, but unfortunately wheat production in Pakistan is not meeting the needs. There are numerous threatening diseases of wheat which effect production of wheat negatively, while loose smut of wheat caused by Ustilago tritici is most important. Loose smut of wheat produces notable symptom at maturity as its kernels and glumes became partially or fully covered with blackish masses, which are actually spores of fungal pathogens. These infected spores deteriorate the kernels of crop which left the bare stems behind, thus reducing the yield. Appearance of dark green color stem with erect leaves, prior to heading is the clear symptoms of loose smut, sometimes yellow streaks appear on crop which causes complete loss of kernels of infected heads. This disease is most common disease of wheat which causes huge yield losses. U. tritici is the member biotrophic fungi shows feeding relationship with the living cells of their hosts. There is no such effective fungicide which is economic, eco-friendly with and is based on advance drug delivery system still available commonly for local farmers. Wheat is cultivated locally in order to meet the food requirements of people living in rural areas thus they are unaware of synthetic fungicides and could not afford expensive treatments. Therefore, keeping in view, the importance of wheat crops an experimental study was designed to prepare plant-based nanoparticles having anti-fungal potential against these biotrophic parasites. Present study is novel and advance because ZnO Nps were prepared for the first time to evaluate their anti-fungal potential against U. tritici. Nanoparticles of zinc oxide had been previously reported to enhance yield and growth of wheat therefore impact of these particles on yield of crop was also recorded. Application of these metallic nanoparticles on crop is marked as safe and an eco-friendly approach as there was no symptom of phytotoxicity afterwards. Pakistan is steadily among the top ten most prone countries to climate change and has witnessed adverse impacts due to climate extremes in recent past. Value and Importance of wheat could not be denied as this is the most important food crop which covers the one-fifth of the world's food. No doubt the demand for wheat in the developing world is projected to increase 60% by 2050. Therefore, both production and protection strategies for the cultivation of wheat is an important concern now a days.

Keywords: Ustilago tritici, loose smut, pathogenic and Nps

Audience Take Away Notes

- Application of these metallic nanoparticles attempted for the first time against fungal pathogens of wheat crop
- Present experimental approach is itself novel as it covers the research gaps in agriculture
- It will help audience to design such kind of novel studies so that cost effective treatments for controlling wheat diseases, so that demand of food production is achieved
- It will be more helpful to design an eco-friendly/organic fungicides
- It will be helpful to prepare an organic solution to the most devastating diseases of wheat crops having a great potential to increase the yield and growth of crop

Biography

Rehana Badar is a PhD scholar in Biochemistry at The University of Lahore, Lahore, Pakistan. She has completed her MPhil in Botany from The University of Lahore, Lahore Pakistan, in the year 2019. She is a member of British Pharmacological Society and Pakistan Journal of Phytopathology society. She is working as a lecturer in Superior University Lahore, Pakistan. She received two merit-based scholarships while doing BS Hons in Botany, from The University of Education Lahore, Pakistan. She was awarded with the laptop and also wins poster competition. Being a junior scientist, she has published 6 articles and 3 abstract in international conferences such as meetings 2019 organized by British Pharmacological Society, 4th edition of World nanotechnology conference 2022 and Agrico 2022.

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Chukwudi S. Ubah[1*], MPH. Lok R. Pokhrel[1]

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Addressing hospital associated infections with novel nano-antimicrobial

Hospitals Acquired Infections (HAIs), also called nosocomial infections and are of public health concern as current antibiotics are becoming obsolete due to bacterial pathogens becoming resistance toward antibiotics. Growing body of research suggests nanotechnology potential to avert bacterial resistance through multivalent Mode Of Action leading to cell wall damage. In this study, we tested the inhibitory efficacy and mode of action (MoA) of positively-charged 5 nm amino-functionalized silver nanoparticles (NH_2–AgNPs) and compared with negatively-charged 45 nm citrate-functionalized AgNPs (Citrate–AgNPs), and Ag+ ions were used as a positive control. Luria-Bertani broth assay was performed using *E. coli* K12 as a pathogenic surrogate for HAIs to assess growth inhibition over the period of 72 hrs. Using an UV-Vis spectrophotometer and results were confirmed with electron microscopy. Our results showed at 10 µg Ag/mL, NH_2–AgNPs were bactericidal via cell wall damage, Citrate–AgNPs were nontoxic, and Ag+ ions were bacteriostatic against E. coli. In addition, adherent fimbriae expression was inhibited with NH_2–AgNPs (0.5-10 µg/mL) or Ag+ ions (only at 10µg/mL) treatments, but with Citrate–AgNPs (0.5-10 µg/mL) adherent fimbriae were fully expressed. These findings suggest that, unlike negatively-charged larger size (45 nm) Citrate–AgNPs, positively-charged small size (5 nm) NH_2–AgNPs may serve as a potent bactericidal agent to address the growing HAIs and antibiotic resistance amongst bacteria, promoting patient health and safety.

Key words: Antimicrobial resistance, silver nanoparticles, E. coli, Bacterial resistance, Fimbriae.

Biography

Chukwudi S. Ubah is a Doctoral Candidate at the Brody School of Medicine, East Carolina University, and Greenville, NC, USA. He is also a Doctoral intern at Duke University Hospital, Durham, NC, where he works on Family Hospital Support Center for families and relatives of Mass Casualty Incident's (MCI) victims. He is a member of American Public Health Association (APHA), member of American Chemical Society (ACS), and member of National Black MBA Association. His activity is centered on harnessing intrinsic properties on nano formulations, particularly silver nanoparticles, in addressing issues of public health concerns. Chuks Ubah has presented his work in several local and international conferences.

Nina Ivanova*, Valentina Kutovay, Nina Ivanova Jr.

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Experimental using of the liposomal ciprofloxacin for the treatment of chlamydia

The field of our research is liposomal drugs because liposomes help drugs penetrate into those areas of the body where they cannot get without liposomes. Therefore, we suggested that this property can be used in the treatment of such intractable intracellular infections as chlamydia. Chlamydia avoids the effects of drugs by hiding in the fat droplets contained inside the cells. Chlamydia is transmitted predominantly sexually, penetrate the cells and use their resources for life and reproduction. The presence of these parasites in the body can lead to inflammation in the genitourinary system, lungs, eyes, leading to arthritis. We suggested that using the affinity of chlamydia for lipids, the use of liposomes loaded with antibiotics for the treatment of chlamydia would be promising, since the liposomes containing the antibiotic would "distract" chlamydia, imitating intracellular fat droplets. In our studies, we used the Bu L2 strain of lymphogranuloma venereum as an infectious agent and 6-7-day-old chicken embryos as a model. Infection with Chlamydia trachomatis was carried out inside the yolk sac. Specific death of embryos and their opening were carried out on the 4th day after. (Link to permission to work with animals) Autopsy of surviving embryos was performed on the 19-20th day after infection. To test the inclusion of the antibiotic in liposomes from the natural lecithin and from a mixture of negatively charged natural lipids were used. We found that the percentage of inclusion of the antibiotic ciprofloxacin in liposomes obtained from polar lipids with a negative charge is 91%, which is 3 times higher than the inclusion in liposomes from lecithin. That's why we continued to work only with negatively charged liposomes. In the experimental groups of embryos after infection with Chlamydia trachomatis, 1% liposomes with ciprofloxacin were injected. After Chlamydia trachomatis infection, commercial ciprofloxacin (Ciprinol, KRKA, and Slovenia) was introduced into the control groups of embryos. The ratio of ciprofloxacin: lipids were 1:2; 1:5, 1:10; 1:20. The death of chicken embryos infected with a suspension of venereal lymphogranuloma (group 3) without treatment was 100% on the 4th-5th-6th day after infection.

Survival table of Chlamydia trachomatis -infected chick embryos

№	The amount of ciprofloxacin per 1 chick embryo in mg				
	0,24	0,12	0,08	0,022	0,012
% of surviving embryos with the introduction of a commercial solution of ciprofloxacin	100	67	60	56	5
% of surviving embryos with the introduction of loaded liposomes with ciprofloxacin	100	100	100	100	100

The using of liposomal ciprofloxacin makes it possible to reduce the therapeutic dose of this antibiotic by 20 times.

An increase in the antichlamydial activity of liposomal ciprofloxacin can be explained by its targeted transport to cells.

In addition, it should be noted that these studies require further continuation, due to the fact that doses of liposomal ciprofloxacin less than 0.012 mg per 1 chick embryo have not been studied.

Audience Take Away Notes

- Chlamydial infection is a serious public health problem. Chlamydia is an intracellular parasite that combines the properties of bacteria and viruses. Chlamydia is related to many tissues of the human body. Studies conducted at the Oakland Research Institute (USA) showed that Ch. trachomatis is not only the leading cause of sexually transmitted diseases, but also the second leading cause of blindness
- In some parts of third world countries, more than 90% of the population is infected. The presence of a cell membrane combines chlamydia with bacteria - this allows the use of antibiotics for the treatment of chlamydia
- Long-term use of high therapeutic doses of antimycotics and antibiotics affects the body due to the toxicity of the substances used
- Liposomes help drugs penetrate into those areas of the body where they cannot get without liposomes. Therefore, we suggested that this property can be used in the treatment of such intractable intracellular infections as chlamydia
- As much as possible a positive therapeutic effect has been reached: 100% of chicken embryos with Chlamydia trachomatis were healthy after one injection of the liposomal ciprofloxacin
- The use of liposomal ciprofloxacin makes it possible to reduce the therapeutic dose of this antibiotic by 20 times
- Unfortunately, due to the military situation in Ukraine after the Russian attack, we cannot continue this work and conduct preclinical and clinical studies. We look forward to cooperation in any form of all those who are interested in this topic

Biography

Dr. Nina Ivanova, Ph.D. She completed Ph.D. from the State University Thin Chemical Technologies 1985. The speciality: bioorganic chemistry, chemistry of natural and physiologically active substances. After that worked for 22 years as the head of the lipid laboratory. Since 2007 I have been working as the leading researcher of the immunology and molecular genetics laboratory, SE „Institute of dermatology and venerology of National Medical Science of Ukraine". She has more 80 publications and 30 patents. Her work: developing of the liposomal preparations for the treatment of Alzheimer's desease, hemolytic diseases, syphilis, anthelmintics in parasitology, antiinfluenzal vaccine, antimycotics.

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Tailored dielectric, optical properties and photocatalytic performance of mg–zn nanoferrites by Cu^{2+} substitution

This research article is focused on the scrutinization of dielectric, optical and photocatalytic activity of $Mg_{0.8}Zn_{0.2-x}CuxFe_2O_4$ (MZC) nanoferrites upon the substitution of Cu^{2+} ions range (0 B x B 0.2; step 0.04). The dielectric constant and conductivity of MZC nanoferrite manifested the higher values than the pristine one. This leveraging demeanor is originated from the effective role of Fe^{2+} and Fe^{3+} In octahedral sites; as a result of occupying Cu ions in tetrahedral sites only. All MZC nanoferrites have the two types of losses; conduction and relaxation losses. The conduction process of MZC nanoferrites is attributed to three different species through different temperature ranges. Nyquist plot manifested that grain and grain boundary resistances were decreased and relaxation time enhanced from 0.79 to 7.95 ls with Cu substitution. Tauc's plots introduced direct allowed Eg for MZC nanoparticles with a red shift from (2.16 eV at x = 0.0 to 1.67 eV at x = 0.2). The degradation efficiency of RhB over MZC photocatalyst is enhanced comparing with that of pristine RhB; 92.39% for x = 0.2 in 300 min. The nanoferrite $Mg_{0.8}Cu_{0.2}Fe_2O_4$ (x = 0.2) has the optimal merits; highest dielectric constant, conductivity, photodegradation percentage, besides lowest energy gap and moderate loss make it advisable for sundry applications as an excellent photocatalyst for wastewater treatment besides high-frequency applications and transformers cores.

Biography

Noor Basfar is an assistant professor of physics in Umm-Alqura University. She received her bachelor's and master's degree in physics from Umm Alqura Unveristy, Saudi Arabia, in 2014, and her doctor degree in physics from King-Abdul University, in 2020. She has published peer-reviewed papers in journals and top international conferences including IEEE. Her research interests included Nanotechnology, physical science.

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