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21st Edition of
International Conference on

Catalysis, Chemical Engineering and Technology

6th Edition of

Chemistry World Conference

June 18-20, 2026

Barcelona, Spain

CCT & CHEMISTRY 2026

21ST EDITION OF

International Conference on

CATALYSIS, CHEMICAL ENGINEERING AND TECHNOLOGY

&

6TH EDITION OF

CHEMISTRY WORLD CONFERENCE

HYBRID EVENT

18-20 JUNE 2026

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Welcome Message

Dr. Dai-Yeun Jeong

Director of Asia Climate Education Center, South Korea
Emeritus Professor at Jeju National University, South Korea

CCT 2026 covers a wide range of catalysis including energy, renewable sources, environment, medicine, fluid mechanics, and many more, all of which are applicable to both academic and industrial value. CCT 2026 will explore the latest research and developments across these areas, providing attendees with a holistic understanding of the current status and future potential of catalysis, chemical engineering and technology.

Current era is defined as a risky society in terms of various environmental problems, which are caused by industrialization having been promoted since the 18th century for improving material affluence and convenience in everyday life. A wide range of strategies are being launched at a global, national and local level for promoting industrialization while solving environmental problems. As all of us know, these strategies are synthesized as sustainable development which is the ideology and practice of present and future socioeconomic development towards the co-existence between humans and nature.

In this context, CCT 2026 is in a narrow sense a chemical technology, but in a broad sense, is a technology-based approach to be mobilized for achieving sustainable development.

The organizing committee is actively looking forward to welcoming you to CCT 2026 and collectively exploring the frontiers for expediting the future endeavors in the development of catalysis and chemical engineering as a means to achieve sustainable development at a global level.

Welcome Message

Prof Dr. Dharani Dhar Patra

Bidhan Chandra Krishi Viswavidyalaya, India

Dear esteemed Chemistry, 2026 participants,

It gives me immense pleasure and honour in writing this welcome notes. Food security to about 10 billion people in 2050 in the world, is a serious concern. However, efforts are on to achieve food sufficiency to the staggeringly increasing world population. Advanced production technology, biotechnology-mediated techniques, breeding high yielding tailored climate resilient varieties, stress tolerant crops, precision farming are some of the options. Natural farming, integrated nutrient management, conservation agriculture, ecofriendly interference is some of the production strategies. Eco-restoration is must and so is regenerative agriculture. Use of hydroponics, soil less agriculture are new options of crop productivity. The future of regenerative agriculture burns with promise, offering a pathway toward a sustainable, resilient and productive food system that harmonizes with the natural world.

Welcome Message

Prof. Dr. Enrico Paris

CREA-IT, Italy

It is my great pleasure to welcome you to the 21st Edition of the International Conference on Catalysis, Chemical Engineering and Technology. I wish you a conference filled with opportunities for knowledge sharing and collaboration, fostering valuable synergies for research and innovation. Events like this are unique occasions to broaden our scientific horizons and to build meaningful, long-lasting collaborations. I encourage you to attend all presentations, even those that may initially seem outside your field of expertise: The diversity of topics explored during this event provides intellectually stimulating insights for the entire scientific community. This year's themes address the core challenges of present and future research, with a strong focus on sustainability, energy efficiency, and technology transfer.

Wishing you an inspiring and productive conference!

Welcome Message

Prof. Dr. Hossam A. Gabbar

Ontario Tech University, Canada

Dear congress participants, visitors, and attendees,

I am delighted and honored to welcome you all to the unique and special event of Chemistry 2026. Climate change and environmental stressors pose an urgent and increasing mandates upon all of us to promote sustainable chemistry with advanced and clean biotechnologies. The emerging area of green chemistry includes key and potential areas such as nanotechnology, clean energy sources, hydrogen and alternate fuel, environmental and pollution control, sustainable polymer and materials, sustainable agriculture, renewable energy, clean nuclear and energy technologies, waste management, computational methods, modeling and simulation techniques, and their applications in industries and communities. The event will provide great opportunities to discuss and adapt modern methods, science, systems, and technologies to support the emerging mandates of climate change with cleaner communities, higher productivity, safer products, and improved quality of life. I am confident that the sessions, presentations, and discussions will bring great benefits to all participants with takeaway strategies and technologies to deploy around the world. Together will make the transition to a cleaner and brighter future.

Welcome Message

Prof. Dr. Ruobo Zhou

Department of Chemistry, The Pennsylvania State University, USA

Dear Congress Visitors,

It is a great pleasure to welcome you to this conference on chemical and biomedical imaging. Rapid advances in chemical probe design, imaging modalities, and quantitative analysis are transforming our ability to visualize molecular and cellular processes with unprecedented spatial, temporal, and chemical resolution. These innovations are increasingly bridging fundamental chemistry with biomedical research, enabling new insights into biological organization, disease mechanisms, and therapeutic development. By bringing together researchers from chemistry, biology, engineering, and medicine, this meeting aims to foster interdisciplinary exchange, inspire new collaborations, and advance imaging technologies that will shape the future of chemical and biomedical sciences.

Welcome Message

Dr. Sergey Suchkov MD, PhD

N.D. Zelinskii Institute for Organic Chemistry of the Russian Academy of Sciences, Russia

Dear Colleagues, Scientists, Bioengineers and Friends,

On behalf of the Organizing Committee, it is my pleasure to invite you from all over the world to Welcome to the "21st Edition of International Conference on Catalysis, Chemical Engineering and Technology" (CCT 2026), to be held in June 18-20, 2026, at Barcelona, Spain.

Being an ancient with its modern and forward-looking image, we are enjoying the place today, and do everything we can to prognosticate the Grand Future. It is a great chance for the participants to present their results and to share the ideas in such broad areas at this prestigious Forum.

The Event will demonstrate cutting-edge research, design-inspired breakthrough biotechnologies, and creative ideas that have the potential to shape the future of chemical engineering. Through a series of unique plenary and keynote speeches, and interactive thematic sessions, we will explore the latest advancements, topical projects and solutions. Under the theme proposed and integration of a variety of fields and subfields, the attendants could accumulate their research and ideas for future endeavors in catalysis, chemical design, and chemical engineering and technology, and mathematical modelling – that would be a global congregation of chemists, designers, engineers and mathematicians focusing on recent advancements in catalysis, chemical engineering, and technology. In this context, the Event will be useful in finding the right partners, look at new projects, bridging the productive strategic alliances, discover reality, and to interact with other chemical experts, engineers and designers, understand their challenges and the routes and approaches-how they solve the problems. This Conference is designed for both newcomers to the field and affiliated subfields, seasoned researchers and designers looking to explore cutting-edge developments, and esteemed academicians creating global ideas and theories. The latter would stimulate further development in catalysis theory and in biocatalysis, mediated either by enzymes, abzymes or by living cells.

This unique event will be one of the global platforms is to share our thoughts and exchange ideas on how to chart our journey forward to reach new heights. The goal of the Event is to exchange breakthrough ideas in the field of nanocatalysis to promote top research projects by focusing on the recent trends. As well as future projects, aiming at the development of catalysis, design-driven chemical engineering and technology. This Conference will provide excellent opportunity to meet distinguished leaders, scholars and experts and to exchange new ideas and application experiences, to establish research relations and academic and business-related collaborations for future research and projects. To secure the latter, the Conference will include Plenary and Keynote Speeches and Invited Talks, which will be presented by Distinguished Scholars and Experts from academic institutions and industry, as well as oral and poster presentations by delegates and young junior participants. The Conference is aiming to support global research and training brilliance through multi-faceted networking platforms. Its mission is to encourage global communication, and collaboration, promote professional interaction and lifelong learning; recognize outstanding contributions of individuals and organizations-this prestigious gathering will be really aiming at fostering collaboration and innovation.

We hope to see you all in Barcelona, to enjoy the Event along with the exceptional beauty of the ancient and unique historical City. We extend a heartfelt Welcome on this occasion and will have an appealing, exciting and unforgettable experience and thank you!

Welcome Message

Dr. Shree Niwas Chaturvedi

Centre for Aptitude Analysis and Talent Search,
Heritage School, Buxar, India

I feel extremely privileged and honoured while writing this welcome message for 6th Edition of the Chemistry World Conference 2026 in Barcelona. Indeed, it's a truly global platform where curiosities and innovations converge. This conference is an opportunity to celebrate the power of chemistry in solving real-world challenges- from sustainable energy to human health. I look forward to engaging discussions, fresh ideas, and collaborations that will inspire breakthroughs beyond this conference.

Welcome Message

Professor Dr. Stanislaw Dzwigaj

Sorbonne University-CNRS, France

Dear congress visitors,

It is my honor and great pleasure to write a few welcome notes to you. Through centuries people were fascinated with the possibilities of synthesis of new materials with extraordinary properties. New materials are practically needed in all domains of life. Design and synthesis of new materials is one of the most important and interesting part of material sciences. Particularly a synthesis of new active and selective catalysts is a very important challenge. Our main aim concentrates on the new methods of the synthesis of single-site hierarchical porous zeolite catalysts with acid-base and redox properties. Such zeolite catalysts with active sites formed by incorporation of heteroelements in their framework are perspective as catalysts of protection of environment and biofeedstock conversion into valuable chemicals.

Welcome Message

Thomas J. Webster Ph.D.

Brown University, United States

Dear Colleagues and Friends,

Welcome to the Chemistry World Conference June 18-20, 2026 in Barcelona, Spain!

Without a doubt, recent advances in chemistry have revolutionized numerous fields including the field I am in: Medicine. But, how did this occur? Was your research part of these advancements? Have we innovated and commercialized enough? Are companies not paying attention to this wonderful research? Are Universities not doing enough to help you? What about federal funding agencies? And, most importantly, are you in the right environment to innovate and commercialize your research?

In my own experience, above all else, it takes a supportive environment. Find the right community. I left the very negative, ultra-competitive Northeastern University in Boston (I have never seen such negative people in my 25-year career) over 4 years ago and I have never looked back. I found a truly supportive environment by forming my own companies and yes, finding supportive people who value me and my contributions. Only then was I able to start numerous companies and commercialize my chemistry research into medical devices now in over 30,000 patients with no failures, only success!

So, I encourage everyone to find that right environment. Make that move and attend the right conferences: The World Chemistry Conference 2026 is such a conference where you will meet the right people!

It will change your life once you make the commitment to surround yourself with positive people. I know, because I lived it.

I look forward to seeing everyone to further share my story!

Welcome Message

Dr. Victor John Law

University College Dublin, Ireland

Dear congress colleagues, open-air solar cooking, and drying, of food has been around for thousands of years. As both energy and food supply is becoming a daily issue, it is a pleasure to see today solar energy based food chemistry is becoming a maim steam study in many university, and communities in many parts of the world. In particular, solar processing of food now presents many new opportunities in off-grid communities or where centralized energy supply is temporally cut-off. In the America's and around the Mediterranean Sea it is a challenge to dehydrate leaves without Sahara dust or insect contamination. Here will explore direct solar dehydration of medicinal and aromatic culinary leaves of the mint family *Lamiacieae* on a family unit scale. Such a challenge presents opportunities to further understanding the solar irradiance interaction with leaf moisture content and leaf structure.

Welcome Message

Prof. Dr. Vladislav Sadykov

Novosibirsk, Russia

Dear conference visitors, it is an honor and pleasure to write a few welcome notes for the sessions entitled Catalysis for Energy, Catalysis for Renewable Sources, Environmental catalysis, Advances in Catalysis and Chemical Engineering, Industrial Catalysis, Computational Catalysis, Nano-Catalysis, Reaction Engineering and Kinetics, Catalyst Design, Synthesis, and Mechanism; Quantum Chemistry in Catalysis, In-Situ and Operando Catalysis, Thermodynamics and Transport Phenomena, Catalyst Deactivation and Regeneration. We are living in the era of transition to Green Energy required to keep humans safely on the earth. A multi-disciplinary approach related to generation of hydrogen from biofuels and its usage in solid oxide fuel cells for efficient and reliable energy generation is based upon design of catalytic nanomaterials for structured catalysts of biofuels transformation into syngas and hydrogen, oxygen and hydrogen separation membranes and solid oxide fuel cells anodes operating in the internal reforming mode. In line with this, these sessions offer a variety of research topics including new approaches to advanced synthesis of nanocomposite catalytic materials, their detailed characterization with modern techniques aligned with quantum chemistry analysis of their atomic structure controlling their catalytic activity and transport properties, elucidation of kinetics and mechanism of catalytic reactions by in-situ and operando methods supported by computational analysis, design of related reactors of a variety of scales and their testing in real feeds followed by their optimization via mathematical modeling with a due regard for transport phenomena. Efficient catalytic processes of biofuels transformation into hydrogen are to be conjugated with environmental catalysis. It will be a great opportunity for the participants including young and senior researchers, scientists and academicians to gain knowledge with the up-to-date research in this field providing humans safe future.

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Magnus Group

About

Magnus Group, a distinguished scientific event organizer, has been at the forefront of fostering knowledge exchange and collaboration since its inception in 2015. With a steadfast commitment to the ethos of Share, receive, grow, Magnus Group has successfully organized over 200 conferences spanning diverse fields, including Healthcare, Medical, Pharmaceutics, Chemistry, Nursing, Agriculture, and Plant Sciences.

The core philosophy of Magnus Group revolves around creating dynamic platforms that facilitate the exchange of cutting-edge research, insights, and innovations within the global scientific community. By bringing together experts, scholars, and professionals from various disciplines, Magnus Group cultivates an environment conducive to intellectual discourse, networking, and interdisciplinary collaboration.

Magnus Group's unwavering dedication to organizing impactful scientific events has positioned it as a key player in the global scientific community. By adhering to the motto of Share, receive, grow, Magnus Group continues to contribute significantly to the advancement of knowledge and the development of innovative solutions in various scientific domains.

About
CPD Accreditation

About

CCT & Chemistry 2026 is officially accredited for Continuing Professional Development (CPD) by The CPD Group (UK), a globally recognized provider of continuing education certification. CPD accreditation ensures that professionals continue to enhance their knowledge, skills, and competencies through structured learning activities.

At **CCT & Chemistry 2026,** participants can earn 1 CPD credit for every hour of attendance in conference sessions. These credits formally recognize the time spent in professional learning and support ongoing professional development across clinical, academic, and research fields.

Earning CPD credits demonstrates a commitment to maintaining high professional standards and staying updated with the latest developments in ophthalmology. CPD participation can also support career advancement, license renewal requirements, and academic or professional portfolios, depending on the policies of individual institutions or regulatory bodies.

In addition to educational value, the conference provides opportunities to engage with experts, researchers, and peers from around the world, encouraging knowledge exchange and professional networking.

Attending **CCT & Chemistry 2026** not only offers a high-quality scientific learning experience but also provides internationally recognized CPD credits that reflect participants' dedication to continuous professional growth.

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KEYNOTE PRESENTATIONS

Dai-Yeun Jeong

Director of Asia Climate Change Education Center, Jeju City, South Korea

Emeritus Prof. at Jeju National University, Jeju City, South Korea

Biography: Prof. Dr. Dai-Yeun Jeong is presently the Director of Asia Climate Change Education Center and an emeritus professor at Jeju National University in South Korea where he served as an environmental professor from 1981 until his retirement in 2012. He received BA and MA degree in sociology from Korea University (South Korea), and PhD in environmental sociology from the University of Queensland (Australia). Throughout his distinguished career, he has held key leadership and advisory roles, including President of the Asia-Pacific Sociological Association, Teaching Professor at the University of Sheffield in the United Kingdom, and the Acting Director of the Jeju Secretariat for the UNESCO World Network of Island and Coastal Biosphere Reserves. He has also contributed to national policy as a member of the Presidential Commission on Sustainable Development of the Republic of Korea, and as Research Associate of the Environmental Policy Commission for Sustainable Development at the National Assembly of the Republic of Korea. He has represented the South Korean government delegate as a delegate to the United Nations Framework Convention on Climate Change (UNFCCC) and to the OECD Environmental Meetings. An esteemed academic and researcher, he is the author of 13 books including Environmental Sociology, and has published 60 academic papers in both domestic and international journals. He has conducted over 100 environmental research projects supported by domestic and international organizations.

A desirable framework for establishing a resource circulation society

Natural resources are not being circulated as their original circulation system in the process that humans are using them. Its main cause is from the unbalance between the use of natural resources and the treatment of wastes discharged. This unbalance threatens not only the self-regulating system of nature, but also the existence of human life depending on the use of natural resources for survival.

In this context, this paper aims at developing a framework of recycling and waste management for establishing a resource circulation society. For achieving the objective, this paper will be composed of four parts as below.

Part 1: <The concept of resource> will be reviewed from two academic fields–resource economics and environmental sociology. The two have significantly different conceptual definitions of what resource is.

Part 2: <What resource circulation society is> will be introduced in terms of three aspects. They are the concept and aim, key strategies and implications, and empirical cases being promoted to achieve a resource circulation society.

Part 3: <Current status of recourse circulation at a global level> will be critically reviewed from three aspects. One is a review using individual indicator, another one is a review using a synthetic indicator, and the other one is to examine the limitations inherent in the existing strategies being launched for establishing resource circulation.

Part 4: <A Desirable direction of recycling and waste management as a resource circulation society> will be established as a framework being composed of four phases. The 1st phase is <identifying the mechanism of resource use and waste discharge>. The 2nd phase is <establishing policies on resource use and waste discharge identified in the 1st phase>. The 3rd phase is <introduction of governance to policy-making process>. The 4th phase is <developing a framework of recycling and waste management for establishing resource circulation society> on the basis of the findings from the above three phases.

As a concluding remark, <What capacity should be built in relation to establishing resource circulation society> will be examined. This is because, for example, finance and advanced technologies, and cooperative network, etc. are required for establishing and/or implementing the policies of recycling and waste management for establishing resource circulation society.

Dharani Dhar Patra

Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, India

Biography: Prof Dharani Dhar Patra earned his PhD from IARI, New Delhi, India, Post-Doctoral research at Rothamsted Experimental, UK and started his career as an Assistant Professor at RAU, India. He shifted to CSIR-CIMAP, Lucknow, India as a Professor and worked there on Soil Biology and Microbiology of polluted soils. Prof Patra is an accomplished Natural Resource Management Researcher and his researches include recycling of distilled aromatic plants as source of nutrients and biofuel. Prof Patra has published more than 200 research papers. He is a recipient of nearly 20 awards and honour. He has been the Vice Chancellor, BCKV, India.

Medicinal plants: Source of phytobiotic compounds as therapeutic agents for human diseases

Medicinal plants exhibit a broad range of potential for nutraceuticals, presenting a diverse assortment of bioactive compounds that confer notable health advantages beyond fundamental nourishment. Natural compounds obtained from different medicinal and aromatic plants have gained respect as alternative treatments to synthetic drugs, as well as materials for different applications.

Bioactive compounds are extra nutritive constituents that typically occur in small quantities in foods and provide beneficial health properties. The functional characteristics that are directly linked to the health advantages of different medicinal and aromatic plants have been the focus of significant study in the last few years. In this context the objectives of the study are to explore the bio-pharmacological as well as nutraceutical values of the phytobiotic compounds and provide a comprehensive insight into environmentally food conservatives. Scientific investigation has been sparked by numerous epidemiologic studies that showed the preventive effects associated with the presence of secondary metabolites, namely polyphenols, glucosinolates, carotenoids, terpenoids, alkaloids, saponins, vitamins, and fibers, among others, derived from their antioxidant, anti-atherogenic, anti-inflammatory, antimicrobial, antithrombotic, cardioprotective, and vasodilator properties. However, their use is often limited, and only a few products are available for commercial use. Characterization techniques for the structural elucidation of phytobioactive compounds such as HPLC, TLC, FTIR, GC–MS/MS, and NMR have been elucidated. It is imperative that phytobioactive

compounds may be used as potential alternative to synthetic compounds as therapeutic agents for the treatment of various diseases.

The paper opens by underlining the significance of medicinal plants as important sources for developing new drugs. The relevance of various extraction techniques and analytical procedures is emphasized as the methods used for the identification and extraction of bioactive components is covered in detail. We examine the possible uses of bioactive substances obtained from medicinal plants in the treatment of numerous ailments.

Enrico Paris*, Beatrice Vincenti, Monica Carnevale, Adriano Palma, Veronica Mari, Francesco Gallucci

Council for Agricultural Research and Economics (CREA), Center of Engineering and Agro-Food Processing, Monterotondo (Roma), Via della Pascolare 16, Monterotondo 00015, Italy

Biography: Dr. Enrico Paris holds an M.Sc. in Analytical Chemistry (2017) and a Ph.D. cum laude in Energy and Environmental Engineering (2022) from La Sapienza University of Rome, Italy. He was awarded a research scholarship at CREA-IT (Monterotondo) in 2018 and has served as a Technologist in the LASER-B Laboratory (Laboratory for Experimental Activities on Renewable Energy from Biomass) since 2022. He has been a member of the Italian Association of Chemists and Physicists since 2020. Dr. Paris is an active reviewer and editor for several international scientific journals and has served on the scientific committees of multiple international conferences. He has authored 65 publications indexed in Scopus and holds an H-index of 11.

Catalytic potential of biochar derived from heavy-metal-contaminated biomass

Plant-Assisted Bioremediation (PABR) represents an eco-friendly strategy for the remediation and valorization of contaminated soils. This approach exploits fast-growing plants capable of extracting pollutants from the soil, offering a sustainable and low-impact alternative to conventional soil-cleaning methods. However, a major challenge associated with PABR is the generation of contaminated plant residues, whose safe disposal remains a topic of scientific and environmental concern. In this context, PABR biomass gasification emerges as a promising solution, enabling both the production of renewable energy and the confinement of the majority of pollutants within the residual solid fraction: The biochar. This dual advantage not only reduces the environmental footprint of residue management but also creates opportunities for biochar valorization. The present study investigates the potential of biochar obtained from PABR residues as a catalytic material. Biochar inherently exhibits distinctive physicochemical properties—such as high surface area, porosity, and functionalized surfaces—that make it an attractive candidate for catalytic applications. In conventional approaches, biochar is often used as a support for metal deposition in heterogeneous catalysis. Conversely, biochar derived from PABR residues offers an intrinsic catalytic advantage, as the plants naturally accumulate catalytically active metals during the phytoremediation process, which are subsequently enriched in the biochar matrix after gasification. In this work, PABR-derived biochar was produced and subjected to a comprehensive physicochemical characterization, including elemental composition, surface

area analysis, and metal content determination, to assess its potential as a catalytic material. The study provides insights into the interplay between soil remediation, biomass valorization, and catalytic applications, suggesting that the integration of PABR and gasification could establish a circular and sustainable approach for the management of contaminated soils and associated biomass residues. This research highlights the dual benefit of combining environmental remediation with the generation of high-value materials, positioning PABR-derived biochar as a promising resource for future green catalytic processes.

Haibo Ge

Department of Chemistry & Biochemistry, Texas Tech University, Lubbock, TX, USA

Biography: Haibo Ge received his PhD degree in Medicinal Chemistry from the University of Kansas in 2006, and then moved to the Scripps Research Institute for postdoctoral study. In 2009, he began his independent academic career at the Indiana University–Purdue University Indianapolis and relocated to Texas Tech University in 2020. Research by his group is mainly focused on the development of novel methods for carbon–carbon and carbon–heteroatom bond formation through transition metal catalyzed C–H functionalization. His research focuses on transition metal catalyzed cross coupling reactions. He has published more than 80 articles in leading journals, including Nature Chemistry, Journal of the American Chemical Society, Chem, and Angewandte Chemie International Edition.

Distal functionalization via transition metal catalysis

The ubiquitous presence of sp^3 C–H bonds in natural feedstock makes them inexpensive, easily accessible, and attractive synthons for the preparation of common and/or complex molecular frameworks in biologically active natural products, pharmaceutics, agrochemicals, and materials. However, the inertness of these bonds due to the high bond dissociation energies and low polarity difference between the carbon and hydrogen atoms makes them challenging reaction partners. Moreover, the desired site-selectivity is often an issue in reactions with multiple analogous sp^3 C–H bonds. To overcome these problems, transition metal-catalyzed C–H functionalization has been developed with the assistance of various well-designed directing groups which can coordinate to a metal center to deliver it on a targeted C–H bond through an appropriate spatial arrangement, enabling C–H activation via the formation of a cyclometalated species. However, the requirement of often additional steps for the construction of the directing groups and their subsequent removal after the desired operation severely hampers the efficacy and compatibility of the reactions. A promising solution would be the utilization of a transient ligand which can bind to the substrate and coordinate to the metal center in a reversible fashion. In this way, the directing group is installed, sp^3 C–H functionalization occurs, and the directing group is then removed in situ without affecting the substrate function after the catalysis is finished. Overall, the whole process occurs in a single reaction pot. Herein, we are presenting our studies on transition metal-catalyzed transient directing group-enabled C–H functionalization reaction.

Hossam A. Gabbar

Professor, P.Eng., Fellow IET (FIET), Distinguished Lecturer IEEE NPSS, Director of Advanced Plasma Engineering Lab (APEL)
Department of Energy and Nuclear Engineering, Faculty of Engineering and Applied Science, Ontario Tech University, Oshawa, Ontario, Canada

Biography: Dr. Gabbar is a full Professor in the Faculty of Energy Systems and Nuclear Science, and cross appointed in the Faculty of Engineering and Applied Science, at Ontario Tech University (UOIT), where he has established the Energy Safety and Control Lab (ESCL), Smart Energy Systems Lab, and Advanced Plasma Engineering Lab. He is the recipient of the Senior Research Excellence Aware for 2016, UOIT. Dr. Gabbar is recognized among the top 2% of worldwide scientists with high citation in the area of energy. He is a Distinguished Lecturer of IEEE NPSS, and he is a Fellow IET (FIET). He is leading national and international research in the areas of smart energy grids, energy safety and control systems, and waste-to-energy using advanced plasma technologies. Dr. Gabbar obtained his B.Sc. degree in 1988 with first class of honor from the Faculty of Engineering, Alexandria University (Egypt). In 2001, he obtained his Ph.D. degree from Okayama University (Japan). From 2001 till 2004, he joined Tokyo Institute of Technology (Japan), as a research associate. From 2004 till 2008, he joined Okayama University (Japan) as an Associate Professor, in the Division of Industrial Innovation Sciences. From 2007 till 2008, Dr. Gabbar was a Visiting Professor at the University of Toronto. He also worked as process control, safety, and automation specialist in energy and oil & gas industries. Dr. Gabbar has more than 290 publications, including patents, books/chapters, journal, and conference papers.

Advances in plasma-based radioactive waste treatment

This talk presents advanced approaches for plasma-based radioactive waste treatment. Different designs of plasma torches and generation systems are discussed, including RF, DC, and microwave plasma, are analysed and compared for waste-to-energy applications. Novel plasma torch design is proposed to support different scales and types of radioactive waste treatment. Process engineering techniques for gasification and pyrolysis process are integrated with the radioactive waste treatment process, which are illustrated with waste characterization. The proposed approaches showed reduced radioactive treatment costs, risks, volumes, in addition to reduced greenhouse gas emissions and improved lifecycle performance. Plasma systems are utilized for nuclear waste treatment for low, intermediate, and high radioactive waste. Process design is discussed for plasma torch that can reduce the volume of radioactive waste. Potential approaches are explored for mass separation that could be utilized for high-level radioactive waste. Simulation methods and experimental setups demonstrate lab-scale process technologies for plasma-based radioactive waste treatment.

Prof. Michael Stockenhuber*, Matthew Drewery, Eric Kennedy, Luke Harvey

University of Technology, Sydney, Australia

Biography: Michael Stockenhuber did his PhD at the Institute of Physical Chemistry TU Vienna which he was awarded with distinction. After appointments in the UK and Australia he moved as a full professor of engineering to University of Technology, Sydney (UTS). Prof Stockenhuber is president of the Australian Catalysis Society and president of a number of international advisory boards and journals. Stockenhuber has established and is head of the Catalysis and Process Engineering (CAPE) research group at UTS. Stockenhuber main research interest is heterogeneous catalysis and porous material with a special emphasis on structure- function relationships used for catalytic process development.

Next-generation transition metal and redox catalysis for renewable feedstocks and methane abatement

Background: Rapidly shifting feedstock profiles and stringent environmental regulations require a fundamental redesign of industrial catalytic technologies. Modern chemical engineering must pivot toward unconventional, sustainable raw materials characterized by high heteroatom and oxygen content, while simultaneously striving for net-zero or negative carbon footprints. Concurrently, mitigating low-concentration greenhouse gas waste streams, particularly methane from hard-to-abate sectors, presents an urgent emission control challenge.

Objectives: This presentation addresses these challenges by exploring novel chemical pathways and engineered catalytic systems designed to control selectivity, maximize productivity, and ensure long-term stability during complex selective oxidation and reduction processes.

Methodology & Breakthroughs: We report a universally applicable breakthrough in the synthesis of transition metal catalysts. By optimizing the preparation phase, we achieved a significant increase in active metal dispersion while mitigating common deactivation mechanisms to extend catalyst lifetime. Furthermore, we investigate the fundamental kinetics and surface science of redox catalysis, which remains vital for synthesising dense liquid energy carriers required by the aviation and maritime sectors.

Results & Significance: Finally, we present data on the development, kinetic modeling, and successful scale-up of a robust catalytic system engineered specifically for the mitigation of low-concentration methane emissions in challenging feedstreams. This work provides actionable chemical engineering solutions that bridge the gap between fundamental surface chemistry and scalable, climate-positive industrial processes.

Ruobo Zhou

Department of Chemistry, Pennsylvania State University, USA

Biography: Dr. Ruobo Zhou earned his B.S. in Applied Physics from University of Science and Technology of China (USTC). He then pursued graduate studies with Prof. Taekjip Ha at the University of Illinois at Urbana–Champaign (UIUC), where he developed a hybrid single-molecule instrument combining optical tweezers with single-molecule fluorescence microscopy and applied this technique to illuminate critical protein-DNA interactions in vitro (cell-free systems) involved in DNA repair, replication, and recombination. Dr. Zhou then completed his postdoctoral training in the laboratory of Prof. Xiaowei Zhuang in the Department of Chemistry and Chemical Biology at Harvard University, where he extended his analyses of functional biomolecular interactions from cell-free to in vivo systems, applying mass-spectrometry-based analysis and super-resolution fluorescence microscopy to study protein organizations and protein-protein interactions at the plasma membrane of neurons. In 2021, Dr. Zhou joined the Department of Chemistry at the Pennsylvania State University as an Assistant Professor. His research aims to quantitatively and functionally dissect the compartmentalization and spatiotemporal organization of protein-protein and protein-RNA interactions involved in fundamental cell functions as well as in cancer and neurodegenerative diseases, from single-molecule to single-cell levels, using cutting-edge single-molecule techniques and super-resolution fluorescence microscopy, mathematical modeling, highly interdisciplinary cell and molecular biology tools, and high throughput “omics” approaches such as mass spectrometry-based proteomic analysis and transcriptome-scale RNA imaging. Dr. Zhou has been recognized with several awards, including being named an HHMI fellow of Life Sciences Research Foundation, a Scialog Fellow for Advancing Bioimaging, and a recipient of the NIGMS Maximizing Investigators' Research Award (MIRA).

Unraveling the ultrastructure and functions of the neuronal membrane skeleton using super-resolution fluorescence microscopy

The neuronal Membrane-associated Periodic Skeleton (MPS), composed of actin, spectrin, and associated molecules, forms a lattice-like cortical structure whose molecular composition and functions have remained incompletely understood. Using co-immunoprecipitation and mass spectrometry, we identified hundreds of candidate MPS-interacting proteins spanning diverse functional categories. Super-resolution imaging of representative proteins, including previously unknown structural components, motor proteins, Cell Adhesion Molecules (CAMs), ion channels, and signaling proteins, revealed periodic distributions characteristic of the MPS along neurites. Genetic perturbations of the MPS and its interacting proteins indicate roles in axon-axon and axon-dendrite interactions, axon diameter regulation. Functionally, the MPS

serves as a dynamic platform for signal integration. It recruits G Protein-Coupled Receptors (GPCRs), CAMs, and Receptor Tyrosine Kinases (RTKs) in response to extracellular cues, promoting colocalization and RTK transactivation that trigger Extracellular signal-Regulated Kinase (ERK) signaling. In addition to signaling, the MPS spatially gates major forms of endocytosis by restricting pit formation to MPS-free “clearing” zones across axonal and somatodendritic compartments. Disruption of the MPS enhances both basal and ligand-induced endocytosis, while ligand-triggered endocytosis activates ERK signaling to further remodel the MPS, establishing a self-reinforcing feedback circuit. Notably, MPS integrity limits Amyloid Precursor Protein (APP) endocytosis and suppresses amyloid-β 1-42 production, linking cytoskeletal organization to neuronal health and disease susceptibility. Together, these findings reveal the MPS as a dynamic, multifunctional scaffold that coordinates structural integrity, protein interactions, receptor signaling, and membrane trafficking, establishing a unifying principle by which cytoskeletal architecture shapes neuronal function, connectivity, and homeostasis.

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[14]The Russian Academy of Natural Sciences, Moscow, Russia
[15]Abe Cancer Clinic, Tokyo, Japan
[16]The College of Biological Sciences, UWC Davis, CA, USA

Biography: Dr. Sergey Suchkov was born in Astrakhan, Russia, into a family of medical doctors. He earned his MD from Astrakhan State Medical University in 1980 and his PhD from Sechenov University in 1985. He received advanced training at the NIH (Bethesda, USA), Wills Eye Hospital (Philadelphia, USA), and several British universities under the Royal Society for Immunology. Dr. Suchkov has held numerous academic and leadership roles, including Director of the Division for Clinical Immunology & Immunobiotechnology at MONIKI, and Professor and Chair of the Department for Personalized & Precision Medicine at Sechenov University. He has also served as Vice-Director of the Institute for Biotech & Global Health at RosBioTech National University. Currently, Dr. Suchkov is Professor of Medicine & Immunology and Director of the Center for Biodesign at the N.D. Zelinskii Institute of Organic Chemistry, Russian Academy of Sciences. He also serves as R&D Director at InMedStar (Russia–UAE) and Senior Scientific Advisor to the China Hong Kong Innovation International Business Association. He is an active member of several international scientific organizations, including the New York Academy of Sciences, EPMA, ISPM, PMC, AMEE, ACS, AHA, ARVO, and ISER, and is Secretary General of the United Cultural Convention (UCC), Cambridge, UK.

Personalized and Precision Medicine (PPM) as a unique healthcare model through biodesign-inspired bio-and chemical engineering applications to secure the human healthcare and biosafety: Engineering of biocatalysts-from evolution to creation

A new systems approach to subclinical and/or diseased states and wellness resulted in a new trend in the healthcare services, namely, Personalized and Precision Medicine (PPM). To achieve the implementation of PPM concept, it is necessary to create a fundamentally new strategy based upon the biomarkers and targets to have a unique impact for the implementation of PPM model into the clinical practice and pharma & medicinal chemistry bioindustry. In this sense, the translation of discoveries into therapies has not kept pace with medical need. It would be extremely useful to integrate data harvesting from different databanks for applications to provide more tailored measures for the patients and persons-at-risk resulting in improved outcomes.

Translational researchers, biodesigners, bio-and chemical engineers, and manufacturers are beginning to realize the promise of PP. Biodesign, bio-and chemical engineering, and nanobiotechnologies are being integrated into diagnostic and therapeutic tools to manage an array of PPM-guided conditions to customize therapeutic management. Partnering and forming strategic alliances between researchers, biodesigners, bio-and chemical engineers, clinicians, business, regulatory bodies and government can help ensure an optimal development program that leverages the Academia and industry experience and FDA's new and evolving toolkit to speed our way to getting new tools into the innovative markets.

Healthcare is undergoing a transformation, and it is imperative to leverage new technologies to support the advent of PPM. It is needed to discover, to develop and to create new (targeted and/or smart/intelligent) drugs being based on design-driven bio-and chemical engineering. In this context and as an example, abzymes are increasingly attractive in a bioindustrial setting as an environmentally friendly alternative to canonical chemical catalysts. To produce the ideal biocatalyst, abzymes often require optimization to increase their catalytic efficiencies and specificities under a particular range of reaction conditions. A number of abzyme engineering strategies are crucial to modify biocatalysts, improving their suitability for large-scale applications in clinical practice and bioindustry.

Of great interest are innovative platforms for the diagnosis, prognosis, and precision care of patients and pre-illness persons-at-risk, and integrating state-of-the-art abzyme-related bioengineering and computational tools to create novel biomarkers and therapeutic targets that will open new frontiers in the treatment of chronic diseases. Biocatalyst-related principles are pioneered for creating a new generation of supramolecular nanomaterials in order to develop personalized cancer treatment and vaccines. With the support of nanotechnology, new targeted therapeutic agents and biomaterials, or aid the development of assays for disease biomarkers and identification of potential biomarker-target-ligand (drug) tandems to be used for the targeting, PPM is making phenomenal steps in the future to come.

Applications of natural and design-driven biocatalysts as a product of engineering biology and biotech aimed for PPM-guided practice and bioindustry, are highly diverse and will change our world. Advances in healthcare, agritech and food industry include new drugs that reduce environmental harm and foods that are more nutritious and easier to grow. They can improve our food security, helping tackle one of our great global challenges. The latter can also deliver a more sustainable chemical design and industry, drastically reducing the use of poisons for the manufacture of bioproducts. Scaling up from a laboratory reaction to an industrial process is the main challenge for chemical and bioengineers resulting in the optimization at many levels. Moreover, developing and optimizing chemical and biotechnological processes plays a key role in modern society. This is the reason for developing global scientific, clinical, social, and educational projects in the area of PPM and design-driven translational applications to elicit the content of the new trend. The latter would provide a unique platform for collaboration among thought leaders and stakeholders in government, academia, industry, foundations, with an interest in improving the system of healthcare delivery and drug discovery, development, and translation.

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Biography: Dr. Sergey Suchkov was born in Astrakhan, Russia, into a family of medical doctors. He earned his MD from Astrakhan State Medical University in 1980 and his PhD from Sechenov University in 1985. He received advanced training at the NIH (Bethesda, USA), Wills Eye Hospital (Philadelphia, USA), and several British universities under the Royal Society for Immunology. Dr. Suchkov has held numerous academic and leadership roles, including Director of the Division for Clinical Immunology & Immunobiotechnology at MONIKI, and Professor and Chair of the Department for Personalized & Precision Medicine at Sechenov University. He has also served as Vice-Director of the Institute for Biotech & Global Health at RosBioTech National University. Currently, Dr. Suchkov is Professor of Medicine & Immunology and Director of the Centre for Biodesign at the N.D. Zelinskii Institute of Organic Chemistry, Russian Academy of Sciences. Also, serves as R&D Director at InMedStar (Russia–UAE) and Senior Scientific Advisor to the China Hong Kong Innovation International Business Association. He is an active member of several international scientific organizations, including the New York Academy of Sciences, EPMA, ISPM, PMC, AMEE, ACS, AHA, ARVO, and ISER, and is Secretary General of the United Cultural Convention (UCC), Cambridge, UK.

Personalized and Precision Medicine (PPM) as a unique healthcare model through biodesign-inspired and upgraded business marketing to secure the human healthcare and biosafety

A new systems approach to subclinical and/or diseased states and wellness resulted in a new trend in the healthcare services, namely, Personalized and Precision Medicine (PPM). To achieve the implementation of PPM concept, it is necessary to create a fundamentally new strategy based upon the biomarkers and targets to have a unique impact for the implementation of PPM model into the clinical practice and pharma & medicinal chemistry bioindustry. In this sense, the translation of discoveries into therapies has not kept pace with medical need. It would be extremely useful to integrate data harvesting from different databanks for applications to provide more tailored measures for the patients and persons-at-risk resulting in improved outcomes.

Translational researchers, biodesigners, bio-and chemical engineers, and manufacturers are beginning to realize the promise of PPM. Biodesign, bio-and chemical engineering, and nanobiotechnologies are being integrated into diagnostic and therapeutic tools to manage an array of PPM-guided conditions to customize therapeutic management. Therefore, partnering and forming strategic alliances between researchers, bio-designers, bio-and chemical engineers, clinicians, business, regulatory bodies and government can help ensure an optimal development program that leverages the academia and industry experience and FDA's new and evolving toolkit to speed our way to getting new tools into the innovative markets.

Healthcare is undergoing a transformation, and it is imperative to leverage new technologies to support the advent of PPM. It is urgently needed to discover, to develop and to create new (targeted and/or smart/intelligent) drugs being based on design-driven bio-and chemical engineering. With the support of nanotechnology, new targeted therapeutic agents and biomaterials, or aid the development of assays for disease biomarkers and identification of potential biomarker-target-ligand (drug) tandems to be used for the targeting, PPM is making phenomenal steps in the future to come.

Scaling up from a laboratory reaction to an industrial process is the main challenge for chemical and bioengineers resulting in the optimization at many levels. Moreover, developing and optimising chemical and biotechnological processes plays a key role in modern society. This is the reason for developing global scientific, clinical, social, and educational projects in the area of PPM and design-driven translational applications to elicit the content of the new trend. The latter would provide a unique platform for collaboration among thought leaders and stakeholders in government, academia, industry, foundations, and disease and patient advocacy with an interest in improving the system of healthcare delivery on one hand and drug discovery, development, and translation, on the other one, whilst educating the policy community about issues where biomedical science and policy intersect. The grand change and challenge to secure our Health and Wellness are rooted not in Medicine, and not even in Science! Just imagine WHERE?! In the upgraded Hi-Tech Culture!

Shree Niwas Chaturvedi

Centre for Aptitude Analysis and Talent Search,
Heritage School, Buxar, India

Biography: Dr. Shree Niwas Chaturvedi was born in India, earned his Ph.D. in Chemistry (specializing in nuclear and radiochemistry) from Banaras Hindu University in 2000. He is the founder of the Centre for Aptitude Analysis & Talent Search ("the EXPLORER") in Buxar, dedicated to identifying and nurturing children's innate talents. A prolific researcher, his work spans hot-atom chemistry, nuclear transformation effects, and energy conversion technologies. As an educator, he blends ancient Indian educational wisdom with modern pedagogy and serves as a consultant and guest faculty at local schools and enterprises.

Nuclear-enhanced photocatalysis: Ionizing radiation meets artificial photosynthesis for atom-efficient hydrogen production

Some of the most promising ideas for clean energy today lie at the crossroads of fields that rarely interact. Take artificial photosynthesis—it mimics nature's ability to store sunlight in chemical bonds, and in theory, could yield fuels like hydrogen without emitting carbon. But turning this vision into a working technology has proved tough: Efficiency losses, unstable materials, and incomplete reactions persist. At the same time, radiation chemistry, a discipline shaped largely by nuclear science, has quietly been demonstrating ways to drive chemical changes using gamma rays, recoil atoms, or decay energy—methods that don't always need reagents in the traditional sense. This paper takes a step back and asks: What happens if we combine these two worlds? Can radiation be used not just for sterilization or imaging, but to support photocatalysis—perhaps by enhancing charge separation or creating more durable catalysts? We propose a few possible routes for doing exactly that, and argue that this hybrid approach could open up new, efficient pathways for generating hydrogen and other fuels, all while keeping atom economy in sharp focus. It's a different kind of fusion—one that might help reshape how we think about clean chemical production.

Stanislaw Dzwigaj

Sorbonne Université, UMR 7197, Laboratoire de Réactivité de Surface, France

Biography: Professor Stanislaw Dzwigaj received his PhD degree in 1982 in Jerzy Haber Institute of Catalysis and Surface Chemistry, Krakow (Poland). After two years of postdoctoral stay at the Laboratoire de Réactivité de Surface Université P. et M. Curie (Paris) he obtained in 1990 a position of contracted researcher in the same Laboratory devoted to surface reactivity in relation to catalysis phenomena. Then, in 2008 he obtained permanent position in CNRS as a researcher. On February 19, 2014 for outstanding scientific achievements he received the title of professor. His published work includes more than 170 papers published in reputable international journals.

Application of vanadium, tantalum and chromium single-site zeolites in heterogeneous catalysis

The metal ions well dispersed at zeolite framework are considered to be active sites of catalytic processes. Therefore, the incorporation of these metals into zeolites as isolated tetrahedral sites appears to be the important task. We have earlier shown that the incorporation of transition metal ions into vacant T-atom sites of framework zeolite is strongly favored when, in the first step, zeolite is dealuminated by treatment with nitric acid solution and then, in the second step, the incorporation of transition metal ions results in the reaction between the cationic metal species of the precursor solution and the SiO-H groups of vacant T-atom sites created by dealumination of zeolite. During my keynote talk the design of single-site zeolite catalysts with transition metal will be described and characterized by different physical techniques both at the macroscopic (XRD, BET, TPR, TEM) and molecular level (FT-IR, NMR, DR UV-Vis, XPS, EPR, XAFS). The application of metal single-site zeolite catalysts in environmental catalysis will be discussed. This two-step postsynthesis method applied in this work allowed obtaining vanadium and tantalum single-site zeolite catalysts active in different catalytic processes such as oxidative dehydrogenation of propane into propene, selective catalytic reduction of NOx to N_2, production of 1,3-butadiene from renewable sources, including ethanol obtained from biomass. Their catalytic activity strongly depended on the speciation and amount of vanadium or tantalum incorporated into zeolite structure as well as their acidity.

Thomas J. Webster

School of Health Sciences and Biomedical Engineering, Hebei University of Technology, Tianjin, China
Division of Pre-college and Undergraduate Studies, Brown University, Providence, RI, USA
School of Engineering, Saveetha University, Chennai, India

Biography: Thomas J. Webster has 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 formed over a dozen companies who have numerous FDA approved medical products currently improving human health in over 30,000 patients. His technology is also being used in commercial products to improve sustainability and renewable energy. He is currently helping those companies and serves as a professor at Brown University, Saveetha University, Hebei University 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 is a former President of the U.S. Society for Biomaterials and has over 1,350 publications to his credit with over 55,000 citations. He was recently nominated for the Nobel Prize in Chemistry. Prof. Webster also recently formed a fund to support Nigerian student research opportunities in the U.S.

Eliminating implant failure in humans with nano chemistry: 30,000 cases and counting

Nanomedicine is the use of nanomaterials to improve disease prevention, detection, and treatment which has resulted in hundreds of FDA approved medical products. While nanomedicine has been around for several decades, new technological advances are pushing its boundaries. For example, this presentation will present an over 25 year journey of commercializing nano orthopedic implants now in over 30,000 patients to date showing no signs of failure. Current orthopedic implants face a failure rate of 5–10% and sometimes as high as 60% for bone cancer patients. Further, Artificial Intelligence (AI) has revolutionized numerous industries to date. However, its use in nanomedicine has remained few and far between. One area that AI has significantly improved nanomedicine is through implantable sensors and neurological applications. This talk will present research in which implantable sensors, using AI, can learn from patient's response to implants and predict future outcomes. Such implantable sensors not only incorporate AI, but also communicate to a handheld device, and can reverse AI predicted adverse events. Examples will be given in which AI implantable sensors have been used in neurology to inhibit implant infection and promote prolonged neural function. Moreover, in vitro and in vivo experiments will be provided that demonstrate how nanotechnology can be incorporated into neurology to help human health.

Víctor Cerdà[1*], Sergio L. C. Ferreira[2]

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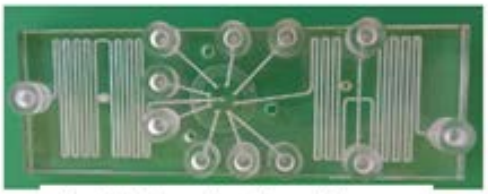
Biography: Víctor Cerdà is Professor Emeritus of the University of the Balearic Islands. His main research lines is related with the development of new automatic methods in Analytical Chemistry and their application to environmental and pharmaceutical samples. He has conducted 41 Ph.D. Thesis, written 15 books, and has collaborated with 13 chapters in other scientific books. Víctor Cerdà has also published 629 scientific papers and presented 830 contributions in national and international symposia. Founder and President of the UIB Spin Off Sciware Systems, devoted to the production of new and innovative instruments for chemical analysis.

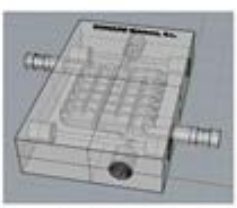
Chips fabrication for kinetic methods in flow techniques

A review on the use of chips applied in flow techniques for kinetic methods of analysis. The use of these chips significantly simplifies the assembly of the devices, resulting in a clearer view of the analytical system. Different ways of producing them are described: The use of milling machines, filament 3D printers, stereolithographic 3D printers, and CO_2 laser printers.

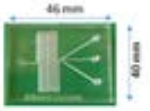
Milling machines offer the advantage of being able to manufacture parts using a wide variety of plastic materials, such as methacrylate (colorless and transparent, but not very resistant to solvents), Ultem, Kel-F, etc. However, they require making the parts in layers that then have to be glued together. 3D printers allow for obtaining three-dimensional parts directly.



Acrylic chip made with a milling



Acrylic chip made with a stereolithographic



Acrylic chip made with a laser engraver

Laser engravers can replace milling machines for the production of very small parts, also using different types of plastics. When the fiber laser beam strikes the surface of the material, the energy is concentrated at a very small point. This high concentration of energy causes the material to melt, evaporate, or ablate, creating a mark or engraving on the surface. The precision and depth of the engraving depend on the power, travel speed, and other parameters controlled by the fiber laser machine.

Filament printers have the disadvantage of producing porous parts, making them unsuitable for fluid conduction. In this respect, it is better to use stereolithographic printers, which produce non-porous parts, but they have the disadvantage of having a very limited variety of materials.

For the production of microchips, one of the preferred materials has been glass. In order to demonstrate the advantages of the systems described, various applications will be described, which they provide very satisfactory results reaching very low levels of determination.

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Biography: Victor John Law B.Scs (1985), Ph.D. degree (by published works, 2003). Since 2012, he held the post of Senior Researcher within the Surface Engineering Group, University College Dublin (UCD) Ireland. He has authored over 160 publications, with a citation index of 20.8 for the first 100 papers. He jointly holds four patents. His research interest includes radio frequency power circuits, and their complex physic-chimerical interactions with biological material at the nano-scale. In addition, off-grid soar processes for cooking and dehydration of foodstuff. John Law retired to the island of Crete, Greece where he continues to contribute to UCD research effort.

Solar box cooker dehydration, and relative humidity endpoint detection, of *Lamiaceae* culinary leaves on the Island of Crete

When solar dehydrating medicinal and culinary leaves, the aim is to removed/lower water moisture within the leaf to a level that slows-down microbial growth leading to physical deterioration of the preserved product within the food cupboard. Proof of principle of Relative Humidity (RH) endpoint detection for culinary leaves is demonstrated within a family sized (27 litre) Solar Box Cooker Dehydrator (SBC-d). The study is performed on the island of Crete in the eastern Mediterranean sea (35.31°N, 24.31°E at an altitude of 119m). Four culinary leaf genera of different water moisture content are studied (female *Laurus nobils* (~28%), *Ocimum basilicum, Ocimum basilicum var,* minimum (~86%), and *Salvia officinalis* (~76%). Their quasi-power function RH dehydration time-profiles are base-lined against unloaded SBC-d dehydration time-profiles using an A-B transformation to yield the leaves moisture removal time-profile. From which, dehydration endpoint is judged to be reached when load and unloaded RH power time-profiles reach the same extreme-end power function value. For 30 to 40g batch processing; dehydration times vary between 5 to 7.5 hours with dehydration rates of 3 to 5.5g/hr.

A leaf abiotic (heat and sunlight) stress score protocol that is normally used to select rice varieties resistant to drought (1, 2, 3, 4, and 5, where 1 is minimal stress, and 4 is maximum stress) is used to characterize leaf-blade morphological change (rolling) to the solar dehydration process. It is found for each leaf genera the score needs to be adjusted to reflect the leaf midrib and pinnate vein collenchyma and sclerenchyma cell structure. This adjusted score to used to visually qualify the solar process. Unloaded SBC-d base-line data is tested across summer and winter months to assess the robustness of the RH endpoint. Finally, a comparison is made of the advantages and disadvantages of this off-grid direct-solar-dehydration process against indirect-solar-dehydration and mixed/hybrid dehydration studies.

Vladislav Sadykov[1,2]*, Yulia Bespalko[1], Nikita Eremeev[1], Ekaterina Sadovskaya[1], Mikhail Mikhailenko[3], Mikhail Korobeynikov[4]

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Biography: Vladislav Sadykov, Doctor of Science and Professor, is the chief scientist at the Boreskov Institute of Catalysis and Professor of Novosibirsk State University. His research interest includes heterogeneous catalysis for the energy production, hydrogen and syngas generation, solid oxide fuel cells, membrane reactors, technologies of nanophase and nanocomposite materials synthesis, solid state ionics, surface science. He has published 640 papers in peer-reviewed journals, 6 monographs and 7 Chapters in books, received 46 patents, his h-factor is 39. He is a member of the Editorial Boards of Applied Catalysis A, of the Materials Research Society (USA) and Russian Mendeleev Chemical Society.

Design of efficient and stable structured catalysts for biofuels transformation into syngas by using advanced technologies of nanocomposite active components synthesis, supporting on heat conducting substrates and sintering

Design of efficient, inexpensive and stable to coking catalysts for transformation of biofuels into syngas and hydrogen is a vital problem of sustainable and renewable energy field. This work presents results of extensive research aimed at design and characterization of such structured catalysts performance in transformation of a variety of biofuels (ethanol, acetone, ethyl acetate, anisole, glycerol, sunflower oil, turpentine oil). Nanocomposite active components were comprised of nanoparticles of metals/alloys (Ni, Co, Pt, Ni+Pt, Ni+Ru) supported on the surface of perovskites ($La_{1-x}Pr_xMn_{1-y}CryO_{3-\delta}$, $CaTiO_3$), fluorite Ln-Ce-Zr-O (Ln=La, Pr, Sm), spinel MnxCr$_3$-xO$_4$ and Ruddlesden-Popper (doped Pr_2NiO_4) oxides with a high lattice oxygen mobility and reactivity (both bulk oxides, their nanocomposites and layers on Fe, Cr, Ti-doped mesoporous $MgAl_2O_4$ oxides) prepared by variety of sophisticated methods including supercritical fluids, self-assembly and Pechini routes. The real/atomic structure of nanomaterials was characterized by modern structural and spectral methods, while oxygen mobility was studied by $C^{18}O_2$ isotope heteroexchange, and surface reactivity- by H_2 TPR. Co-existence of several channels of oxygen migration in these systems with

diffusion coefficients differing by several orders of magnitude was demonstrated with fast channels corresponding to interfaces in nanocomposites, grain boundaries enriched by some cations as well as to cooperative mechanism of oxygen migration in oxides with asymmetric structures such as Ruddlesden-Popper one. Pulse and transient kinetic studies revealed that mechanism of fuels reforming on these types of catalysts can be described by a bifunctional redox scheme. Strong metal-support interaction and oxygen mobility provide stability of metal alloy nanoparticles to sintering and coking.

Active components were loaded on structured substrates (Ni-Al, SiC, Si-Al-O foams; Fe-Cr-alloy foils, gauzes and microchannel platelets with protective corundum or $La_2Zr_2O_7$-$LaAlO_3$ layers sintered by e-beam; microchannel FeAl(O) cermets) from suspensions with addition of surfactants and (Ce,Pr) ZrOx binders, total loading up to 10-20wt.%. They were sintered by microwave and e-beams using an ILU-6 accelerator. In pilot tests in real concentrated feeds of structured catalysts with optimized active components and substrates, a high yield of syngas was demonstrated approaching equilibrium at ~700-800°C in steam, dry, partial oxidation and mixed reforming of biofuels at short (~0.2s) contact times, main by-products being CH_4 due to cracking and C_2H_4 due to dehydration. Suppression of the surface acidity and O_2 addition to the feed decrease C_2H_4 content, thus preventing coking even for such fuels as sunflower and turpentine oils. Stable performance was confirmed for more than 200h time-on-stream. Mathematical modelling demonstrated absence of any heat transfer limitations due to a high thermal conductivity of substrates. No spallation or cracking of the active component layers supported on substrates was revealed. In pilot reactors for the autothermal reforming of the mixtures of natural gas and biofuels equipped with the heat exchangers to warm the inlet feed, a high yield of syngas approaching equilibrium was obtained even at the inlet temperatures not exceeding 100°C, thus demonstrating a high energy efficiency of their operation.

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ORAL PRESENTATIONS

Abhishek Bansal
New Era Consultancy Services, India

From quantum structure to chemical and biochemical laws: A unified projection geometry framework for thermodynamics, kinetics, reactions, transport, and magnetism

Contemporary chemistry, biochemistry, and physics are built upon a collection of highly successful yet conceptually fragmented models. Electrons are alternately described as particles, waves, charge densities, quasiparticles, or transient carriers depending on experimental and computational context. Thermodynamics, kinetics, transport, and magnetic response emerge phenomenologically from microscopic theory, while biochemical processes—such as metabolism, enzymatic catalysis, protein folding, and membrane transport—are typically treated as domain-specific extensions rather than as structurally grounded consequences of quantum theory. Although these descriptions yield accurate predictions, they lack a unified structural explanation for why such diverse representations coexist and remain simultaneously valid.

This work presents a unified projection-geometry framework (B–Chem) and related/restricted biological framework that reorganizes chemical, biochemical, and physical phenomena without modifying established quantum mechanics, thermodynamics, or the Standard Model. The central premise is that physical and biochemical entities are not primitive particles or fixed objects, but stratified algebraic fiber objects defined over a contextual manifold. Observable quantities arise exclusively through admissible projections, which select context-compatible components of the underlying structure. Projection, rather than force or dynamics, is treated as the primary organizing operation.

Within this framework, the chemically relevant electron is not assumed to be a permanently existing particle. Instead, it is interpreted as a context-dependent projection event of an underlying field–geometry state. Charge density, phase coherence, spin, transient structure, and relativistic compatibility occupy distinct algebraic strata, with familiar electron models—point particles, Schrödinger waves, densities, spinors, quasiparticles, and effective Kohn–Sham electrons—emerging as stable operational projections selected by experimental or environmental conditions. Constants such as Avogadro's number and the Faraday constant retain their full quantitative role but are reinterpreted as projection-scaling relations, rather than as evidence of fixed microscopic particle inventories.

Thermodynamics, chemical kinetics, reaction mechanisms, transport, and magnetic response emerge naturally as geometric consequences of projection admissibility and projection curvature. Entropy, free energy, irreversibility, and rate laws are shown to arise from structural restriction of admissible projections rather than from additional microscopic assumptions. Transport and diffusion appear as projection-mediated redistribution of admissible states, while magnetic and spin-dependent phenomena arise from quaternionic and split-algebraic orientation residues that remain compatible with chemical observability.

The framework extends consistently to biochemistry by restricting admissible projections to biologically meaningful regimes. Metabolic pathways, including glycolysis, carbohydrate chemistry, lipid organization, membrane structure, and protein behavior are interpreted as chemically admissible projections under biological constraints. Protein folding and conformational dynamics are reformulated as admissible projection collapse and structured motion on low-dimensional manifolds, resolving classical paradoxes without altering thermodynamic descriptions. Enzymatic catalysis, regulation, and transport arise from controlled modulation of projection constraints rather than from ad hoc mechanistic assumptions.

Across all scales—from subatomic structure to biochemical organization—the framework preserves standard equations and experimentally validated predictions while providing a single structural ontology. The result is a conservative yet unifying reinterpretation that explains why existing models work, how they are related, and where their domains of validity arise, without introducing new forces, particles, or modified dynamics.

Biography

Abhishek Bansal is an independent consultant, researcher, and amateur scholar. His latest works represent the culmination of more than 20 years of independent self-funded and self-directed research characterized by original discovery, rigorous simulation, open dissemination and introduce novel research claims, discoveries, models, equations, theories, propositions, and algorithms, broadly grouped into (a) Engineering: Novel B-Equations and frameworks, with applications in impedance analysis, transformers, inverters, generators, pumps, solar systems, machinery, turbines, batteries, SMPS, and short-circuit analysis. (b) Medical: Unified approaches bridging engineering with clinical and pharmaceutical sciences through novel B-Bio Models, Equations and BVidAI Algorithms for diagnosis and therapeutic support.

Adeem Mahmood

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Developing novel obafluorin analogues as potent natural product antibiotics

The emergence of multi-drug antibiotic resistance in many disease-causing bacteria has raised the prospect of a devastating return to the pre-antibiotic era with recent predictions suggesting that infectious disease could become the biggest killer of humans by 2050. It is therefore imperative that new antibiotics are developed to counteract this problem.

The development of a unique natural product antibiotic called obafluorin, that is produced by a soil bacterium called Pseudomonas fluorescens, is the topic of talk. Obafluorin was discovered 40 years ago and works by a different mechanism to any clinically used antibiotic which means it can kill bacteria that have resistance to existing drugs. However, its chemical structure means it is rapidly broken down in the body which limited its further development.

The Pseudomonas metabolite obafluorin was discovered in 1984 as part of a program to identify new beta-lactam antibiotics. Obafluorin is active against gram-negative and–positive pathogens, including in mouse models, and comprises a reactive beta-lactone moiety that is essential for its activity. Despite this, obafluorin was never developed as an antibiotic, possibly due to the reactivity of the beta-lactone.

To address the reactivity of obafluorin the synthesise of structural analogues in which the beta-lactone is replaced with a beta-lactam ring, in addition to analogues altered in other key structural motifs. These new analogues are tested for their antibacterial activity and used as chemical probes in biochemical, protein mass spectrometry, and structural biology studies to help understand the mechanism of action. Ultimately, this information will be used to design improved variants of obafluorin as potential lead structures for antibiotic development.

Biography

Adeem Mahmood is obtained an HEC Pakistan Scholarship to pursue a PhD in Synthetic Organic Chemistry at in Professor's group (2006–2011). Following an EPSRC-funded postdoctoral fellowship at, Adeem served as a chemistry faculty member at and. Recently, Adeem was awarded the prestigious Daphne Jackson Trust Fellowship UK (2023–2025). Adeem expertise includes synthetic organic, natural product, and medicinal chemistry, with publications in leading international journals.

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Tailored TiO_2-based carbon nanotube composites for enhanced dye photodegradation

Composites of nitrogen-doped TiO_2 (TiO_2:N) and Single-Walled Carbon Nanotubes (SWNT), TiO_2:N/SWNT functionalized with carboxyl groups (SWNT-COOH) and TiO_2/SWNTs were prepared via solid-state interaction of the two constituents. Their structural and optical properties were characterized using X-Ray Diffraction (XRD), UV-VIS spectroscopy, and Raman scattering. According to XRD measurements, all composites exhibited a crystalline anatase phase. Incorporation of carbon nanotubes caused an increase in the Full Width at Half Maximum (FWHM) of the Raman band peaked at 144-146cm^{-1}, corresponding to the Eg(1) vibrational mode of TiO_2:N and TiO_2, indicating local lattice modifications. Additionally, the band gap of TiO_2:N and TiO_2 nanoparticles decreased in the presence of SWNTs and SWNT-COOH. Photocatalytic activity of TiO_2:N/SWNT, Tio and TiO_2/SWNT composites was evaluated by degrading Rhodamine B (RhB) and Rhodamine 6G (Rh6G) in aqueous solutions after UV irradiation. The results indicated that RhB photodegradation efficiency increased up to 70% with 2.5wt.% SWNT, and up to 85% for TiO_2:N/SWNT-COOH at the same loading. For Rh6G, the highest efficiency of 85.1% was achieved with TiO_2/SWNT containing 1wt.% well-dispersed semiconducting SWNTs. The reaction kinetics revealed that photodegradation of both dyes followed a complex three-stage first-order mechanism. These results demonstrate that nitrogen-doped TiO_2/carbon nanotube composites, particularly when functionalized with carboxyl groups, exhibit enhanced photodegradation of organic dyes through structural modification and band gap tuning, providing a promising strategy for water purification applications.

Biography

Adelina Udrescu is a scientific researcher IIIrd degree at the National Institute of Materials Physics in Romania and holds a PhD in Physics. Her research focuses on synthesis, structural, and optical characterization of advanced nanostructured materials. She has co-authored multiple studies on composites containing carbon nanotubes and photodegradation processes, employing experimental techniques such as X-ray diffraction, Raman, and UV-VIS spectroscopy. Her interdisciplinary work spans materials engineering, spectroscopy, and she actively contributes to national and international collaborations on clean water and energy storage materials research.

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Antimicrobial surface modification of orthodontic archwires

Fixed orthodontic archwires affect oral hygiene leading to microbial infections, resulting in specific changes in the oral environment, including a reduction in pH and an elevation of cariogenic flora levels in saliva and biofilm, entailing a risk of gingival and cariogenic lesions. These effects can be maximized or minimized using different materials. In recent years, considerable interest has grown considering the usage of ions or nanoparticles to increase the antimicrobial efficacy of biomaterials used for orthodontic appliances. In this communication, we studied the possibilities of improving the surface characteristics and biofunctionality of the orthodontic materials used in clinical dental practice. Hereby, seven commonly used commercial archwires, belonging compositionally to four alloys: Stainless-steel, β-titanium alloy, nickel-titanium alloy, and titanium-niobium alloy were surface-treated, through hydrothermal etching using an aqueous phosphate solution, before being coated with silver. All samples were analyzed structurally and microbiologically. The structural assessment was performed pre-and post-etching and post-silver deposition using Scanning Electron Microscopy (SEM) and High-Resolution and Scanning Transmission Electron Microscopy (HRTEM and STEM), all combined with energy dispersive X-Ray Spectroscopy (EDX). This assessment confirmed the successful etching process and the growth of two types of titanium phosphate phases on most of the titanium-containing alloys. Furthermore, microscopic inspection revealed that the obtained silver coating on all alloys is in the form of Silver Nanoparticles (AgNPs). Microbiologically, the bacterial and fungal affinity of the blank and treated archwires were assessed, besides their cytotoxicity. Overall, the surface treatment of most of the alloys succeeded in improving their antimicrobial effectiveness, without much compromise to their cytocompatibility for at least half of the treated archwires.

Biography

Dr. Alaa Adawy is a Ramon y Cajal researcher at Oviedo University, Spain, specialized in biophysics, protein crystallization and biomaterials. She has an extensive academic background, with a PhD from Radboud University, the Netherlands. She is staff scientist operating the HRTEM facility at Oviedo University and involved in multidisciplinary research projects. She has contributed significantly to the fields of macromolecular crystallography and biomaterials, with several publications advanced scientific understanding and practical applications in these areas. Her work includes innovative methods for surface engineering of solid-state materials used for biomedical applications, constructing collagen scaffolds, and innovating new crystallization methods for biological macromolecules. Her research focuses on bio-inspired functions and the optimization of crystallization processes, which are essential for various industrial applications, including pharmaceuticals and materials science.

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Tuning optical properties and thermal conductivity of a fluorescent polymer through the incorporation of magnetic nanoparticles

The development of polymer magnetic nanoparticle composites has garnered increasing interest due to their adjustable multifunctional properties and potential technological applications. In this study, we present the synthesis and detailed characterisation of a new Poly (Fluoromandelic Acid) (PFMA) matrix incorporating various types of Magnetic Nanoparticles (MNPs). The effect of the magnetic filler type on the structural, optical, thermal, and magnetic properties of the resulting composites was systematically examined. These MNPs, synthesised via thermal decomposition, were also utilised to produce polymer composites with the novel fluorinated polymer PFMA. The thermal decomposition of MNPs was used to produce polymer composites with the newly developed fluorinated polymer PFMA. Three different sizes of Magnetic Nanoparticles (MNPs) were used to produce PFMA-based magnetic composites: Small, medium, and large. The synthesis of these composites involved physically mixing PFMAs and MNPs at different proportions (10%, 30%, and 50%). The mixture was maintained at 130°C for 1 hour. During this process, the polymer melts, embedding the MNPs into its matrix.

Fourier Transform Infrared (FTIR) spectroscopy was used to analyse the structural features of the composites and to evaluate the interactions between the polymer matrix and the embedded magnetic nanoparticles. Fluorescence spectroscopy was employed to assess how nanoparticle incorporation influences the optical behaviour of the polymer, showing changes in emission intensity and spectral characteristics depending on the type of magnetic nanoparticle. The magnetic properties of the composites were studied using Vibrating Sample Magnetometry (VSM), which provided insights into their magnetic response and confirmed the successful incorporation of magnetic nanoparticles into the polymer framework.

Thermal conductivity measurements indicated that both the presence and nature of the magnetic fillers significantly affect heat transfer within the polymer matrix. In these PFMA-based magnetic composites, thermal conductivity (λ) generally increases with temperature. Composites made with small-sized MNP show relatively stable λ values across different temperatures. Specifically, in magnetic PFMA composites with 50% small-sized MNP, λ increases by up to 185% during polymer formation. For composites with larger MNP, thermal conductivity rises with higher MNP content: Adding 10% MNP doubles λ, while 30% MNP results in nearly an 80% increase. Filler contents of 10% and 30% yield only slight improvements, whereas incorporating 50% MNP boosts λ by 136%. Overall, these magnetic composites do not show significant changes in λ with temperature.

Overall, these findings underscore the versatility of PFMA as a host matrix for magnetic nanoparticles and suggest that careful selection of magnetic filler characteristics can tune composite properties, making these materials promising candidates for multifunctional applications.

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Biography

Dr. Alexandrina Nan is a researcher at INCDTIM Cluj-Napoca, specializing in organic synthesis, polymer science, and nanostructured materials. She holds Bachelor's, Master's, and PhDs from Babeș-Bolyai University, where she pioneered the use of NMR and mass spectrometry for analyzing heterocyclic compounds. Dr. Nan's work has advanced the synthesis and characterization of conductive polymers, recyclable magnetic organocatalysts, and biodegradable materials from renewable resources. Her current research focuses on developing new polymers and polymeric materials for heat dissipation, which is important for the functionality, reliability, and lifetime of modern electronic devices.

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Backbone-engineered sulfonium polymers: A click chemistry approach to dual antimicrobial and anticancer agents

Cationic materials have long been recognized as potent antimicrobial agents, with quaternary ammonium salts dominating this space for over a century. Their antibacterial mechanism primarily relies on electrostatic attraction to negatively charged bacterial membranes, followed by hydrophobic insertion of alkyl chains, leading to membrane disruption, loss of permeability control, cytoplasmic leakage, and eventual cell death. However, the extensive and prolonged use of these nitrogen-based cationic systems has contributed to the emergence of resistant bacterial strains, necessitating the development of alternative cationic motifs with improved efficacy and reduced resistance potential. In this context, trivalent sulfonium salts represent a promising yet underexplored class of cationic functionality. Herein, we report the design, synthesis, and biological evaluation of novel dual-cationic polymers incorporating both quaternary ammonium and sulfonium moieties within the polymer backbone. These materials are based on poly(β-hydroxyl amine)s synthesized via a green and efficient amine-epoxy "click" polymerization strategy carried out in aqueous media under ambient conditions. Post-polymerization functionalization through selective protonation and alkylation at nitrogen and sulfur centers enables the generation of structurally tunable cationic polymers with controlled charge density and hydrophobicity. The antimicrobial evaluation of these polymers revealed potent activity against both Gram-negative and Gram-positive bacteria, including *Escherichia coli, Bacillus subtilis,* and Methicillin-Resistant *Staphylococcus Aureus* (MRSA). Notably, polymers bearing alkyl substituents at the nitrogen and sulphur center demonstrated exceptional antibacterial efficacy, achieving >95% growth inhibition at concentrations as low as 1-40µg/mL. Selected candidates also showed strong activity against *Bacillus subtilis* and MRSA, highlighting their potential as effective agents against clinically relevant pathogens,

particularly those associated with rapidly spreading skin infections. Hemocompatibility studies indicated that the majority of these polymers exhibited minimal hemolytic activity, suggesting low toxicity toward red blood cells. Mechanistic investigations supported a membrane-disruption mode of action, wherein the cationic polymers interact with and destabilize bacterial membranes, ultimately leading to cell lysis. Importantly, these materials demonstrated high selectivity for bacterial cells over mammalian cells, with selectivity indices among the highest reported for polycationic antimicrobial systems. Additionally, the most potent compounds exhibited significant biofilm disruption capability, further underscoring its therapeutic potential. Beyond their antimicrobial performance, these polymers also displayed notable anticancer activity. A series of poly(β-hydroxyl amine)s was evaluated across multiple cancer cell lines, including resistant breast and colon cancer, where they exhibited strong cytotoxicity with IC_{50} values in the range of 8–15μg/mL. Importantly, these compounds showed approximately 10-fold selectivity toward normal cell lines, indicating a favourable therapeutic window. Overall, this work establishes dual-functional sulfonium-ammonium polymer systems as a promising platform for next-generation therapeutics. By integrating antimicrobial and anticancer activities within a single molecular framework, these materials offer a versatile approach to address both antimicrobial resistance and cancer, paving the way for the development of multifunctional biomedical agents.

Biography

Amit Sharma is a medicinal chemist currently working as a Scientific Researcher (R1) at the National Institute for Research and Development of Isotopic and Molecular Technologies (INCDTIM), Cluj-Napoca, Romania. He completed his Ph.D. in Medicinal Chemistry from BITS Pilani, India in 2024, following an M.Pharm. from BIT Mesra, India. His research focuses on antimicrobial drug discovery addressing AMR, along with drug design and discovery through synthetic medicinal chemistry using organic and green approaches. His expertise includes hit-to-lead optimization, structure activity relationship studies, and new method development with process optimization. He is skilled in polymer synthesis and assembly, including ring-opening polymerization and click chemistry, and has contributed to several peer-reviewed publications.

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Mechanistic insights into charge carrier dynamics in TiO_2–SWCNT nanocomposites for enhanced photocatalysis

The development of high-performance photocatalysts requires a detailed mechanistic understanding of photoinduced charge carriers that extend beyond conventional metrics. In this context, mixed-phase TiO_2 (anatase+rutile) and its composites with Single-Walled Carbon Nanotubes (SWCNT) are investigated as a model system to understand the photo-physical processes governing charge generation, separation, and recombination.

Photoluminescence (PL) and Photoluminescence Excitation (PLE) studies under successive light irradiation are utilized to elucidate the quenching behaviour of spectra attributed to a dead-layer model driven by surface-adsorbed oxygen species. A synergistic dual role for TiO_2 polymorphs has been identified: Rutile supports electron–hole generation due to its strong light absorption, while anatase is responsible for a long-lived charge carriers via defect-related states. Additionally, a striking contrast in behaviour was observed when PLE analysis is conducted for the pristine anatase and pristine rutile samples following irradiation. The increase in the PLE band intensity for rutile was attributed to the downward barrier of a space-charge separation region because of hydroxyl group's aggregation. Conversely, the decline in the PLE band intensity within anatase structure was attributed to the accumulation of superoxide species leading in an upward depletion region.

The incorporation of SWNT in the TiO_2 (anatase+rutile) matrix has not a passive role but acts as electron acceptor centre that promotes electron delocalization and enhances charge separation efficiency. In this context, detailed spectroscopic insights given by Raman and FTIR are essential to confirm the formation of TiO_2-SWCNT interfacial coupling that governs the space-charge separation region.

The present study establishes a mechanistic framework in which the generation of charge (governed by rutile), the stabilization of charge (established by anatase), and the extraction of charge (facilitated by SWNTs) operate simultaneously, providing a robust strategy for engineering next generation photocatalysts. Furthermore, these findings demonstrate that subtle photo-physical processes such as band bending and defect states are of critical importance to photocatalytic performance. Consequently, their in-depth understanding is imperative for the rational design of advanced photocatalytic systems.

Biography

Andreea Nila received her PhD in Physics from University of Bucharest, Faculty of Physics, Romania in 2019 and a bachelor's degree in chemistry and engineering from the Polytechnique University of Bucharest, Romania. She has been a scientific researcher at National Institute of materials Physics since 2013. Her research interests include the development of 2D materials and their heterostructures, photocatalysis, optical and spectroscopy of materials, DFT, sensing applications.

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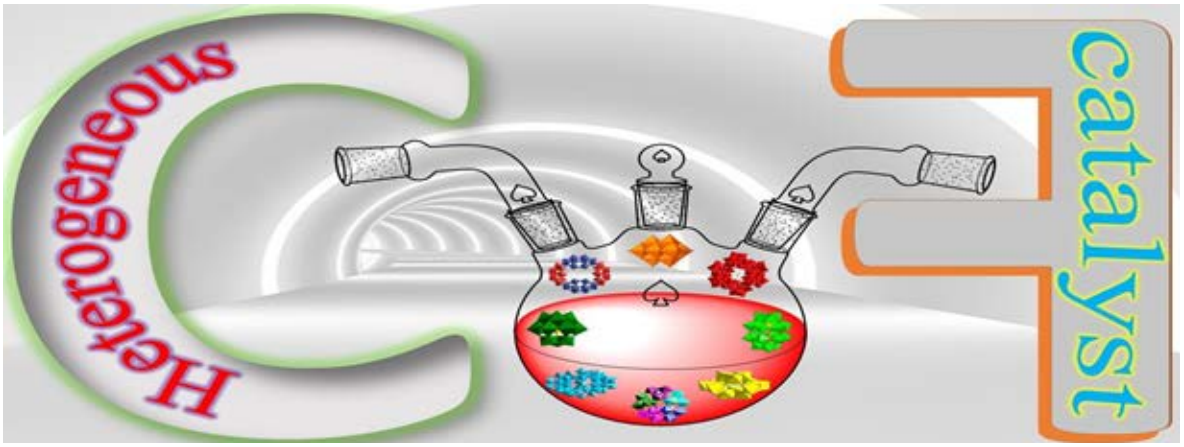
Prospective polyoxometalate-based covalent organic framework heterogeneous catalysts

The rapid advancement in developing Polyoxometalate-Based Covalent Organic Frameworks (POMCOFs)—a novel class of extended porous materials—has greatly expanded the functional scope of cutting-edge heterogeneous catalysts. These crystalline frameworks demonstrate remarkable efficiency across diverse catalytic applications, including redox processes, organic transformations, water splitting, and environmental remediation. By integrating the distinctive properties of both Polyoxometalates (POMs) and Covalent Organic Frameworks (COFs), POMCOFs provide a unified platform with enhanced functionality. Ongoing research not only broaden their versatility and applicability but also open new directions for designing next-generation catalytic systems capable of supporting a wide range of chemical reactions. This presentation summarizes recent synthetic approaches and catalytic performances of POMCOFs, organizes their classification, and offers a comprehensive perspective on their future potential in emerging areas of chemistry.



Biography

Arash Ebrahimi is a distinguished scientific researcher of Inorganic/Material Chemistry at Department of Inorganic Chemistry of Comenius University Bratislava, Slovakia, with research expertise in the synthesis of MOFs/COFs used for photocatalytic Hydrogen Evolution Reaction (HER), energy storage and conversion, water remediation, and programmed de-reticulation.

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Design, hemisynthesis and anticancer evaluation of totarol–oxazole derivatives derived from *Tetraclinis articulata*

Oxazole derivatives are important motifs in medicinal chemistry due to their broad biological versatility. In the present study, totarol, a bioactive diterpenoid isolated from *Tetraclinis articulata* (thuya) wood sawdust, was used as a natural scaffold for the design of novel oxazole-based derivatives. A series of totarol–oxazole derivatives was hemisynthesized via selective functionalization of the phenolic group of totarol, followed by cyclization reactions leading to the formation of the oxazole ring. Structural elucidation was achieved using a combination of NMR spectroscopy, FT-IR, HRMS, and single-crystal X-ray diffraction, confirming the chemical structures and providing detailed insights into stereochemistry and molecular geometry. Density Functional Theory (DFT) calculations were performed to investigate electronic properties, frontier molecular orbitals, and reactivity descriptors, while molecular docking studies were carried out to explore potential binding interactions with molecular targets associated with fibrosarcoma HT-1080 cells. In vitro cytotoxicity evaluation revealed that several oxazole derivatives exhibited significant antiproliferative activity, showing improved efficacy compared to the parent totarol. The consistency between experimental results and computational predictions highlights the relevance of oxazole functionalization in enhancing anticancer activity. Overall, these findings support totarol–oxazole derivatives derived from *Tetraclinis articulate* as promising anticancer agents, providing a solid foundation for further structural optimization and mechanistic investigations.

Keywords: Totarol, *Tetraclinis Articulate*, Oxazole, X-Ray Crystallography, DFT, Molecular Docking, HT-1080.

Biography

Ayoub Boualli is a fourth-year PhD candidate in organic chemistry at the Faculty of Sciences Semlalia, Marrakech. His research focuses on the valorization of medicinal plants and the functionalization of terpenic compounds isolated from natural sources. In particular, his work centers on the valorization of *Tetraclinis articulata* (thuya) wood sawdust through the hemisynthesis of natural and hemisynthetic derivatives and the evaluation of their anticancer activity. With solid expertise in organic synthesis and hemisynthesis, Ayoub's research contributes to the advancement of medicinal chemistry and the development of novel bioactive molecules.

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From conjugation chemistry to antibody-targeted nanoformulations: Diagnostic and therapeutic applications

Bis-aryl haloacetamide (BisHalide) approach has been designed to address limitations experienced with current protein conjugation chemistries, as well as enabling the opportunity to develop novel antibody-conjugate modalities. This chemistry incorporates well-established thiol reactive halo-acetamide chemistry into an aryl scaffold, to deliver a unique disulfide re-bridging platform. We have deployed these linkers, moving them beyond their conventional scope, towards the development of novel antibody-nanoparticle conjugates.

Using traditional conjugation methods to produce antibody-targeted Nanoparticles (NPs) has yielded limited control over antibody binding orientation and structural stability. Although these NPs have demonstrated proof of concept, they lack uniformity, reproducibility between batches, and stability, which hinders their clinical development.

To address these issues, BisHalide approach was adopted to construct Ab-immobilised NPs site-specifically. Initially, the conjugation of atezolizumab (anti-PDL1 antibody) with polymeric NPs was achieved using BisHalide rebridging chemistry, followed by click chemistry (NP-Fab BisHalide Ab and NP-Fc BisHalide Ab). For comparison, NPs created with conventional methods were also included. Flow cytometry and confocal microscopy were used to assess the targeted NPs (loaded with a fluorescent dye) for cellular binding and uptake. Results showed that NP-Fab BisHalide Ab and NP-Fc BisHalide Ab bound to and were taken up by EMT6 cells 19-fold and 13-fold more effectively, respectively. Overall, this work introduces a straightforward conjugation method that can be used to actively target NPs with various therapeutic antibodies approved for different malignancies.

Biography

Dr. Bayan Alkhawaja received her Doctorate from the University of Bath (UoB), United Kingdom, in 2019, specialising in medicinal and bioconjugation chemistry. She served as an Assistant Professor in the Faculty of Pharmacy and Medical Sciences at the University of Petra from 2019 to 2023. Subsequently rejoined UoB as a Research Fellow in March 2024, a position she currently holds. Her research is centred on developing innovative chemical solutions for bioconjugation and biotherapeutics. Dr. Alkhawaja was awarded the Gold Medal in the STEM for British 2025 and was a finalist for the Peter Troughton Research Staff Prize in 2025.

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Bridging optical functionality and mechanical performance in advanced biomaterials: From fundamental insights to biomedical applications

In this talk, I would like to highlight how recent advances in materials science are reshaping the design principles of biomedical materials, particularly those used in dental and orthopedic applications. Traditionally, biomaterial development has been driven by requirements such as mechanical strength, durability, and biocompatibility. However, it is now increasingly recognized that these conventional criteria alone are insufficient for emerging biomedical technologies. Modern biomaterials are expected to exhibit multifunctional behavior, where optical functionality is becoming an important additional design parameter. This shift is closely related to the growing interest in optical diagnostics, biosensing, and light-assisted therapeutic applications, which require materials with tailored interactions with electromagnetic radiation. Therefore, understanding the coupled relationship between optical and mechanical properties has become essential.

In this presentation, I will provide a comparative perspective on the photophysical and mechanical behavior of two representative biomaterial systems: Dental filling composites and bone cement. In addition, I will discuss mechanical performance. A central point of this talk is that optical and mechanical properties are not independent but are intrinsically linked through composition and microstructure. Dental materials are designed to achieve a balance between mechanical robustness and optical responsiveness, whereas bone cement systems prioritize mechanical compatibility and uniform behavior. In conclusion, I will emphasize that integrating optical characterization into biomaterial design provides a pathway toward multifunctional systems and aligns with current interdisciplinary trends in materials science and chemical engineering for next-generation biomedical applications.

Biography

Prof. Dr. Bayram Gündüz is a scholar in Solid State Physics, specializing in optoelectronic materials, organic semiconductors, and functional nanomaterials. Bayram received his Ph.D. from Fırat University. Bayram has authored nearly 100 SCI/SCI-Expanded publications, delivered about 150 international conference presentations, and contributed to over 25 research projects. Bayram's work has received around 2,000 citations (h-index: 24). Bayram's research focuses on photonic devices, organic field-effect transistors, and graphene-based materials, aiming to bridge fundamental solid-state physics with advanced technological applications.

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Mechanistic insights of PP/zeolites pyrolysis via ReaxFF MD and DFT simulations

Zeolites offer tunable acidity and porous frameworks, making them an ideal candidate for the plastic upcycling process. However, the efficiency of currently used zeolites has yet to satisfy needs in terms of industrial-scale applications. In-depth understanding is required to realise the catalytic effect of zeolite structures and pyrolysis parameters. Particularly, the active site distribution and Si/Al ratios of zeolites result in uncertainties towards their conversion efficiency and gas product of plastic recycling, leaving the quantitative relationship between zeolites' structural parameters and catalytic efficiency insufficiently understood. Herein, Reactive Molecular Dynamics (ReaxFF-MD) simulations and Density Functional Theory (DFT) calculation integrated with experimental validation are employed to elucidate how pyrolysis temperature, ratio of feedstock to zeolites, zeolite topology, aluminium distribution, and Si/Al ratio govern Polypropylene (PP) upcycling behaviour. Through ReaxFF-MD simulation techniques, it was discovered that the optimal pyrolysis temperature and catalyst loading of PP are 2000K (475°C in the experiments) and 30% respectively, with a conversion efficiency over 98%. Moreover, the catalytic efficiency of PP decreased by less than 2% after 5 cycles for HZSM-5. Comparative analyses of HZSM-5, HZSM-11, HZSM-23, and HZSM-35 reveal that HZSM-23 achieves the highest gas yield of 44% and complete conversion efficiency, corresponding to a 57.7% enhancement over non-catalytic PP pyrolysis. The strong acidity and derived activation energy (184.8kJ mol^{-1}) confirmed its superior catalytic activity. DFT calculation identifies the T7 position with the lowest Fermi level (-3.488eV), facilitating hydrogen transfer that converts ·C3H5 intermediates into propylene (C3H6). The optimal Si/Al=30 ratio further balances acidity and desorption, maximising olefin selectivity. Orthogonal optimisation established HZSM-23@T7 (Si/Al=30) as the most efficient configuration with good reusability and stability. This combined computational–experimental approach

provides molecular-scale insights for rational zeolite design, offering a predictive pathway for industrial-scale production toward energy-efficient and sustainable plastic recycling.

Biography

Mr. Tian is a third-year PhD candidate in the Hong Kong Polytechnic University. His research focuses on developing a numerical framework to optimise and design the zeolites structure for plastic cycling via reactive forcefield molecular dynamics.

Collin G. Joseph

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Sonophotocatalysis in advanced oxidation process: A short review

Sonophotocatalysis integrates ultrasonic cavitation, ultraviolet/visible irradiation, and a semiconductor photocatalyst to generate reactive oxygen species (e.g., hydroxyl radicals) that accelerate the oxidative degradation of aqueous pollutants. This review synthesizes published experimental and engineering studies to evaluate mechanistic synergy, performance gains, and practical barriers to scale-up. Ultrasound enhances mass transfer, promotes catalyst surface cleaning and dispersion, and produces localized high-temperature/pressure microenvironments; simultaneous photoexcitation of the semiconductor produces electron–hole pairs that further generate radical species. The combined action yields higher radical fluxes, faster degradation kinetics, and lower chemical dosing than either sonocatalysis or photocatalysis alone. We analyze reported parameters that control performance-ultrasound frequency and power, light wavelength and intensity, catalyst composition and morphology, reactor geometry, and water matrix effects-and summarize typical outcomes across pollutant classes (dyes, pharmaceuticals, endocrine disruptors, and persistent organics). Laboratory studies consistently report synergistic rate enhancements and improved catalyst stability due to ultrasound-induced anti-fouling and deagglomeration. Key engineering challenges identified include energy efficiency of ultrasound at scale, uniform coupling of cavitation and irradiation in larger reactors, and economical catalyst recovery or immobilization for continuous operation. Based on the literature, we recommend targeted strategies for pilot and commercial development: Optimize combined ultrasound and light regimes rather than treating them independently; design reactors that maximize spatial overlap of cavitation zones and illuminated regions; adopt immobilized, magnetic, or otherwise separable catalysts to simplify downstream handling; and perform pilot tests on real waters to quantify matrix effects and lifecycle energy balances. Sonophotocatalysis offers a promising pathway for intensified, low-temperature advanced oxidation with reduced reagent use, but realization at commercial

scale will require integrated advances in reactor engineering, catalyst design, and energy optimization.

Graphical Abstract:

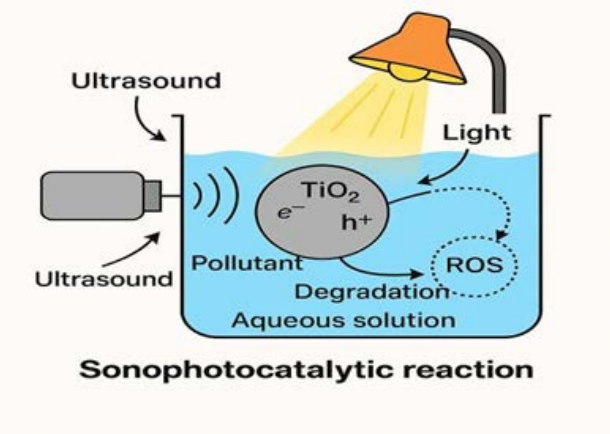

Figure Caption: The mechanisms of Sonophotocatalytic reaction.

Keywords: Sonophotocatalysis, Cavitation, Photocatalysis, Advanced Oxidation Processes, Reactor Design, Catalyst Recovery, Water Treatment.

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Biography

Dr. Collin G. Joseph is a Chartered Chemist and Associate Professor in the Industrial Chemistry Program at Universiti Malaysia Sabah (UMS), where he began his academic career in 2003. He earned his PhD in Chemical Engineering from the University of Nottingham, UK, in 2011. Over the years, he has received numerous Excellence and Service Awards, along with Gold Medals for research and innovation at MTE, ITEX, and PEREKA competitions. Dr. Joseph is a highly accomplished researcher and author, with expertise spanning Adsorbent Technology, Sonophotochemistry, and Ozone Chemistry. In 2014, he founded the Sonophotochemistry Research Group and continues to lead it to this day. From 2020 to 2023, he served as Head of the Industrial Chemistry Programme within UMS's Faculty of Science and Natural Resources. His academic contributions have been widely recognized—he has been invited to review over 250 manuscripts for Tier 1 journals published by Elsevier B.V., Springer, and Taylor & Francis since 2007. He is also a frequent keynote speaker and session chair at international conferences, and research collaborator with local and international universities. Dr. Joseph sits on the Editorial Board of the Malaysian Journal of Chemistry (ISSN: 2550-1658), serves as Review Editor for Photocatalysis in Frontiers in Chemistry (ISSN: 2296-2646), and is a Guest Editor for Catalysts (ISSN: 2073-4344). As of July 15, 2025, his Google Scholar profile reflects an h-index of 22 with 2,944 citations. In recognition of his outstanding contributions to the Malaysian Institute of Chemistry, he was awarded its highest honour—Fellowship status—in 2021. He is also a member of the American Chemical Society and Majlis Profesor Negara. Beyond academia, Dr. Joseph is deeply committed to community engagement. He serves as a lifelong volunteer and committee member with MERCY Malaysia and UMS4WDVC, participating in initiatives that support the well-being of Sabah's communities.

Dae Dong Sung

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Simple and effective methods for identifying in vivo gene response reaction mechanisms

Recently, biomedicine has made a great contribution to the development of the anti-aging field. Biomedical research has revealed that aging mechanisms are deeply linked to the development of cancer and chronic diseases. However, there are still many difficulties in accurately identifying the process by which the human body ages and the causes of chronic diseases. The field of chemical reaction mechanism tools has made a significant contribution to the field of biomedicine. Among the areas of biomedicine, reaction mechanism tools are making a groundbreaking contribution to treating the anti-aging field, which aims to realize the dream of gene scissor therapy and life extension. Understanding of reaction mechanisms is an important role in identifying and resolving the results of measurements of analysis of cellular heterogeneity in gene expression. Although the latest physiological measurements are used to identify the diseases and to provide a lot of measurement data, there are many difficulties in accurately determining the cause of the disease, diagnosing and finally treating it. Recently, new technologies have been used as variant of flow cytometry based on fluorescence, light scattering and separation techniques to sort cells and to confirm the results of measurements. These tools are based on molecular spectroscopy. Laser capture microdissection based on mass spectrometry is helpful to identification that is coupled to a microscope and focused on a tissue. Molecular mass spectrometry is widely applied in RNA sequencing tool based on headspace solid-phase microextraction/gas chromatography-mass spectrometry. Inflammation is one of the major causes of cellular senescence. Inflammatory aging is characterized by increased levels in the proinflammatory factors in the cells. Senescent cells secrete molecules that promote chronic inflammation and organ deterioration, contributing to chronic diseases and aging. The cell changes lead to the aging of the cells. Utilizing the separation techniques based on mass spectrometry in the field of biomedicine can help in understanding and applying treatments for a multitude of different disease or diverse types

of cancer and even expand upon efficient and reliable diagnosis in clinical settings. However, despite the use of these technologies, interpretation of the measured results is very difficult. Chemical reaction mechanisms, especially nucleophilic substitution reaction mechanism tools are applied to accurately interpret these measurement results to determine the cause of chronic diseases and develop treatments. Aniline and its derivatives serve as important molecules in biomedicine. Understanding the nucleophilic substitution reaction mechanism of basic molecule as aniline helps to accurately understand the base reactions of DNA in our body cells. How the length of telomeres at the ends of DNA in our body's cells increases or decreases can be understood by applying the reaction mechanism of aniline and its derivatives. Using the nucleophilic substitution reaction mechanism tools of basic molecule likely aniline and their derivatives in the field of biomedicine are available to understand and to apply also treatments for multitude of different diseases like Alzheimer's disease and divers types of cancer, and to expand on efficient and reliable diagnosis in clinical treatments.

Biography

Professor Dae Dong Sung studied chemistry at Dong-A University as BS and MS and Princeton University as Ph.D. in 1984. He joined the research group of Professor Donald Bethel at Liverpool University as the Royal Society Fellow of Chemistry UK in 1985. He joined the research group of Professor Hideo Tomioka at Mie University Japan as visiting Professor in 1989. Dae Dong Sung worked at Dong-A University and Korea University in the field of physical organic chemistry from to now on 2025. Now he has been contributing to the development of new drugs and anti-aging drugs that can be applied to the treatment of chronic diseases in the biomedicine area. He has published more than 240 research articles in SCI journals and has given more than 70 invited oral presentations at international academic conferences.

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Computational studies of functionalized [Pn_7] (Pn=P, As) clusters for the catalyzed hydroboration of pyridine; exploration of the treatment of entropy

Zintl clusters have recently emerged as competent catalysts for a variety of organic transformations. This work reports the mechanism of functionalized Zintl-cluster-catalyzed hydroboration of pyridine and subsequent analysis of the energetic profile of this catalytic cycle, employing the energetic span model to identify key states that underpin the catalytic activity and observe how these states and other properties of the catalytic cycle change for several catalyst analogues.

We also explore the effect of entropy, and how it is computed in solution, in determining the energetics and kinetics of the target systems, highlighting the issues caused by the parameterisation of Continuum Solvation Models (CSMs) around free energies, and how these issues can result in inaccurate Gibbs energies; currently there is variance in how entropy is accounted for, and little-to-no consensus as to what method is most appropriate. Our work shows that two technically theoretically sound methods can produce distinctly different outcomes. This is especially true in the context of a catalytic cycle involving association and dissociation steps, where large energetic discrepancies between these steps can cumulatively lead to different conclusions about which catalyst performs best and which states within the cycle influence that performance.

We use electronic energies calculated within the Solution Model based on Density (SMD) method of solvent incorporation, partially incorporate entropic due to the aforementioned CSM parameterisation, which allows us to reframe this electronic energy as a Gibbs energy, in opposition to the more traditional method of deriving entropic contributions from the vibrational frequencies. We find this allows for the calculation of turnover frequencies that

are much more catalytically viable when compared to more conventional methods, whereas obtaining a Gibbs energy from the combination of solvated electronic energies with gas-phase derived vibrational frequencies, a method we refer to as 'double counting', results in insurmountable energetic barriers.

We also find little substantial change in the catalytic mechanism for these analogues, in spite of substantial changes to their structure, with this being testament to the versatility of these functionalized Zintl clusters, and the complete mechanism and subsequent employment of the ESM being a substantial advancement in our understanding of the processes that underpin their catalytic activity.

Biography

Daniel Galano was born in London. He obtained his Master's degree in chemistry from the University of Nottingham, where his thesis involved using quantum mechanical Density Functional Theory (DFT) methods to study rhenium complexes and evaluate their usability as photosensitisers and DNA probes. Daniel Galano is currently undertaking a PhD at the University of Manchester under the supervision of Professor Nikolas Kaltsoyannis, working with the Mehta group at the University of Oxford to better understand the mechanisms by which main group clusters catalyse organic transformations, as well as conducting research into a new class of nitrogen chain radical anions.

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The impact of packaging material on the stability of probiotic products

Objective: The stability of probiotic products is essential for preserving their functionality and health benefits. The aim of this study was to investigate the impact of different packaging materials on the viability of probiotic strains, with a particular focus on Aluminum–Aluminum (Al–Al) blister packaging combined with nitrogenization of each compartment.

Methodology: Probiotic capsules were packaged in three types of containers: Standard polymer blister, polymer bottles, and Al–Al blister with nitrogenization. Over several months of storage, the number of viable cells in the capsules was monitored using standard microbiological methods. In parallel, parameters of oxidative stress and moisture content inside the packaging were measured to establish correlations between packaging type and product stability.

Results: The findings indicate that Al–Al blister packaging with nitrogenization significantly slows down the degradation of probiotic strains compared to conventional packaging. The inert atmosphere within each compartment reduces oxidative stress and prevents moisture accumulation, resulting in the preservation of a higher number of viable cells throughout the storage period. Extension of the product's shelf life in this type of packaging was confirmed through statistically significant differences compared to control groups.

Conclusion: The results confirm that the choice of packaging material has a decisive impact on the stability of probiotic preparations. The application of Al–Al blister packaging with nitrogenization represents an effective strategy for extending shelf life and maintaining the quality of probiotic products. These findings have practical relevance for the pharmaceutical

and food industries, as they enable the development of more stable formulations and the improvement of packaging standards for probiotic preparations.

Biography

Davor J. Korčok is a university professor and President of the Scientific and Technical Committee of the Republic of Serbia, as well as an international evaluator for Quality Management Systems (QMS). He is the author of 44 scientific papers and three professional books, with research focused on the stability of probiotic products and the role of packaging materials in extending shelf life. As a recognition of his scientific and professional contributions, he is the recipient of the most prestigious awards and decorations in Serbia and the wider region, affirming his significant impact on advancing quality standards and innovation.

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Electrochemical CO_2 reduction to CO in a zero-gap anion exchange membrane cell for a novel sustainable aviation process

The electrochemical reduction of carbon dioxide (CO_2RR) has emerged as a promising route for the sustainable production of Carbon Monoxide (CO) and other carbon-based intermediates, serving as feedstock for synthetic fuel synthesis within Power-to-X schemes. This approach directly couples renewable electricity with CO_2 utilization, offering a pathway to close the carbon cycle and mitigate greenhouse gas emissions.

This work forms part of a broader research initiative (4AirCRAFT H2020 project GA 101022633) aimed at developing novel routes for the production of Sustainable Aviation Fuels (SAFs), addressing one of the most challenging sectors to decarbonize due to its high energy density requirements and limited alternative technologies. Within this framework, the selective electrochemical conversion of CO_2 to CO represents a crucial intermediate step toward the synthesis of hydrocarbons compatible with current aviation fuel specifications.

In this work, a planar zero-gap electrochemical cell equipped with an anion-exchange membrane and an active geometric area of 15cm^2 was developed and tested for the selective reduction of CO_2 to CO under mild operating conditions. The cell configuration employed a Ni-based anode and a ZnAl electrocatalyst deposited on carbon substrate cathode, operating in 0.1M $KHCO_3$ electrolyte. Systematic Chrono Potentiometric (CP) experiments were conducted to assess the effect of applied potential and current density on Faradaic Efficiency (FE), and stability.

Electrochemical Impedance Spectroscopy (EIS) measurements were performed to evaluate charge transfer resistance and ion transport properties across the electrode-electrolyte interface, providing insight into limitations of the system. The combined analysis enabled the identification of optimal operating conditions that maximize CO selectivity while minimizing energy consumption and performance degradation.

The results demonstrate the feasibility of CO_2 electroreduction to CO in anion-exchange membrane cells with scalable planar geometry, reaching faradaic efficiencies to CO close to 99%. Moreover, they highlight the relevance of integrating EIS characterization to guide material and design optimization toward efficient and durable Power-to-Fuels conversion technologies.

Biography

Eduardo Bernad holds a bachelor's degree in chemistry and chemical engineering, and a master's degree in Nanomaterials from the University of Zaragoza. Currently finishing his doctoral thesis in Chemical Engineering, at the Aragon Hydrogen Foundation, focused on the exploration of new processes using green hydrogen and renewable gases to synthesise alternative fuels in industries that pose a challenge for decarbonisation. The experience includes advanced characterisation techniques, showing a substantial contribution to innovative projects, as well as technology development processes at low TRL.

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Modular conversion of CO_2 into synthetic fuels through plasma and bio-/chemo-catalysis assisted process: Presentation of +C_2Fue-LS project

The transition towards sustainable mobility demands new Power-to-X (PtX) routes capable of converting renewable electricity, green hydrogen and CO_2 into liquid and gaseous fuels efficiently and under mild conditions. Conventional thermocatalytic approaches often require high temperatures and pressures, limiting their energy efficiency and scalability. In response, emerging hybrid systems based on disruptive and hierarchical catalyst are gaining attention for their potential to enhance conversion rates, selectivity, and overall process integration while operating close to ambient condition.

The +C_2FUe-LS project Turning recycled carbon into valuable fuels for all transport sectors by marrying selective plasma and bio-/chemo-catalysis at mild conditions), a Horizon Europe funded project (GA 101236115), aims to develop and validate an innovative modular technology for the conversion of CO_2 into renewable fuels and chemicals. The initiative combines catalytic and plasma-assisted processes in cascade reactor configurations to intensify reactions and improve selectivity towards target products such as CO, formaldehyde and light alcohols.

The project, formed by 7 European research and technology centres, addresses the entire CO_2 conversion value chain from fundamental catalyst development to system validation under relevant conditions (TRL4). Its objectives include: (i) Design of robust and selective catalysts

(plasma-, bio- and chemo-based, including MOFs) and supports with high specificity for intermediate reaction steps; (ii) Design and integration of a 3D-structured reactor modules operating under mild and adjustable conditions; (iii) Experimental validation of modular platform for direct alcohol production and its validation in fuel cell applications, and (iv) Overall assessment in terms of sustainability, energy and cost efficiency and applicability.

The technical methodology follows a design-build-test-validate approach involving catalyst synthesis and characterization, kinetic modelling, reactor engineering, and environmental and economical assessment. The modular cascade reactor will be evaluated under simulated conditions, controlled heating per each step and online/offline analysis for precise quantification of product compositions under mild conditions (aiming T<100ºC, 1 bar).

Expected outcomes include the transformation of CO_2 into C_2 with high selectivity and improving overall energy efficiency of the process, and the definition of reference models and operational guidelines for next-generation PtX processes, contributing to decarbonisation of transport and the circular carbon economy in Europe.

Biography

Eduardo Bernad holds a bachelor's degree in chemistry and chemical engineering, and a master's degree in Nanomaterials from the University of Zaragoza. Currently finishing his doctoral thesis in Chemical Engineering, at the Aragon Hydrogen Foundation, focused on the exploration of new processes using green hydrogen and renewable gases to synthesise alternative fuels in industries that pose a challenge for decarbonisation. The experience includes advanced characterisation techniques, showing a substantial contribution to innovative projects, as well as technology development processes at low TRL.

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Effective B_2O_3 modified Ni/Al_2O_3 co-precipitated catalysts for waste cooking oil transformation into green diesel

The replacement of fossil fuels with biofuels produced from renewable sources is imperative nowadays, as the latter reduce some undesirable aspects of fossil fuels production and use. More precisely, biofuels don't contain S, N, or metal substances, which lead to the production of conventional pollutants, and contribute almost zero to the emission of greenhouse gases causing global warming and climate change. Biodiesel, as a biofuel, is already widely used despite the disadvantages it presents due to the presence of oxygen in its composition. On the other hand, green diesel or Hydrogenated Vegetable Oil (HVO) is an oxygen free drop in fuel, produced via hydrotreatment of triglyceride feedstock. Conventional hydrotreatment catalysts (NiMoS and CoMos) used for oil upgrading have been extensively studied also for HVO production. However, their performance is not stable in case that a sulfur containing compound is not added in the feed. To overcome this difficulty, research has turned towards metallic catalysts for the aforementioned process. Noble metal catalysts have proved very active, but their cost is prohibited for industrial application.

Some pioneer groups have tried to develop such catalysts based on base transition metals (e.g. Ni, Co, Fe, Cu, etc.). In the frame of this effort, our group has focused its recent research on the development of Ni based catalysts. The simultaneous achievement of high activity, selectivity for hydrocarbons in the diesel range with small amounts of branched hydrocarbons for obtaining good pour properties together with high catalyst stability and low hydrogen demand were our main targets. Considerable progress has been pointed out towards these ambitious goals. It seems that catalysts with high surface/active metal area, medium acidity and mesoporous structure and suitable formulation are very promising. The role of metallic and metal oxide promoters in metallic nickel catalysts used for HVO production has been

recently reviewed by our group. Boron is a non-metallic promoter usually used for transition metal-based catalysts (Ni, Cu etc.) as it alters the electronic environment of metal ions enhancing metal dispersion and coking resistance. In this work a series of Ni/Al_2O_3 catalysts with constant Ni loading (57.5wt%) doped with various amounts of B_2O_3 (0-5wt.%) were studied for the transformation of waste cooking oil (wco) into HVO. The catalysts were thoroughly characterized by XRD, XPS, N_2-physisorption, H_2-TPR, NH_3-TPD, CO-chemisorption, TEM, TGA, and evaluated in a semi-batch high pressure reactor. A catalyst containing 2.5% B_2O_3 proved the most effective one among the studied catalysts. This catalyst exhibited the highest active surface (metallic Ni), pore volume and acidity.

Acknowledgment: This paper has been financed by the funding program "MEDICUS", of the University of Patras.

Biography

Dr. Eleana Kordouli is an Assistant Professor in Physical Chemistry and Development of Catalysts for Valorization of Renewable Raw Materials in the Department of Chemistry at the University of Patras, Greece. She is also a tutor at the Hellenic Open University for several M.Sc. programs. She has worked as a postdoctoral researcher at the Hellenic Open University, at Institute of Chemical Engineering Science (FORTH/ICE-HT) and at the Department of Chemistry at the University of Patras. Dr. Eleana Kordouli's research interests are focused on heterogeneous catalysis, interfacial chemistry, catalyst preparation, surface characterization, biomass valorization, biofuels, and environmental catalysis.

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Recycled emissions to alcohols, optimization process for renewable and sustainable production

Most of the world's energy consumption comes from fossil fuels, while the least comes from decarbonized sources. The massive use of carbon-based energy sources has a negative impact on the environment due to increased Greenhouse Gases Emissions (GHG), which cause climate change. For this reason, our ecosystem needs a fast action to reduce emissions. The international climates goals aim to achieve zero-net emissions by 2050. This requires a shift from natural fossil sources into low carbon fuels, such as renewable gases and liquid combustible.

A key element of this transition is establishing a competitive green fuels market with the necessary infrastructure, networks and use. The production of zero-net emission methanol (CH_3OH), between others, obtained from Greenhouse Gases emissions (GHG) (including CO_2, CH_4, and low-grade biogas) and an oxidant as green Hydrogen (H_2) or Nitrous Oxide (N_2O), is crucial for a carbon-neutral economy. So far, methanol produced to be used as a chemical building block and as a transportation fuel or as a precursor of other liquid fuels (in particular shipping, a difficult sector to decarbonize), has been traditionally produced from coal or natural gas. However, activation of light alkanes without combustion is challenging; their oxidative functionalization requires the intervention of reactive species capable of breaking apolar C-H bonds while limiting overoxidation of products that contain progressively weaker C-H bonds. This process requires efficient catalysts to lower the activation energy of the key steps of the reaction and to control the selectivity vs conversion. In this presentation, we show the development of novel technologies to produce sustainable fuels at mild conditions, drastically reducing the energy consumption. We discuss the CH_4 conversion to CH_3OH at mild conditions (up to 200ºC) in a fixed-bed reactor under efficient

catalytic and flow conditions. To validate the reactor bench design, the propane conversion reaction is firstly assessed. The kinetic parameters are studied too.

Biography

Esther holds a PhD in Inorganic Chemistry from the University of Zaragoza and a master's degree in Organic Chemistry and a bachelor's degree in Chemistry from the University of Valencia. Her PhD was contextualized in the search for a more sustainable energy model through OLED and hydrogen technologies. She currently works on R&D department at Aragon Hydrogen Foundation, focused on the research of new hydrogen technologies with renewable gases to synthesise sustainable fuels. She is author of five scientific papers in high-impact journals and collaborator to three patents, including experience in advanced characterisation techniques, catalysis and kinetic experiments.

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Synthesis of alcohols for sustainable aviation fuels under unconventional cold plasma and thermo-catalysis technology

Climate change and its potentially dramatic consequences at a global level force us to seek more efficient and sustainable solutions and technologies. In 2022, around 25% of the world's CO_2 emissions came from the transportation sector, where aviation contributed around 14% of the total transport emissions. Moreover, global demand for jet fuels is projected to double between now and 2050. To this, the use of Sustainable Aviation Fuels (SAFs) is essential to reduce the environmental impact and dependence on fossil fuels and foreign petrol-sources.

To date, several SAF production processes have been developed and have demonstrated commercial success, although with limited capacity. However, further research is needed for the sustainable, clean, affordable, and safe production of C_{12+} alcohols.

In this presentation, we will present the concept of Hy^{+}_{4}SAF approach, funded by Agencia Estatal de Investigación (Generación de Conocimiento 2024), which will develop a disruptive technology of a cascade reactor for producing synthetic relevant chemicals and SAFs via CO_2 hydrogenation at mild conditions. In particular, it will involve the selective synthesis of chemicals (C_{8+} alcohols) and SAF precursors (C_{12+} alcohols) from renewable fuels (CO_2 and H_2) via an ethanol-mediated route under mild conditions. To this end, designed catalysts will be tested in near-real-world environments: 1) Functionalized catalysts for plasma ethanol synthesis on digitally structured supports will be tested with near-real-world RFNBO feedstocks, impure CO_2, and H_2 with varying H_2O content; 2) Cooperative multi-element MOF catalysts for C_{8+} alcohol synthesis on digitally structured supports from plasma-

synthesized ethanol will be tested, also evaluating the catalytic effects of byproducts such as methanol, ethanal, ethylene, CH_4, or CO from CO_2 hydrogenation. Hy4OL will benefit from a pioneering design in catalytic and process engineering to enhance aspects related to fluid separation, reaction engineering, and materials engineering. This efficient and systematic integration of process intensification concepts will optimize the novel cascade reactor using a safe, compact, and energy-efficient dual-reaction technology. Verification of the progress achieved in capillary condensation-enhanced thermocatalytic chain-growth reactions under realistic conditions will pave the way for future application in commercial reactor.

Biography

Esther holds a PhD in Inorganic Chemistry from the University of Zaragoza and a master's degree in Organic Chemistry and a bachelor's degree in Chemistry from the University of Valencia. Her PhD was contextualized in the search for a more sustainable energy model through OLED and hydrogen technologies. She currently works on R&D department at Aragon Hydrogen Foundation, focused on the research of new hydrogen technologies with renewable gases to synthesize sustainable fuels. She is author of five scientific papers in high-impact journals and collaborator to three patents, including experience in advanced characterization techniques, catalysis and kinetic experiments.

Eva Faillace*, Virginie Brunini-Bronzini de Caraffa, Claude Gambotti, Liliane Berti, Jacques Maury and Sophie Vincenti

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Optimized biocatalytic process for 13-HPOs production from hempseed oil: A step toward natural green leaf volatiles synthesis

Natural Green Leaf Volatiles (GLVs), such as short-chain aldehydes responsible for the characteristic fresh green aroma, are widely used in the flavor and food industries. Their sustainable production can be achieved through a biocatalytic cascade starting from vegetable oils. In this process, triacylglycerols are first hydrolyzed by a lipase to release free Polyunsaturated Fatty Acids (PUFAs), which are subsequently oxygenated by a Lipoxygenase (LOX) to yield corresponding Hydroperoxides (HPOs). HPOs can then be converted by a hydroperoxide lyase to produce volatile aldehydes and oxoacids.

To meet the growing demand for such natural compounds, the production of 13-Hydroperoxyoctadecadienoic Acid (13-HPO) from hempseed oil (*Cannabis sativa*), a rich source of linoleic and linolenic acids, was investigated. The lipolysis step was optimized using Response Surface Methodology (RSM) to evaluate the effects of pH, temperature, duration, oil/aqueous ratio, and lipase load on the hydrolysis rate. Under optimal conditions, a commercial *Candida Rugosa* Lipase (CRL) achieved a hydrolysis rate of 97.2±3.8%.

The resulting hydrolysate, containing the released PUFAs, was then directly used as substrate for the second step catalyzed by a commercial soybean 13-lipoxygenase (*Glycine max.*) to form 13-HPOs. Following a RSM design, the LOX-catalyzed step was optimized, by evaluating the effect of temperature, duration, oxygen flow, LOX load, and hydrolysate load on the conversion. The optimized conditions led to an 84.15±0.03% conversion of PUFAs into 13-HPOs.

These results confirm the efficiency of the sequential CRL-LOX biocatalytic system for the selective production of 13-HPO from hempseed oil.

Biography

Eva Faillace is a Temporary Teaching and Research Fellow (A.T.E.R.) at the University of Corsica. For the past five years, she has been a member of the Biotechnology and Biocatalysis team within the CNRS UMR 6134 laboratory (SPE). Her research focuses on the heterologous expression and production of recombinant enzymes, as well as their evaluation as biocatalysts for integration into complete industrial production processes. Her work involves the systematic optimization of each reaction step, utilizing both commercial and laboratory-produced enzymes. With a strong background in biotechnology, enzymology, and biocatalysis, she has authored three peer-reviewed publications in JCR-indexed journals.

Farshad Akbarnejad

Vice President of Scientific Department at Rayka Shimi Saba and Consultant of Scientific Department at Dr. Jahangir Knowledge-Based Co., Iran

Saffron in dermatology: A comprehensive review

Saffron has a very long history of human use, including in wound healing and skin inflammation. Several studies have shown the role of saffron and its components in wound healing and inflammatory skin diseases. In modern days, the therapeutic effect of saffron on the skin has been evaluated from various perspectives, but the findings of ancient knowledge are very discreet or not transcribed and get lost in time; therefore, in the current review, saffron wisdom in dermatology, particularly in the treatment of the skin, is revisited.

Saffron, derived from the Crocus sativus flower, is a precious commodity from Iran with a rich history in cooking, color and traditional medicine. Iran accounts for almost 90% of the global production and exports of saffron, with its versatile applications in the traditional, medicinal, cosmetic and aromatic sectors. The main components of saffron, such as safranal, crocin and crocetin, offer antioxidant, anti-inflammatory and anti-aging properties, making it a popular choice in skin care products. Saffron also offers medicinal benefits for respiratory problems, skin conditions and general well-being. As the demand for natural ingredients increases, saffron remains a valuable asset in various industries, including cosmetics. Research highlights its potential in the treatment of skin and hair diseases such as psoriasis and atopic dermatitis, and suggests further exploration of its anti-inflammatory and skin-lightening properties, and also of its potential applications in the treatment of allergies, skin cancer and wounds. This study aims to clarify the dermatological benefits of saffron to guide future research in dermatology.

Biography

Farshad Akbarnejad received his Doctor of Veterinary Medicine (DVM) degree from Shahid Chamran University of Ahvaz, Iran. He currently serves as the Vice President of the Scientific Department at Rayka Shimi Saba and as a Consultant of the Scientific Department at Dr. Jahangir Knowledge-Based Co. He has authored more than 40 scientific publications and 11 books. His professional and research activities have been primarily focused on medicinal plants, dermatological sciences, and cosmetic formulations for over 16 years.

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[2]Department of Industrial Engineering & Management Systems, Amirkabir University of Technology, Tehran, Iran
[3]Shahid Beheshti University of Medical Sciences, Iran

Sustainable application of agricultural residues as biosorbents for heavy metal removal from aqueous systems: A comparative study

Anthropogenic activities have increasingly contributed to the deterioration of water quality through the discharge of industrial effluents, agricultural runoff, and other contaminant sources. As water quality requirements vary depending on its intended use, effective treatment strategies are essential to meet regulatory and environmental standards. In this context, sustainable wastewater treatment approaches that integrate resource recovery and circular economy principles have gained considerable attention.

The utilization of agricultural residues as biosorbents represents an eco-friendly and cost-effective alternative for removing heavy metals from contaminated water. This approach not only improves water quality but also promotes the valorization of agricultural by-products, thereby reducing environmental waste. In the present study, the biosorption performance of two widely available agricultural wastes in Iran, namely peanut shells and walnut shells, was comparatively evaluated for the removal of selected heavy metals from aqueous solutions.

The biosorbents were processed to obtain uniform particle sizes and were applied to contaminated water under controlled experimental conditions. Parameters such as heavy metal concentration and pH were monitored over defined time intervals, while the system temperature was maintained at 25°C. The findings indicated that walnut shells exhibited superior biosorption efficiency compared to peanut shells for the target pollutants. Among the investigated heavy metals, cadmium and lead demonstrated the highest adsorption rates for both biosorbents.

Future studies are recommended to examine the influence of particle size variation, pH fluctuations, and temperature changes on biosorption performance, as well as to evaluate the effectiveness of these biosorbents in real wastewater systems. The results of this study highlight the potential of agricultural waste-derived biosorbents as sustainable materials for heavy metal remediation in water treatment applications.

Biography

Dr. Fatemehsadat Mirmohammadmakki received her PhD in “Food industrial engineering and science-Food Chemistry” in 2021 from Islamic Azad University, Sciences and Research Branch. She then joined the research group at the same institution. Her research focuses on agricultural products, edible oils, and extracts, with a specialization in biosorbents for reducing heavy metals in food, soil, and wastewater. Also, she is researcher of Medical Ethics and Law Research Center, Shahid Beheshti University of Medical Sciences. A lecturer and researcher, she has contributed to sustainable pollution control and has published over 10 research articles and participated in more than 50 national and international conferences.

Geovanna Tafurt-García[1]*, Amner Muñoz Acevedo[2], Massuo J. Kato[3]

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[2]Department of Chemistry and Biology, Universidad del Norte, Puerto Colombia, Atlántico, Colombia

[3]Universidade de São Paulo, Sao Paulo, Brazil

The volatilome of *Piper* tenue in plant–coleopteran interactions

Piper species are rich in Volatile Metabolites (VMs), which comprise diverse classes of organic compounds whose composition and abundance vary according to environmental conditions and chemotypes. Monoterpenes, Sesquiterpenes and phenylpropanoids are among the most important VM found in *Piper* species. *Piper tenue* grows between 80 and 180m above sea level and is most frequently recorded in Colombia and Venezuela. The aim of this study was to determine the volatile chemical composition of fruits, pollen, and leaves from *P. tenue* collected in Arauca, Colombia. The volatile chemical composition of leaves from plants with and without coleopteran herbivory was also included. The VM constitute chemical signals (allelochemicals) that plants use in ecological interactions (communication, adaptation, and survival). Solid-Phase Microextraction (SPME) and Simultaneous Distillation–Extraction (SDE), coupled with Gas Chromatography and a Mass Selective Detector (GC-MSD), were used for the extraction and analysis of volatile compounds. *P. tenue* was characterized by a high proportion of Sesquiterpenes (ST), Monoterpenes (MT), and Aromatic Esters (AR-EST). Fruits were differentiated by a high content of MT and ST; pollen was dominated by ST and MT; leaves with herbivory were distinguished by a higher proportion of AR-EST; leaves without herbivory were differentiated by ST and AR-EST contents; and the volatile fraction of leaves obtained by SDE was characterized by a high content of aldehydes and MT. Volatile metabolites play key roles in attracting pollinators, repelling herbivorous insects, signalling neighbouring plants, and recruiting natural enemies of herbivores. The classification of VM as attractants or repellents is not standardized due to fluctuations in insect behavioural responses. This preliminary study contributes to supporting the ecological interactions of P. tenue related to herbivory by coleopteran insects.

Biography

Geovanna Tafurt-García is a Chemist with a PhD and MSc in Chemistry from the Universidad Industrial de Santander (UIS). She is an Associate Professor at the Universidad Nacional de Colombia, affiliated with the Academic Directorate of the La Paz Campus. Her main research area is the bioprospecting of plant species, focusing on chemical analysis of volatiles, fatty acids, and phenolic compounds, as well as antioxidant capacity and biocidal activity. She has led and participated in projects on native fruits from tropical dry forests, biotechnological applications of plant extracts for rural communities, and phytochemical analysis and utilization of promising plant species from Orinoquia region Colombia.

Hepzibah Konadu Agyeman
University of Ghana, Ghana

Determination of bacteriological loads in borehole water

The proliferation of boreholes dug by individuals, private entities and the public in an attempt to overcome the problem of water scarcity has caused various communities in New Juabeng North and New Juabeng South to depend on borehole water as a reliable source of water for drinking and domestic purposes in Ghana. Unfortunately, the water is not well treated before it is used for drinking and there is no surveillance of bacteria in the water to ascertain its safety. Before usage in consideration of this fact, a study case was conducted to assess the bacteriological quality of borehole water in some communities in the area. Borehole water samples were aseptically collected from the various communities and the bacteriological assessment was carried out using standard microbiological methods which include determination of total coliform count, total faecal coliform count and total heterotrophic bacterial count. The total coliform counts of the water samples ranged from 1.3x102 to 1.3x104 CFUmL-1 while the total faecal coliform and total heterotrophic bacterial counts ranged from 1.3x102 to 5.8x104 CFUmL-1 and 1.1x102 to 8.7x104 CFUmL-1 respectively. The organisms isolated from the borehole water samples included *Salmonella typhi, Shigella dysenteries, Staphylococci aureus, Vibrio cholera, Enterococcus faecalis, Klebsiella sp* and *Escherichia coli.* The total bacteria counts exceed the limit set by the World Health Organization for drinking and domestic purposes. Furthermore, the pathogenic organisms isolated from the water samples could have cause serious detrimental health problems in humans. Hence, the borehole water should be treated properly before usage and other preventive approaches should be adopted to minimize potential health risks associated with the use of the borehole water contaminated with bacterial.

Keywords: Microbes, Borehole Water, Bacterial Count, Media, Culture Technique.

Biography

Hephzibah Konadu Agyeman is a Principal Technologist at the Ghana Atomic Energy Commission and currently pursuing a PhD in Nuclear and Environmental Protection at the University of Ghana, School of Nuclear and Allied Sciences (SNAS). Agyeman holds an M.Sc. in Environmental Science from Kwame Nkrumah University of Science and Technology (KNUST) and a B.Tech in Science Laboratory Technology from Accra Technical University, along with additional diplomas and certificates in laboratory sciences and computer applications. Agyeman has undergone extensive professional training, including programs organized by the IAEA, World Nuclear University, and ENEN, and has contributed to IAEA technical cooperation projects and Coordinated Research Projects (CRPs). Agyeman has authored eight publications and co-authored seven more, with her work on ResearchGate reaching over 8,200 reads as of February 24, 2026. Agyeman has peer-reviewed 25 manuscripts and five book chapters, receiving certificates for her contributions. Agyeman is an experienced speaker at seminars and conferences and maintains a personal website here and her Amazon publication page here. Notable recognitions include Best Worker (2019) at GAEC and an invitation by UNESCO to a Women in Science award ceremony for Sub-Saharan Africa in Botswana (2023).

Dr. Hossam Ahmed Aly Moustafa Tieama

Abu Qir Fertilizers and Chemical Industries Co. Alexandria, Egypt

Associate DR. City of Scientific Research and Technology Applications, Egypt

Functionalization, modification and development of some polymeric membranes producing an advanced variety membranes with selective and distinct specifications can be applicable in desalination

Approximately 97% of all water on Earth is saline water, found primarily in oceans and seas. The remaining 3% is freshwater. Of this freshwater, a significant portion is locked up in glaciers, ice caps, and underground, leaving a much smaller percentage readily available for human use. At the same time the concurrent growth in population and industrial development has led to a drastic increase in the demand for fresh water. The demand for clean water is increasing due to the rapid increase in urbanization, and in economic and industrial development. Water treatment companies are therefore turning to seawater as the major source from which freshwater is produced. Seawater can be treated using many physical, biological, and chemical methods. On a general note, the choice of any of these methods depends on many factors which include cost of treatment, nature of chemicals, space for installation, and possible generation of secondary pollution. For these reasons, membrane technology is being adopted for certain stages of water treatment processes. The commonly used types of membrane technology in seawater treatment are microfiltration, ultrafiltration, nanofiltration, and Reverse Osmosis (RO). All these membrane processes can be used either independently or combined as hybrid systems. The choice of any of these membranes will depend on the type of impurities that need to be removed from the wastewater. These membrane techniques can substantially reduce the energy consumption of water treatment, reduce waste formulation, and make the treatment more cost-effective, safer, and sustainable. Out of all the membrane desalination technologies, RO is the most popular and this technology has the highest number of plants. RO has different sources of feed water ranging from seawater, to brackish, river and wastewater. Membranes can be organic (polymeric) or inorganic (ceramic or metallic), according to its composition, and their morphology is dependent on the nature

of the material. There is a need for improved membranes that have higher efficiency and are more resistant to the chemical environment, especially chlorine. At present the demand of membrane technology in the field of Gas Separation (GS), medicine, waste water treatment, production of drinking water by desalination, and other methods is increasing day by day. The use of synthetic materials in biomedical applications has increased dramatically during the past few decades. Surface properties of polymers are of fundamental importance in many branches of industrial applications (e.g., separation of gasses, liquid mixtures, desalination, coating, adhesion, etc.). Performances of membranes also depend on the properties of their surfaces, since membrane may be considered as one of the surface phenomena. Hence, it is very natural that much attention has been paid to the membrane surface modification. Many of the surface modifications were done to improve the selectivity and permeability. Plasma treatment, grafting reaction, etc., were applied for this purpose. In this presentation showing some polymeric membranes modifying and developing techniques, and also its applications and results in water desalination.

Keywords: Membranes, Functionalization, Modification, Environmental Sustainability, Desalination.

Biography

Dr. Hossam Ahmed Tieama studied Chemistry at Alexandria University, Egypt and graduated in 2000. He then joined the research group of Polymer Chemistry in City of scientific research and technology applications Alex. Egypt. He obtained his PhD degree in the field of water and waste water treatment applications using modified membranes. He is currently employed as a utilities general manager at Abu Qir Fertilizers Company, and he has got 25 years of experience in the field of water treatment technologies. He has participated in many international conferences in Europe and US, and presented many scientific researches in water purification and desalination applications using modified membranes. He is an international lecturer in many countries and training centers in the field of water and waste water treatment technologies and he has published in several international journals on membranes topics and continuing his research activity at the city of scientific research and technology applications.

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Metal matters: How vanadium and molybdenum rewrite hydrazone-based oxidation catalysis

The development of efficient and sustainable catalysts for benzylic oxidation remains an important challenge in modern oxidation chemistry, particularly in the context of greener routes. Although the conventional Co/Mn/Br catalytic system used for xylene oxidation is effective, its corrosive and environmentally demanding nature motivates the search for halogen-free alternatives. Transition-metal complexes capable of promoting selective oxidations under mild conditions therefore continue to attract considerable attention.

In this work, we report a new family of vanadium catalysts supported by hydrazone ligands derived from 5-methoxy-salycylaldehyde and salycylaldehyde. Hydrazone-based frameworks provide a versatile platform for tuning electronic and steric environments around redox-active metal centers, offering opportunities for improved catalytic performance. Despite vanadium's recognized role in certain oxidative transformations, its application to the oxidation of xylenes is limited. Here, we explore these vanadium–hydrazone complexes as catalysts for the aerobic oxidation of xylene, as well as for the oxidation of benzyl alcohol, as a complementary model substrate commonly used to probe benzylic oxidation pathways. Our research group has previously investigated the oxidation of benzyl alcohol and its chloro-, nitro-, and methyl-substituted derivatives, providing a valuable reference point for evaluating the reactivity of the new catalysts.

To explore the influence of the metal center, the vanadium complexes were directly compared with their molybdenum analogues constructed from the same 5-methoxy-salycylaldehyde and salycylaldehyde ligand scaffold. Comprehensive structural and catalytic studies highlight how differences in electronic structure and coordination chemistry translate into distinct oxidative behaviors.

Overall, this comparative investigation expands the chemistry of hydrazone-based vanadium and molybdenum complexes and offers new insights into the design of sustainable oxidation catalysts for both industrial and model benzylic substrates.

Biography

Dr. Jana Pisk is an Associate Professor of Chemistry at the University of Zagreb, Faculty of Science, where she has been a member of the Department of Chemistry since 2007. She earned her Ph.D. in 2012 and has conducted extended research in catalysis at the Laboratoire de Chimie de Coordination in Toulouse, France. Her scientific work centers on the coordination chemistry of molybdenum and vanadium compounds, with a strong focus on their catalytic applications in oxidation processes. Dr. Pisk has authored more than fifty publications and is actively engaged in advancing sustainable catalytic methodologies and functional inorganic materials.

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Utilisation of optical spectroscopy and physical chemistry methods in studies of interaction between pesticide molecules and vital bio-macromolecules

Food production is expected to increase the quantity and quality crops, so pesticides are globally used for crop control. Question is whether using pesticides endangers the health of consumers. Comprehensive knowledge about pesticide side-effects on humans and animals includes a research of their influence on molecular level. Studies of interactions between pesticides and vital bio-macromolecules on the molecular level represent an important step towards understanding pesticides´ toxicity and reducing their excessive using.

In this contribution we want to show how methods of optical spectroscopy and physical chemistry can be applied in the research concerning an influence of these problematic molecules on vital bio-macromolecules here represented DNA and transport proteins (Human Serum Albumin, HSA). We have chosen two pesticide molecules as the examples to find basic binding characteristics between them and DNA, respectively HSA. Epoxiconazole (EPC) is a fungicide representing a conazole group of fungicides and a relatively new phenylpyrazole insecticide Fipronil (FIP) which is extremely neurotoxic with good selectivity among insects and mammals. Optical methods such as absorption, fluorescence spectroscopies and optical dichroism associated with thermodynamic calculations, synchronous and 3D fluorescence spectra, competitive measurements and others have enabled to determine main binding characteristics of the pesticide molecules within the DNA and HSA, respectively, macromolecule structures. The absorption and fluorescence spectra as well as a protein binding theory have utilized in finding of binding constants and mode of interaction between EPC and HSA and FIP and DNA, respectively. Moreover, the fluorescence spectra thermal dependence has used for the determination of a quenching mechanism given by Stern-Volmer equation at an incorporation of the fungicide molecule EPC within the HSA

macromolecule. Thermodynamic parameters such as melting temperature or enthalpy determined by thermal denaturation of FIP-DNA complex give an important fact about DNA stabilization or destabilization after the insecticide FIP interaction with DNA. Synchronous, 3D fluorescence, and CD spectra can be utilized for a finding of the studied macromolecules conformation changes as a consequence of pesticide molecules incorporation. Our contribution contains more possibilities of the utilization physical-chemical methods in the comprehensive characterization of interaction (or incorporation) of two chosen pesticides with vital-bio-macromolecules represented by DNA, and HSA.

Biography

Jana Stanicova has received her PhD. in Biophysics, specializing in Molecular Biophysics and Chemical Physics, at Comenius University in Bratislava, Slovakia. Her post-doctoral study was realized at University of Texas, San Antonio Health Science Centrum, USA where she has been working in Biochemistry Department on the research dealing with a relationship between structure and function of cytochrome-c-oxidase enzyme. Jana Stanicova academic carrier is associated with Medical Biophysics at First Faculty of Medicine, Charles University in Prague, Czech Republic where she works in an associate professor position. Recently, her research interest is focused on an investigation of the interaction of the ligands such as agents, or pesticides with bio-macromolecules on the molecular revel.

Jinsong Wu

University of Chile, Chile

Environmental sustainability and intelligence as well as general green technologies

Although the term of green has been often used to refer to energy consumption reduction or energy efficiency by many people and literatures, green actually should refer to environmental sustainability in more general senses. Environmental sustainability issues have been important topics for recent years, which has impacted and will further impact individuals, enterprises, governments, and societies. Environmental sustainability is not simply regarding reducing the amount of waste or using less energy, but relevant to developing processes leading to completely sustainable human society in the future. The long term consequences of the relevant serious issues have not yet been fully forecasted, but it has been generally accepted in many communities that immediate responses are necessary. From 30 November to 12 December 2015, the 21th United Nations Climate Change Conferences of the Parties (COP 21) was held in Paris, France, as the a historical breakthrough and milestone towards securing the future Earth, a global agreement on the reduction of climate change, the text of which represented a consensus of the representatives of more than 193 countries attending it, which was a profound milestone for global environmental sustainability. Nowadays there is another significant tendency on data driven intelligence. This talk would discuss the history, technical issues, challenges, and new trends of data driven environmental sustainability and Intelligence. Further this talk will extend the view to general green technologies.

Biography

Jinsong Wu received the Ph.D. degree from the Department of Electrical and Computer Engineering, Queen's University, Kingston, Ontario, Canada, in 2006. He received 2020 IEEE Green Communications and Computing Technical Committee Distinguished Technical Achievement Recognition Award, for his outstanding technical leadership

and achievement in green wireless communications and networking. He systematically defined the basic concepts and research scope of green communications (2011 and 2022), proposed and analyzed the concept of green big data (2016), early analyzed the relationship between information and communication technology and the United Nations Sustainable Development Goals (2018), proposed the definition of the concept and scope of general green technologies (2022/2023), and proposed the definition of the concepts of Generalized Green Artificial Intelligence (GGAI), Generalized Red Artificial Intelligence (GRAI), Red Big Data (RBD), and Red Information and Communication Technology (RICT), Red Digital Technologies (RDT), Red Electronic and Electrical Engineering (REEE) (2026). He was the leading Editor and a co-author of the comprehensive book, entitled “Green Communications: Theoretical Fundamentals, Algorithms, and Applications", published by CRC Press in September 2012. He won 2017,2019,2021 IEEE System Journal Best Paper Awards. He won the 2018 IEEE Green Communications and Computing Technical Committee Best Magazine Paper Award. He was the founder and founding Chair (2011-2017) of IEEE Technical Committee on Green Communications and Computing (TCGCC). Jinsong Wu was Chair (2022-2024) and the co-founder (2014) and founding Vice-Chair (2014-2022) of IEEE Technical Committee on Big Data (TCBD).

Liang Xue*, Nghia Tran
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Development of highly potent fluorogenic triplex-specific ligands

Triplex-Forming Oligonucleotides (TFOs) have long attracted interest due to their remarkable sequence specificity in targeting duplex DNA, allowing recognition of extended DNA sequences. However, the formation of triplex structures is both thermodynamically and kinetically unfavorable under physiological conditions. To address these limitations while preserving the specificity of TFOs, researchers have developed small-molecule ligands that selectively stabilize triplex DNA. In this study, we present a novel class of highly potent fluorogenic ligands specific to triplex DNA, derived from natural flavone scaffolds. We evaluated their binding affinity and specificity for triplex DNA using a range of biophysical techniques, including UV thermal denaturation, fluorescence spectroscopy, circular dichroism, and gel mobility shift assays. These ligands effectively inhibit enzymatic activity through ligand-mediated triplex formation. Notably, they exhibit excellent selectivity for triplex DNA, inducing intense blue fluorescence, whereas they show negligible fluorescence enhancement with duplex DNA. Overall, our studies show that these ligands have strong potential as fluorogenic probes for detecting triplex DNA and as therapeutic agents for gene-regulation applications.

Biography

Dr. Liang Xue earned his Bachelor of Science in Chemistry from Fudan University in China in 1996 and his Ph.D. in Bioorganic Chemistry from Clemson University in 2004. He then completed postdoctoral training at Johns Hopkins University from 2004 to 2007. He is now a Professor of Chemistry at the University of the Pacific. His research focuses on understanding the interactions between small molecules and DNA secondary structures, specifically G-quadruplexes and triplexes. Dr. Liang research is supported by grants from the University of the Pacific, the National Science Foundation, and the National Institutes of Health.

Long Lyu*, Shengjie Huang, Yongrui Luo, Xunchu Cheng, Qilong Shen

State Key Laboratory of Fluorine and Nitrogen Chemistry and Advanced Materials, Shanghai Institute of Organic Chemistry, University of Chinese Academy of Sciences, Chinese Academy of Sciences, China

A modular approach to N-fluoroalkyl amides via nitrene insertion into fluoroalkylcopper(I)

This work presents a modular and efficient synthetic strategy for the construction of N-fluoroalkyl amides via nitrene insertion into fluoroalkylcopper(I) species, addressing a long-standing challenge in organofluorine chemistry related to the formation of C–N bonds bearing fluoroalkyl substituents. Traditional approaches to such motifs are often limited by harsh conditions, narrow substrate scope, or the need for prefunctionalized starting materials. In contrast, this method enables the direct and flexible assembly of N-fluoroalkyl amides from readily available precursors, thereby offering a more practical and general solution.

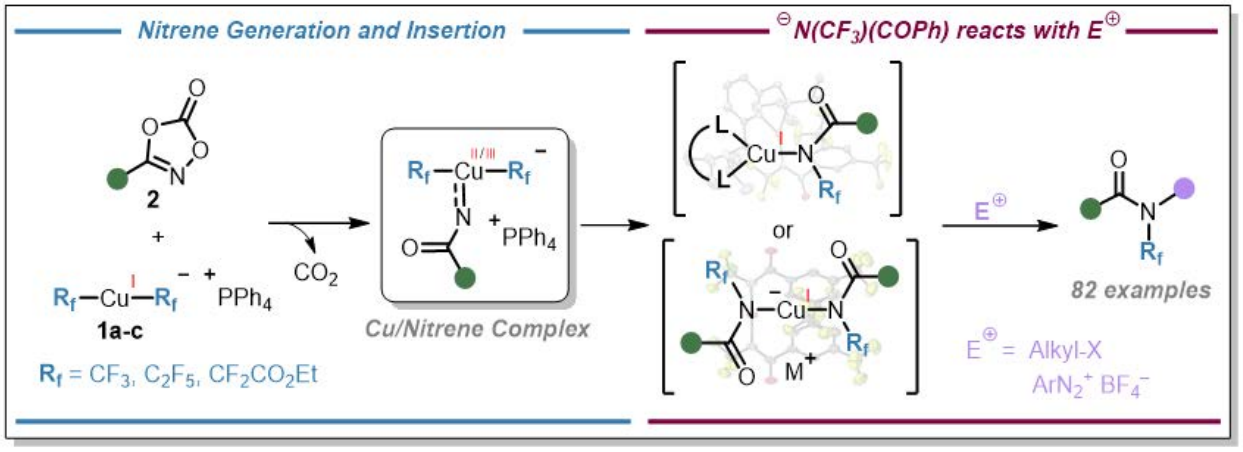
The reaction exhibits a broad and versatile substrate scope. A wide range of fluoroalkyl groups can be effectively incorporated, including both perfluoroalkyl chains and partially fluorinated alkyl groups with varying electronic and steric properties. In parallel, different nitrene precursors are well tolerated, allowing for the synthesis of structurally diverse amide products. The transformation demonstrates excellent compatibility with various functional groups, such as esters, halides, nitriles, and heterocycles, as well as both electron-rich and electron-deficient aromatic systems. This broad applicability underscores the robustness of the catalytic system and its potential utility in complex molecule synthesis.

Mechanistic investigations provide valuable insight into the nature of the transformation. Experimental studies support the involvement of a key fluoroalkylcopper(I) intermediate, which undergoes nitrene transfer to form the desired C–N bond. Control experiments, including radical trapping and reactivity studies, suggest that the reaction does not proceed through a free radical pathway. Instead, the data are consistent with a concerted insertion mechanism or a closely related stepwise process involving a well-defined organometallic intermediate. The copper center is believed to play a crucial role in both activating the fluoroalkyl substrate and

stabilizing reactive intermediates, thereby enabling efficient and selective bond formation. Additional observations, such as ligand-dependent reactivity and substituent effects, further support the proposed mechanism and provide insight into the factors governing reactivity and selectivity.

The practical utility of this methodology is further demonstrated through its application to gram-scale synthesis and the late-stage functionalization of structurally complex molecules. These features highlight the scalability and functional group tolerance of the protocol. Importantly, N-fluoroalkyl amides represent valuable structural motifs with potential relevance in medicinal chemistry and agrochemical development. The incorporation of fluoroalkyl groups is known to modulate key physicochemical properties, including lipophilicity, metabolic stability, and membrane permeability. Although the direct application of these specific motifs as bioisosteres remains to be fully explored, their structural characteristics suggest promising potential for future investigation in drug discovery and molecular design.

Overall, this work establishes a general and practical platform for the synthesis of N-fluoroalkyl amides, combining broad substrate scope, mechanistic insight, and synthetic utility. It not only advances the methodology for constructing fluorinated amine derivatives but also opens new opportunities for the exploration of these motifs in pharmaceutical and materials chemistry.



Scheme 1: Three-component synthesis of N-fluoroalkyl amides.

Biography

Dr. Long Lu currently a professor at State Key Laboratory of Fluorine and Nitrogen Chemistry and Materials, Shanghai Institute of Organic Chemistry (CAS). His research spans organic fluorine chemistry, fluorine-containing functional materials, energetic materials, novel pesticides, and traditional Chinese medicine polysaccharides. He has received numerous honors, including the CAS Natural Science Award (1995, 1998), the Youth Chemistry Award (1993), selection for the CAS "Hundred Talents Program" (1997), and the National Science Fund for Distinguished Young Scholars (1998). He also holds significant academic and advisory roles in national scientific committees and professional societies.

Madhulata Shukla

Department of Chemistry, Gram Bharti College, Ramgarh,
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Synthesis of copper oxide nanoparticles using curcumin and investigation of molecular interactions through DFT analysis

Copper Oxide (CuO) nanoparticles have garnered considerable attention due to their unique properties and diverse range of applications. Researchers have developed various methods for synthesizing CuO nanoparticles, spanning physical, chemical, and biological approaches. These nanoparticles play a crucial role in fields such as electronics, energy storage, photocatalysis, medicine, and materials science. The synthesis of copper oxide nanoparticles using curcumin has been successfully conducted in an environmentally friendly solvent. We explored the molecular interactions between curcumin, a naturally occurring polyphenolic compound known for its numerous health benefits, and copper oxide nanoclusters using Density Functional Theory (DFT). Understanding the molecular-level interaction between curcumin and these nanoclusters is vital for advancing applications in drug delivery, bioimaging, and therapeutics. The DFT calculations align well with experimental results, including UV-visible and IR spectra. A comprehensive analysis of the density of states indicates that curcumin functions not only as a reducing and stabilizing agent for copper nanoclusters but also plays a role in activating the nanoparticles by lowering the band gap in CuO nanoparticles. The research also delves into the photocatalytic degradation of the organic pollutant 4-nitrophenol under different conditions, such as acidic and basic environments, with and without visible light irradiation. The findings reveal that in a basic environment, the degradation of 4-nitrophenol remains minimal regardless of the presence of light. On the other hand, in an acidic environment, the degradation process occurs slowly in the absence of light, but significantly accelerates when exposed to light, as shown in Figure 1. DFT calculations explain the charge distribution and interaction between curcumin and CuO nanoclusters.

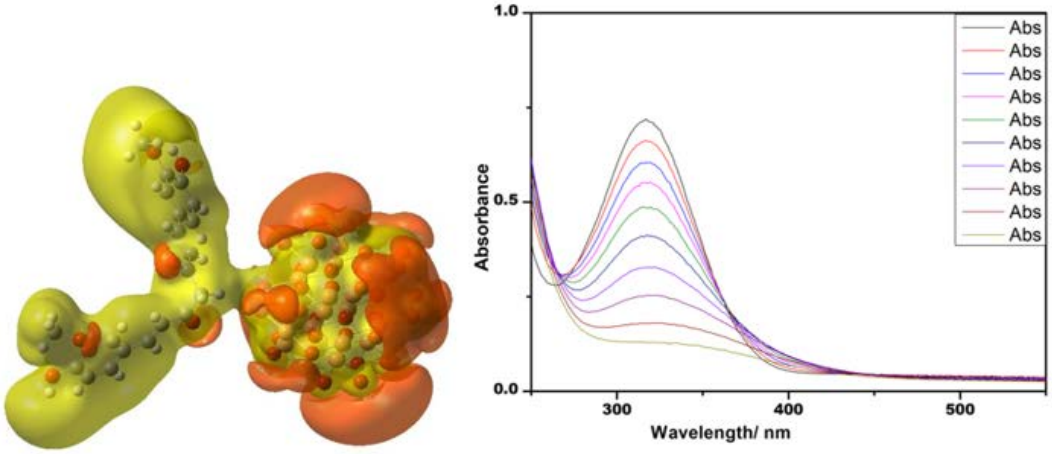

Figure 1. (a) Electrostatic potential charge distribution on CuO-curcumin, (b) The photocatalytic reduction of PNP using CuO nanoparticle in the acidic medium in the presence of LED light.

Keywords: Copper Oxide Nanoparticles, Curcumin, Molecular Interaction, DFT Calculation.

Biography

Dr. Madhulata Shukla has received her B. Sc and M. Sc. Degree from Banaras Hindu University. She completed her Ph.D from Department of Chemistry, Institute of Science, BHU in 2014. After that she moved to Department of Chemistry, IIT-BHU for Post-doctoral research. At present she is a permanent faculty in Department of Chemistry, G. B. College Ramgarh, Veer Kunwar Singh University, Bihar. Her present research interests are: Synthesis, structure and interaction in Ionic Liquids, Spectroscopic study, DFT calculation, Nanoparticle synthesis in Ionic Liquids.

Dr. Mai Yan Yuen

Department of Chemistry, The University of Hong Kong, Hong Kong

Utilizing generative AI for interactive borane modeling: Insights from Wade's rule in undergraduate education

Boranes, a class of electron-deficient cluster compounds, exemplify the principles of polyhedral skeletal electron pair theory as described in Wade's Rule. As these borane clusters are 3D in nature, and have a different geometries compare to other organic compounds, understanding and predicting the borane cluster's three-dimensional structures is challenging for the students in introductory chemistry curricula. This study explores the application of generative Artificial Intelligence (AI) models, including Grok and DeepSeek, to generate interactive, structurally accurate borane models, serving as an innovative pedagogical tool for visualizing chemical bonding concepts.

We prompted these AI systems with descriptions of simple boranes (e.g., B_2H_6, B_5H_9) guided by Wade's Rule, requesting 3D structural outputs in html format. For simple closo-, nido-and arachno boranes, such as $B_4H_4^{2-}$, the AI produced geometrically precise models, correctly predicting the borane cluster geometries, bridge hydrogens, and electron counts. Interactive features, such as rotatable animations and orbital overlays, were seamlessly integrated, enhancing student engagement during virtual simulations.

However, challenges emerged with hyper-complex higher boranes where AI outputs deviated from Wade's predictions, possibly due to the training data biases toward common organic motifs. Refinement through iterative prompting mitigated some inaccuracies, yielding 85% structural fidelity for benchmark cases.

This AI-driven approach offers a dynamic, accessible entry point for undergraduate discussions on multicentre bonding and cluster topology. By utilizing generative AI tools, it fosters intuitive understanding without prerequisite computational expertise, paving the way for the incorporation of AI in chemical education.

Biography

Dr. Angela M.Y. Yuen is the Associate Head (Teaching & Learning) in the Department of Chemistry at the University of Hong Kong. She obtained her PhD degree in Chemistry from the University of Hong Kong, focusing on luminescent materials and molecular self-assembly of organometallic complexes. Angela is a dedicated academic and programme leader with over 14 years of experience in higher education, specializing in strategic planning, curriculum development, science outreach, and youth engagement. She has expertise in stakeholder liaison and community outreach, with a strong track record of developing innovative programmes and publicity campaigns. Angela has achieved the status of Fellow (FHEA) in recognition of her attainment against the UK Professional Standards Framework for teaching and learning support in higher education. She has also been actively involved in organizing various academic and outreach programmes, including the MSc in the field of Chemical Technologies for Health and Materials (MSc CTHM), HKUSI Chemistry Summer School, and partnership with the Department of of Chemistry at Imperial College London to establish summer research programme for undergraduate students. In recognition of her innovative and effective teaching, Angela is awarded the HKU Faculty of Science award for E-innovation in 2020 and the Award for Teaching Excellence in 2024.

Malayil Gopalan Sibi*, Rajenahally V. Jagadeesh, Radek Zboril

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Empowering a sustainable future by biomass conversion on single atom catalysis

Efforts have traditionally concentrated on the use of organic carbon as bioenergy, to produce chemicals and fuels. In the past decade, technologies have been developed to recover high-value commodities from renewable feedstocks. Simultaneously, innovative heterogeneous catalytic processes have been proposed to produce chemicals that can be immediately reused from the biowaste to facilitate a renewable future. Several biomass conversion techniques based on supported metal catalysts comply with most green chemistry principles, provided that metal particles and supporting materials leach into the reaction medium. Metal-catalyzed biomass conversion reactions including hydrogenation, dehydrogenation, deoxygenation, and oxidation reactions will achieve by multistep conversion in a single pot, maybe in combination with acid/base-catalyzed reactions like hydrolysis and dehydration reactions. Apart from Nanoparticle Catalysts (NCs) which contain bulk metals, Single Atom Catalysts (SACs) expose all metal atoms on the surface with a 100% metal utilization rate. Current single metal atom catalysts based on carbon supports relay on in plane doping, limiting the interactions with the substrates due to the geometry and interlayer stacking phenomena of the carbon sheets. Therefore, here, Lignocellulosic biomass conversion using SACs on various supports such as Zeolites, Metal Oxides and Graphene to be addressed.

Biography

Dr. Malayil Gopalan Sibi completed his masters, MSc-Chemistry and MTech and later received PhD in chemical science from AcSIR India. The outcome of the research was the development of “Single-step route for lipids to bio-jet fuel”, Currently, this biofuel technology is under progress to be commercialization (TRL 10 stage). In 2016 February, he Joined in the Institute for Advanced Materials Chemistry (SAIAMC) at the University of the Western Cape, later moved to University of Lavel, Quebec and then, in 2018, he moved to SKKU South

Korea, as Research Professor (BK+21). He has published more than 30 research articles, filed 7 Indian and 1 US patent. Currently, Dr. Malayil Gopalan Sibi is working as an Individual Marie Sklodowska Curie Action (MSCA-2023-PF-01) fellow as well as senior researcher.

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SIMS profiles of alteration films formed on the surface of alkali-resistant glass in acidic and basic environments

The aim of this study is to analyze in depth the elemental profiles of the alteration films formed on the altered surface of alkali-resistant zirconium containing glasses in acidic and basic environments, using Secondary Ion Mass Spectroscopy (SIMS) or ion probe. For this, we have developed 5 glass compositions: V1 (with zirconium and without heavy metals) and V2 (with zirconium and heavy metals), then three glasses of fly ashes V3 (without zirconium and with heavy metals), V4 (with 30% of V3, zirconium and heavy metals) and V5 (with 60% of V3, zirconium and heavy metals). SIMS profiles obtained on the alteration layers of glasses V1, V2, V3, V4, and V5 using the ion probe made it possible to observe the behavior of the elements H, Na, K, Ca, Si, and Zr at 28 days and at pH=4 and 13, and to understand the different dissolution mechanisms involved. At pH=4 and 13, the profiles showed that a hydrated layer developed on the surface and was characterized by an enrichment in hydrogen H and a depletion in sodium Na regardless of the glass. These 5 glasses were also characterized by a surface enrichment in zirconium (except V3, which did not contain zirconium) regardless of the pH. Other elements behaviour (K, Ca, and Si) was strongly linked to the glass composition. SIMS profiles highlighted the low hydration of glasses V4 and V5 compared to the other glasses and confirmed the enrichment of the alteration layers in zirconium and their depletion in Na.

Biography

Mrs Mbemba Kiele Molingo received her PhD degree from the University of Paris-Est (France) in Chemistry specializing in “Geomaterials and Environment” in 2010. She was recruited as a Permanent Teacher in Marien NGOUABI University in Congo at 2012, then assigned to the Faculty of Science and Technology, in the chemistry track. As soon as she took up her post, she joined the Plant and Life Chemistry Unit as a home structure for her participation in training

and her research development. In 2020, she registered with CAMES and was confirmed on the Assistant Professor aptitude list of Marien NGOUABI University. She has published more than 20 research articles in scientific peer-reviewed journals.

Mikhail Budyka
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Mechanisms of forward and reverse [2+2] photocycloaddition of ethylene derivatives: Concerted addition according to the Woodward-Hoffmann rules and stepwise ring opening via predissociation

The [2+2] Photocycloaddition (PCA) reaction of ethylene derivatives results in the formation of cyclobutane derivatives and is one of the most fundamental reactions widely used in organic synthesis for the construction of strained carbocyclic systems, natural product synthesis, and in materials chemistry. According to the symmetry of the molecular orbitals, the ground state of the two ethylene molecules participating in the PCA reaction correlates with the excited state of cyclobutane, and vice versa. Therefore, both the forward ring-closing reaction and the reverse ring-opening reaction (retro-PCA) are considered to obey the Woodward–Hoffmann rules for concerted pericyclic reactions: Both reactions are thermally forbidden in the ground state, but photochemically allowed in the excited state.

However, experimental and theoretical data indicate that for substituted ethylenes having an unsaturated substituent conjugated with the π-bond of ethylene, the mechanisms of the forward and reverse reactions are fundamentally different.

If the ethylene double bond is incorporated into the common π-conjugated chain, the Long-Wavelength Absorption Band (LWAB) of the substituted ethylene is determined by the entire conjugated π-system. Upon irradiation with relatively soft light in the LWAB region, the desired “ethylene” ππ*-excited state is populated, and the forward PCA reaction proceeds in a concerted manner according to the Woodward—Hoffman rules.

To obey the Woodward–Hoffmann rules, the reverse retro-PCA reaction requires excitation of cyclobutane into the σσ*-excited state, which can only be populated upon irradiation with hard UV light. The LWAB of substituted cyclobutane is determined by the absorption of the substituents. In this case, upon irradiation with light in the LWAB region, the binding ππ*-excited state, in which the excitation energy is localized on the substituent, is first populated. The energy must then be transferred to the cyclobutane core and localized on the cyclobutane σ-bond to initiate bond cleavage and ring opening. The transition from the binding state to the dissociative state corresponds to the predissociation mechanism. The rupture or the first σ-bond of cyclobutane leads to the formation of a tetramethylene biradical intermediate, which then either completely cleaves into two molecules of substituted ethylene or is converted back to cyclobutane.

It is obvious that the predissociation mechanism is characteristic of the majority of practically important cyclobutanes, in which, upon irradiation with light, the π-system of the substituent, rather than the σ-system of the cyclobutane ring, is excited.

The study was performed in accordance with the State task No. 124013000686-3.

Biography

Mikhail F. Budyka is a Doctor of Chemical Sciences, Professor, Head of the Laboratory of Organic and Supramolecular Photochemistry at the Federal Research Center of Problems of Chemical Physics and Medicinal Chemistry, Russian Academy of Sciences, Chernogolovka, Russia. Research interests: Molecular photonics, Supramolecular Photochemistry, Photodissociation of (hetero) aromatic azides; Photoisomerization, photocyclization and [2+2] photocycloaddition of heteroaromatic diarylethylenes; Photoinduced electron, proton, and energy transfer in supramolecular systems; Hybrid nanosystems based on quantum dots and photoactive organic ligands; Fluorescent photochromes; Photonic molecular switches and logic gates; Quantum chemical description of chemical reactions.

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Membranes modified with photocatalytic structures based on TiO_2 nanoparticles and carbon nanoparticles

The Membranes (MEMs), modified through the incorporation of photocatalytic structures as for example the one based on TiO_2 nanoparticles in combination with different types of carbon nanoparticles, represent a valuable alternative to conventional systems used for physical filtration. They are acting as hybrid structures which benefit not only of their overall properties generated by their components but also of their synergic action. The PVC membrane plays double role both in physical separation processes and as a catalyst support offering an extended contact at the interface with the contaminated water flux through the uniform distribution of the catalyst nanoparticles.

In this study, we used MEMs that were prepared using the phase inversion method and modified with photocatalytic blends based on TiO_2 nanoparticles and Carbon Nanostructures (CNs). The aim was to remove dyes from water. The main CNs used were Reduced Graphene Oxide (RGO), Single-Walled Carbon Nanohorns (SWCNH), and Single-Walled Carbon Nanotubes (SWNTs).

The focus will be on the characterization and testing of the MEMs based on PVC, TiO_2 and different type of CNs, in dye photodegradation reaction. Both Raman scattering and FTIR spectroscopy will be used to characterise the membranes, highlighting the contribution of the TiO_2/CNs to the performance of the PVC/TiO_2/CNs MEMs. The results obtained show that the dye degradation efficiency increased when using PVC/TiO_2/CNs MEMs compared to using PVC/TiO_2 MEMs.

In the investigated MEMs, CNs act as receptors for the photoinduced electrons generated in TiO_2. This reduces the recombination of electron–hole pairs, which normally limits the photocatalytic activity of TiO_2. Consequently, more electrons and holes are available to form reactive species such as hydroxyl and superoxide radicals, accelerating the degradation of dyes.

Of all the carbon nanoparticle tested within the PVC/TiO_2 MEMs, the PVC/TiO_2/SWNT MEMs proved to be the most efficient at photo-degrading dyes. This is due to the more efficient transfer and separation of electrical charges between the TiO_2 and the SWNTs, leading to an improved UV absorption and a longer lifetime of charge carriers.

Biography

Dr. Mirela Vaduva (formerly Ilie) is a researcher specializing in advanced materials science, with a focus on composite materials and their applications. She is affiliated with research projects in the field of water management and innovative material technologies, contributing as a postdoctoral researcher within multidisciplinary scientific teams. Her work is connected to the development and characterization of composite materials for practical engineering applications. Through her ORCID profile, she is identified as an active contributor to collaborative research initiatives, demonstrating involvement in both experimental and applied studies. Her academic activity reflects a strong engagement in materials research and interdisciplinary scientific projects.

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Advanced and synergistic treatment strategies for rubber industry wastewater: From conventional methods to ozone-based integrated systems

Water pollution is a major global concern that threatens both environmental sustainability and human health. Rapid industrialization and population growth have intensified the consumption of freshwater resources and led to the discharge of industrial effluents, agricultural runoff, and domestic waste into water bodies, resulting in widespread environment contaminations. Rubber industry is recognized as one of the primary contributors to wastewater pollution in the Malaysia. Latex centrifugation and multiple washing processes use a lot of water, resulting in effluents that are highly organic matter, including lipids, proteins, sugars, volatile acids, Ammonical Nitrogen (NH_3-N), Phosphorus contents (PO_4^{3-}-P) unstable pH, suspended solids, strong odor and elevated BOD and COD. Moreover, the expansion of glove and condom production has also raised environmental challenges, because effluent from these industries contain major contents of latex residues, pigments e.g. Phthalocyanine Blue, Red E3B 130, Blue A2R 131 and dyes e.g. Sunset yellow (FCF), and other contaminants that harm the ecosystem, moreover difficult to remove by simple processes. Thus discharge of untreated rubber effluent to waterways resulting in water pollution that affects the human health and aquatic life severely. With a new global trend towards a sustainable development, the industry needs to focus on cleaner production technology, waste minimization, utilization of waste, resource recovery and recycling of water to satisfy the Standard Discharge Limits (SDL) via traditional and modern technologies. This comprehensive review paper presents the current status of rubber industry, its environmental impacts, discussion of traditional and modern treatment methods, including physical, chemical, biological and advanced oxidation processes categorizing them into pre-treatment, secondary, and tertiary treatment processes the advantages and dis¬advantages. Special attention is made to elaborate the ozone based synergetic methods emerging with nanotechnology and other advanced processes. Besides, this review paper discovers

more about the potential of reactors and integrated methods which apply the synergetic effectiveness of processes to achieve the recycling of treated wastewater and the sustainable development of water resources. These new and effective effluent treatment methods would minimize environmental pollution of rubber industry and bring it to become sustainable and environmental friendly in Malaysia. Lastly, challenges and future perspectives in developing treatment technology for rubber industry wastewater are proposed to achieve sustainable and integrated water management. The paper also explores the potential of utilizing untreated or treated wastewater and by-products of wastewater treatment in contributing towards achieving several United Nations Sustainable Development Goals (UN-SDGs); SDG 6, SDG 7, SDG 9, and SDG 12.

Biography

Muhammad Shahid Iqbal is a Ph.D. researcher in Industrial Chemistry at Universiti Malaysia Sabah (UMS), Malaysia, specializing in advanced oxidation processes (AOPs) for industrial wastewater treatment. His work emphasizes emerging technologies, particularly sonophotocatalysis and photo-ozocatalysis, for the efficient degradation of complex pollutants. He has previously served as a Lecturer in Chemistry at the University of Education, Lahore, and the Punjab Group of Colleges, Pakistan, contributing to both teaching and academic development. His research interests include advance oxidation processes (AOPs), environmental remediation, and sustainable treatment technologies.

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Design and synthesis of poly(thioether) dendrimers

Polythioether dendrimers constitute a versatile class of three-dimensional macromolecules that combine the structural precision of dendritic architectures with the chemical functionality of sulfur-containing linkages. In this presentation, we will describe an efficient and modular synthetic strategy for the preparation of polythioether dendrimers through the synergistic use of esterification and thiol-ene “click” reactions. The approach relies on iterative growth cycles in which multifunctional cores units bearing hydroxyl groups are first elaborated via esterification to introduce alkene functionalities. Subsequent thiol-ene coupling with thiol-containing building blocks proceeds under mild conditions to afford thioether linkages with high efficiency.

The orthogonality and robustness of these two transformations enable precise control over dendrimer generation, size, and surface functionality. Esterification provides a reliable means to construct the dendritic scaffold, while thiol-ene chemistry offers a highly selective and tolerant route to install thioether bonds without the need for protecting groups. The stepwise repetition of these reactions allows for the rapid buildup of higher-generation dendrimers with low defect densities and narrow dispersities. Furthermore, the modular nature of the synthesis permits the incorporation of a wide range of functional groups at the periphery or within the dendritic interior, facilitating the tuning of physicochemical properties such as solubility and chemical reactivity.

Biography

Dr. Narra Rajashekar Reddy is a Scientific Researcher (R1) at the National Institute for Research and Development of Isotopic and Molecular Technologies (INCDTIM) in Cluj-Napoca, Romania. Specializing in synthetic organic chemistry, he obtained his Ph.D. from Indian Institute of Technology Madras in 2019, and then moved to the Hong Kong University of Science and Technology (HKUST) for postdoctoral research. Currently, he focuses on the PNRR-funded synthesis of novel antibacterial dendrimers. His expertise includes multi-step synthesis, developing efficient step-economical synthetic methodologies and green chemistry applications that continue to drive innovation in sustainable drug discovery and advanced materials.

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Computer modeling of the Li,La,K||Cl phase diagram: Digital twins for PD variants, cross-validation of horizontal and vertical material balances, electrical conductivity & DTA spectra simulation

Chloride ternary systems based on LiCl–KCl are widely used as catalytic materials and as electrolytes in spent nuclear fuel reprocessing, where accumulation of lanthanides and actinides' fission products occurs. However, traditional experimental determination of phase diagrams is resource-intensive, and published diagrams often contain graphical errors or inconsistencies due to the complexity of 3D spatial structures. To address these challenges, a comprehensive 3D computer modeling methodology has been developed. Within this approach, 3D computer model reproduces the geometric structure of a phase diagram according to a specific literature source. When conflicting data exist for the same ternary system, multiple digital twins are constructed, each representing one possible variant of its phase diagram structure. This enables direct visual comparison, detection of inconsistencies, and identification of which variant better corresponds to the fundamental laws of phase equilibria.

In the present work, this methodology is applied to the LiCl–$LaCl_3$–KCl system, for which two substantially different versions of the phase diagram have been reported in the literature. The first version, based on thermodynamic optimization, considers the formation of two compounds: K_2LaCl_5 (congruently melting) and $K_3La_5Cl_{18}$ (incongruently melting). According to this source, the ternary system is characterized by two eutectic reactions (E_1 and E_2) and one quasi-peritectic transformation (Q). The second version, based on direct experimental data, also includes two compounds—K_2LaCl_5 and KLa_3Cl_{10}—but with different stoichiometry of the incongruently melting phase. Both models share the same topological prototype but differ fundamentally in the compound stoichiometry, coordinate systems (mole fractions vs. weight fractions; Kelvin vs. Celsius).

Beyond resolving inconsistencies between conflicting literature sources, 3D models of phase diagrams can enable cross-validation of horizontal and vertical material balances, as demonstrated for the analogous Li,M,K||Cl (M=Nd,Pr,La) systems, providing coherence analysis of polythermal sections at fixed temperatures and for specific compositions. The methodology is equally applicable to catalytic materials design, where precise knowledge of phase equilibria guides synthesis and processing. Furthermore, the 3D models facilitate education by providing intuitive visualizations of complex phase relationships, allowing students to understand the family of eutectic-type diagrams with different degrees of phase region degeneration and to recognize graphical errors in erroneous interpretations of experimental or computational data.

The work was performed under the state assignment of IPMS SB RAS (project 0270-2024-0013).

Biography

Maria Parfenova is a Materials CAD Laboratory Engineer and Ph.D. student at the Institute of Problems of Materials Science (IPMS), SB RAS. She has Participated in several international conferences, including CALPHAD Global Conference 2021, CYSC-2021 (Serbia), ICMS-2021 (Mongolia), Society and Science: Problems and Prospects (London, 2022), SIPS-2022 (Thailand), MSDAM-2022 (Belarus), and CCT conferences (Paris 2024, Rome 2025).

Priyanka Sahariah
University of Iceland, Iceland

EUROSTOP: Advancing diagnosis and treatment of antibiotic-resistant bacterial infections in Europe

The emergence and spread of drug-resistant bacteria are an important health and socioeconomic threat with global dimensions. Unavailability of drugs and poorly effective diagnostic tools negatively impacts the treatment and survival of critically ill patients. Current research in this field is highly fragmented and monodisciplinary, thus limiting the development of innovative diagnostic and therapeutic solutions. The cost action, EURESTOP, brings together over 500 European scientists from 49 countries with different skills and expertise (industrial and academic) in a multidisciplinary and concerted initiative. The action combine disciplines such as chemistry, physics, bioinformatics, genetics, biology, immunology, and medicine to understand the genetic and molecular bases of bacterial drug resistance, work on developing innovative diagnostic tools and delivering lead/pre-clinical candidates, antibody-based therapies, and clinical-ready repurposed drugs towards the personalized treatment of drug-resistant bacterial infections. Since 2022, the action has been actively working on three main areas: 1) Genomics-Proteomics-Glycomics and Diagnosis: Creating and updating a priority list of the most prevalent and potentially dangerous bacteria and development of novel biosensors for the diagnosis of pathogenic DR bacteria; 2) Microbiology–Microbiota: Characterizing the mechanisms of drug resistance at the molecular and cellular levels and elucidating the structural features of proteins or other macromolecules involved in drug resistance and 3) Drug Design and Delivery: Designing and synthesizing novel potential agents and immune therapies to counteract DR bacteria and creating the Action's library of compounds for screening purposes. Additionally, this action has been actively working to enhance networking among European scientists e.g., by the creation of novel SMEs, by knowledge creation and sharing and training young scientists in multiple aspects related to bacterial drug resistance. The aim of this presentation is to highlight the achievements and ongoing activities of EURESTOP and attract more experts to join the action to foster collaboration and knowledge sharing.

Biography

Priyanka Sahariah is currently working as a Research Scientist at the University of Iceland with research focused on synthesis of bioconjugates for biomedical application. She is also working as a Senior Scientist at the biopharmaceutical company, Alvotech, Iceland and holds the position of the Grant Awarding Coordinator for the EURESTOP COST Action. Priyanka Sahariah completed her PhD in Medicinal Chemistry from Department of Pharmaceutical Sciences, University of Iceland. After her PhD, she worked as a postdoctoral researcher in the field of peptide synthesis, synthesis of biopolymer conjugates and eradication of bacterial biofilms.

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Computational study of pillararenes as selective sorbents for greenhouse gases

Pillar[n]arenes (P[n]A) are emerging as highly tunable supramolecular materials for CO_2 capture and industrial gas separation, yet the molecular factors governing their adsorption performance remain incompletely understood. Unlike traditional rigid frameworks, the unique "pillar" architecture of these macrocycles provides a symmetrical, electron-rich cavity that can be precisely engineered for specific guest molecules. In this work, we combine high-level Density Functional Theory (DFT) and Density Functional Tight Binding (DFTB) calculations with rigorous experimental characterization to systematically investigate how cavity size, guest polarity, and functionalization influence adsorption in P[n]A-based systems. Our computational results reveal that CO_2 binds most strongly at "cavity-in" sites of P[4]A and P[5]A through a delicate balance of multiple non-covalent interactions. Specifically, the binding energy is dominated by C-H --- O hydrogen bonding and π-π interactions between the aromatic host rings and the guest molecule. In contrast, common flue gas components such as CH_4, N_2, and CO exhibit significantly weaker physisorption, as they lack the significant quadrupole moment and polarizability required to stabilize within the confined macrocyclic space. Furthermore, toxic gases including NO_2 and NH_3 show enhanced adsorption profiles, suggesting that these materials could serve a dual purpose in both carbon mitigation and environmental remediation. To further refine these properties, we investigated functionalized derivatives, including P[5]A-OCH_3, P[5]A-OCOH, and the oxidized P[5]Q (Pillar[5]quinone). These modifications tune the binding strength by modulating electronic redistribution across the phenolic units and inducing subtle shifts in the cavity geometry. Experimentally, the optimized synthesis and recrystallization of P[5]-OH and P[5]Q confirm these host-guest interactions via Infrared (IR) spectroscopy and ab initio analysis, showing clear vibrational shifts that correlate with predicted binding affinities. Upon activation, P[5]A-OH forms stable, crystalline porous frameworks that achieve high CO_2/N_2 selectivity. Crucially, these materials

maintain their structural integrity and performance under both dry and humid conditions, a vital requirement for real-world flue gas processing. By bridging the gap between quantum mechanical simulations and macroscopic gas-uptake measurements, this study provides a unified structure-property framework. These results offer a predictive roadmap for the rational design of next-generation P[n]A sorbents tailored for high-efficiency carbon capture and industrial gas purification.

Biography

Quoc Duy Ho is a computational materials physicist and tenured researcher at the University of Stavanger, Norway. His research investigates point defects in semiconductors and the adsorption properties of porous materials for energy applications using first-principles simulations. He earned his Ph.D. (magna cum laude) from the University of Bremen, Germany (2019), where his doctoral work focused on defect physics in wide-bandgap semiconductors, combining hybrid functional theory with experimental EPR studies. His current work includes defect engineering for solar cell materials and the computational design of porous structures for CO_2 capture and utilization.

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Enhanced photocatalytic activities of $NaLi_{1.07}Co_{2.94}(MoO_4)_5$ nanoparticles under solar light

$K_3NaCo_4(MoO_4)_6$ photocatalyst has been prepared using a solid-state reaction method. First, its crystal structure is determined from single-crystal X-ray diffraction data. This material crystallizes in trigonal system, space group $R3^-$ (No.148) with cell parameters a=14.434(3)Å and c=19.811(6)Å. The crystal structure of the title compound can be described by the junction of ribbons and MoO_4 tetrahedra by sharing vertices to give a three-dimensional framework in which Na^+ and K^+ cations are resided. Second, the as prepared sample has been characterized by X-Ray Diffraction (XRD), Fourier Transform Infrared (FTIR), Raman spectroscopy, UV–visible spectroscopy, Scanning Electron Microscope (SEM) and EDX analysis. The SEM analysis demonstrates the presence of agglomerates with uniform nanoparticles having different crystallite sizes. FTIR and Raman spectra confirm the presence of characteristic MoO_4 tetrahedra. Moreover, the optical band gap was found to be 3.5eV. Finally, the photocatalytic removal of Acid Yellow 23 (AY-23) organic azo dye was investigated under solar light in the presence of $K_3NaCo_4(MoO_4)_6$ photocatalyst and H_2O_2. A good photocatalytic activity for the degradation of AY-23 dye has been noted with a removal rate reaching 98% when adding H_2O_2 at optimum reaction.

Biography

Rawia Nasri have a PhD in chemistry. He carried out three postdoctoral positions. The first one was in 2018-2019 at the laboratory of materials at the University of Tunis Elmanar, the second one was in 2019-2021 for a postdoc in industry for wastewater treatment. The third postdoctoral position was in 2021-2022 at the laboratory of materials and crystal chemistry in Tunisia.

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Abzymes (catalytic antibodies) as a generation of unique biomarkers, biocatalysts, potential targets and translational tools towards nanodesign-driven antibody engineering and precision medical practice: From magic bullet to precision weapon

Antibodies (Abs) endowed with catalytic (enzymatic) properties (DNA-and RNA-hydrolizing, proteolytic ones and others) have been isolated from the serum of patients with different chronic diseases. Disease-associated abzymes may have been "induced" by the Ag implicated in the disease and might precisely control a wide variety of physiological processes and thus are important drug targets. Regarding abzymes, their phenomenal property mentioned is buried in the Fab-fragment of the Ig molecule and is appearing to sound as a functional (Ag-binding and enzymatic) property of the Ab molecule.

The primary translational potential of abzymes (Ab-proteases, predominantly) and thus of this knowledge is in the rational design of new therapeutics to exploit the role of the key pathways in influencing disease. The latter is a brand-new field of chemical engineering. For instance, abzymes can selectively cleave the peptide bonds of the virus coat protein, thereby preventing the virus from binding to target cells.

Selective chemical modification of abzymes can be used to create novel proteins, particularly enzymes and Abs, with altered specificities and catalytic activities. Abzymes can be chemically engineered to make proteins of higher affinity or smaller molecular variants that retain or change the functional properties of the original Ab. In this context, targeted Ab-mediated proteolysis could thus be applied to isolate from Ig molecules catalytic domains containing segments to exert proteolytic activity and then be used as therapeutic modifiers. Ab-based therapeutics have entered the central stage of drug discovery as a result of a major shift in focus of many biotech and biopharma companies. Modification strategies should soon yield a wide spectrum of novel biomolecules whose activities are optimized for therapeutic applications.

Catalytic Abs can be artificially engineered, or elicited by immunizations. Their mechanisms of action include nucleophilic catalysis, induction of conformational strain, coordination with metal ions, and stabilization of transition states. The latter means that catalytic Abs made it feasible to develop new biocatalysts, which are widely used in chemistry, biology, life sciences and medicine.

Abzymes can be programmed and reprogrammed to suit the needs of the body metabolism. Or biodesigned for the development of principally new catalysts with no natural counterparts. A catalytic antibody has multiple functions compared with a Monoclonal antibody (Mab) because it possesses unique features to digest antigens enzymatically. Therefore, many catalytic Abs, including their subunits, are developed. Moreover, several evidence-based cases demonstrate the potential for a new method of creating catalytic Abs from the corresponding monoclonal Abs.

Recent applications of abzymes with clinical significance include the conversion of cocaine to a non-psychoactive form, the degradation of nicotine, activation of prodrugs for targeted chemotherapy, protection from ultraviolet radiation, inhibition of HIV infectivity, and the destruction of aggregates of β-amyloid implicated in Alzheimer's disease.

Of tremendous value are Ab-proteases directly affecting remodeling of tissues. By changing sequence specificity one may reach reduction of a density of the negative proteolytic effects within the myelin sheath and thus minimizing scales of demyelination.

The immobilization of abzyme has been successful and will greatly promote the process of industrialization. Thus, abzyme study has an important value in theory and practice for biology, chemistry and medicine. Further studies on targeted Ab-mediated proteolysis may provide biomarkers of new generations and thus a supplementary tool for assessing the disease progression and predicting disability of the patients and persons-at-risks. And the new approach is needed to secure artificial or edited Ab-proteases as unique translational probes to diagnose, to monitor, to control and to treat and rehabilitate autoimmune conditions patients

at clinical stages and to prevent the disorder at subclinical stages in persons-at-risks to secure the efficacy of preventive, prophylactic and restorative manipulations.

Biography

Dr. Sergey Suchkov was born in Astrakhan, Russia, into a family of medical doctors. He earned his MD from Astrakhan State Medical University in 1980 and his PhD from Sechenov University in 1985. He received advanced training at the NIH (Bethesda, USA), Wills Eye Hospital (Philadelphia, USA), and several British universities under the Royal Society for Immunology. Dr. Suchkov has held numerous academic and leadership roles, including Director of the Division for Clinical Immunology & Immuno biotechnology at MONIKI, and Professor and Chair of the Department for Personalized & Precision Medicine at Sechenov University. He has also served as Vice-Director of the Institute for Biotech & Global Health at RosBioTech National University. Currently, Dr. Suchkov is Professor of Medicine & Immunology and Director of the Center for Biodesign at the N.D. Zelinskii Institute of Organic Chemistry, Russian Academy of Sciences. He also serves as R&D Director at InMedStar (Russia–UAE) and Senior Scientific Advisor to the China Hong Kong Innovation International Business Association. Dr. Sergey Suchkov is an active member of several international scientific organizations, including the New York Academy of Sciences, EPMA, ISPM, PMC, AMEE, ACS, AHA, ARVO, and ISER, and is Secretary General of the United Cultural Convention (UCC), Cambridge, UK.

Sergey Suchkov[1-14]*, Roger D. Kamm[15], Holland Cheng[16]

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[8]AMEE (Association for Medical Education in Europe), Centre for Medical Education, Dundee, Scotland
[9]ACS (American Chemical Society), Washington, DC, USA
[10]AHA (American Heart Association), Dallas, TX, USA
[11]ARVO (The Association in Research in Vision & Ophthalmology), Rockville, MD, USA
[12]ISER (International Society for Eye Research), Anchorage, AK, USA
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Enabling technologies for engineering precision biomaterials, biocatalysts and nanoparticles for drug delivery to re-shape personalized & precision healthcare services

Biodesigners, biotechnologists and biomanufacturers are beginning to realize the promise of PPM, translating to direct benefit to patients or persons-at-risk. For instance, companion diagnostics tools and targeted therapies and biomarkers represent important stakes for Bio-Pharma, in terms of market access, of return on investment and of image among the prescribers. So, developing medicines and predictive diagnostic tools requires changes to traditional clinical trial designs, as well as the use of innovative (adaptive) testing procedures that result in new types of data. The areas where companies are most likely to encounter chal-

lenges, are data analysis and workforce expertise, biomarker and diagnostic test development, and cultural awareness. Navigating those complexities and ever-evolving technologies will pass regulatory muster and provide sufficient data for a successful launch of PPM, is a huge task. So, partnering and forming strategic alliances between researchers, biodesigners, clinicians, business, regulatory bodies and government can help ensure an optimal development program that leverages the Academia and industry experience and FDA's new and evolving toolkit to speed our way to getting new tools into the innovative markets.

Healthcare is undergoing a transformation, and it is imperative to leverage new technologies to support the advent of Personalized and Precision Medicine (PPM). Both PPM, nanobiotechnologies, precision biocatalysts and engineering biology are new to medical practice, which are being integrated into diagnostic and therapeutic tools to manage an array of medical conditions. Novel nanomedicines, biocatalysts and design-driven biomolecules have been employed in the treatment of several diseases, which can be adapted to each patient-specific case according to their genetic profiles. For instance, clinical application of nanotheranostics would enable subclinical detection and preventive treatment of diseases.

Abzymes can fully prevent the emergence of autoimmune disorders, especially in the field of infection and immunity, where the process of its occurrence and development often takes a long time. Novel monoclonal abzyme-based therapeutics are set to revolutionize existing drug therapies targeting a wide spectrum of diseases, thereby meeting several unmet medical needs. The unique properties of abzymes make them an attractive tool in nanotechnology. They can be designed to catalyze specific reactions, allowing for the synthesis of complex molecules and nanoparticles with high precision and efficiency. Moreover, abzymes can be engineered to operate under mild conditions, making them suitable for applications in biomedical nanotechnology.

In this context, a special class of catalytic monoclonal Abs are an emerging class of therapeutics that combine two powerful modalities: The high specificity of Abs for targeting distinct cell surface antigens and the protein targeted proteolytic capabilities. This bipartite design facilitates a catalytic mode of action where a single molecule of the antibody conjugate can trigger the elimination of target proteins that may be otherwise "undruggable" with conventional small molecules or antibodies alone. The above-mentioned antibodies are being developed as a novel class of therapeutics that integrate the precision targeting capabilities of antibodies with the catalytic efficacy of protein degraders. As evidenced by both academic studies and industry partnerships documented in seminal patents and clinical reports, the field has seen rapid innovation and is transitioning from concept to clinic. The convergence of antibody engineering, targeted protein degradation, and advanced nanobiomaterial chemistry promises not only improved outcomes for patients but also a broader application across various disease modalities.

PPM has thus become an interdisciplinary challenge where nanotechnology-enabled theranostic approaches may indeed become a key driver in harmonizing the needs of the various stakeholders by allowing cost-effective delivery and monitoring of drug efficiency and safety, and close-meshed high-quality data collection.

With the support of nanotechnology and biocatalysis-driven engineering, the solubility, absorption and targeting of traditional drugs were greatly improved by modifying and fabricating with various types of nanoparticles to some extent, though many shortages remain. For instance, candidate proteins associated with disease development and progression might provide novel targets for new targeted therapeutic agents and biomaterials, or aid the development of assays for disease biomarkers and identification of potential biomarker-target-ligand (drug) tandems to be used for the targeting. Latest technological developments facilitate proteins to be more thoroughly screened and examined in the context of drug discovery and development.

Biography

Dr. Sergey Suchkov was born in Astrakhan, Russia, into a family of medical doctors. He earned his MD from Astrakhan State Medical University in 1980 and his PhD from Sechenov University in 1985. He received advanced training at the NIH (Bethesda, USA), Wills Eye Hospital (Philadelphia, USA), and several British universities under the Royal Society for Immunology. Dr. Suchkov has held numerous academic and leadership roles, including Director of the Division for Clinical Immunology & Immunobiotechnology at MONIKI, and Professor and Chair of the Department for Personalized & Precision Medicine at Sechenov University. He has also served as Vice-Director of the Institute for Biotech & Global Health at RosBioTech National University. Currently, Dr. Suchkov is Professor of Medicine & Immunology and Director of the Center for Biodesign at the N.D. Zelinskii Institute of Organic Chemistry, Russian Academy of Sciences. Also, serves as R&D Director at InMedStar (Russia–UAE) and Senior Scientific Advisor to the China Hong Kong Innovation International Business Association. Dr. Suchkov is an active member of several international scientific organizations, including the New York Academy of Sciences, EPMA, ISPM, PMC, AMEE, ACS, AHA, ARVO, and ISER, and is Secretary General of the United Cultural Convention (UCC), Cambridge, UK.

Sujit Kumar Bandyopadhyay
Retired Scientist, Variable Energy Cyclotron Centre, India

Role of d electrons in multifunctional materials

Multifunctional materials are of today's quest. A class of multifunctional materials display simultaneous ordering in different dimensions like magnetism, polarization etc. They are more known as multiferroics. Quite a significant number of them are based on perovskite structures having a transition metal ion in the body centre. The electronic configuration of this central transition element play a key role in the behavior of those multiferroics. For example, those with d^0 configuration display ferroelectricity while those with d^n (where n is non zero) generally display magnetic behavior. The d0 configuration leads to distortion of metal-oxygen bond in these perovskites and breaking of special inversion symmetry causing a local dipole moment and ferroelectricity. Often this distortion in metal-oxygen bond is caused by lone pair of electrons of non transitional cations in the corners of the perovskite structure. $BiFeO_3$ (BFO) is a shining example of this kind of distortion, where the central ion Fe(III) causes magnetism but Bi(III) ions in the corner cause the polarization leading to the multiferroicity in BFO displaying both ferroelectric and antiferromagntic ordering. The symmetry breaking manifests in different kinds of ordering. Moreover, the variable valency of the central transition metal ion with d electrons manifests in redox behavior in these materials leading to various uses. We have observed such various functions in the multiferroic BFO like ferroelectric, magnetic and high specific capacitance rendering these materials useful in green energy storage materials. More over these redox behavior of these transition metal ion also leads to antimicrobial behavior in BFO.

Biography

Dr. Sujit Kumar Bandyopadhyay is an Emeritus Fellow who served at the Meghnad Saha Institute of Technology from 2017 to 2020 and at the Institute of Engineering and Management from 2020 to 2021. He is a former Head of the Material Science Studies Division and served

as Scientific Officer (H)+ and Professor at the Homi Bhabha National Institute, Variable Energy Cyclotron Centre (VECC), Department of Atomic Energy, Government of India. He retired on superannuation on 30 September 2015. Dr. Bandyopadhyay began his career in 1978 as a Scientific Officer in the Chemical Engineering Division of the Bhabha Atomic Research Centre and joined the Variable Energy Cyclotron Centre in 1982 in the same capacity. He obtained his PhD in Physics from Jadavpur University in 1998, with a thesis titled "Charged Particle Irradiation Studies on Copper Oxide Superconductors." In 2000, he worked as a Postdoctoral Fellow at the Atomic Institute of Austrian Universities, Vienna, focusing on magnetisation studies of neutron-irradiated high-temperature superconductor single crystals. He has been a Professor at the Homi Bhabha National Institute, a deemed university, since 2009. His achievements include the National Science Talent Search (NSTS) Scholarship and the National Scholarship from the Government of India in 1971, as well as the A. P. J. Abdul Kalam Award for outstanding research.

Susanne Näf-Rüdiger

Hamilton Bonaduz AG, Via Crusch 8, 7402 Bonaduz, Switzerland

Enhancing process efficiency and safety with advanced sensor technology

At the heart of chemical manufacturing plants lie fundamental operations, including standard utility and storage processes, that are essential for the plant's functionality and success. They provide the crucial infrastructure and resources required for efficient and safe operations, therefore must be performed, and maintained using reliable and accurate tools.

Process Analytical Technologies (PAT) are tools that when used optimally, can enable enhanced process monitoring, improved product quality, increased safety and reduce operational costs. However, older measuring technologies and inefficient maintenance practices compromise plant functionality. Advanced sensor technologies offer a powerful solution to address these challenges. Not only can modern advanced sensor technologies offer improved measurement accuracy, but they often require minimal maintenance due to their superior measurement principle and construction.

This presentation will focus on the application of advanced sensor technologies to measure key parameters–pH, dissolved oxygen, and conductivity–across core techniques such as blanketing, inertization, and corrosion monitoring in pipelines and storage tanks to ensure safety, product quality, and maintain operational efficiency during chemical manufacturing. Case studies will be used throughout to demonstrate real-world applications and the benefits of correct PAT application in these core processes.

Biography

Susanne Näf-Rüdiger is an experienced Application Specialist at Hamilton Process Analytics with a strong foundation in analytical chemistry and process technology. With over 20 years of industry experience, Susanne possesses a deep understanding of the challenges faced by the chemical industry. Her extensive technical knowledge and practical experience in sensor technology enable her to provide innovative solutions to complex problems. Having held various roles at Hamilton, including Product Manager, Team Leader, and Customer Support Specialist. Susanne has a comprehensive understanding of the needs of researchers and industrial professionals. She is passionate about leveraging sensor technology to improve process efficiency, enhance product quality, and ensure safety. By working closely with customers, Susanne helps them identify their specific needs and develop tailored sensor solutions.

Prof. Susarla Venkata Ananta Rama Sastry
Harcourt Butler Technical University, Kanpur, India

Nano lubricant enhancement through hydrothermal synthesis of 2D nanoparticles: A pathway to reduced wear and enhanced efficiency

Two-Dimensional (2D) nanomaterials synthesised by hydrothermal means have become a key technology in nanotechnology, especially for applications requiring accuracy in particle shape, crystallinity, and surface properties. This process creates well-defined nanostructures by means of chemical reactions in aqueous medium at high pressures and temperatures. The most extensively researched 2D nanomaterials produced by hydrothermal techniques are iron-based nanoparticles, Zinc Oxide (ZnO), and Titanium Dioxide (TiO_2). Advanced lubricants with better tribological properties have been developed through a revolution in the field of lubricants with the addition of nanomaterials. For the purpose of attaining homogeneous dispersion within lubricating matrix, these nanomaterials' size, shape, and surface functionality can be precisely controlled during their hydrothermal production. These two-dimensional nanomaterials can have their surface properties precisely altered through hydrothermal synthesis, which benefits their lubricating system performance. Improved dispersion stability and efficacy of the nanomaterials in the lubricant can result in decreased wear, decreased friction, and enhanced thermal stability. This can be achieved by optimizing the particle size, shape, and surface fictionalization.

Biography

Dr. S.V.A.R. Sastry has more than 20 years of teaching and research experience. He is a B. Tech Gold Medalist, an M.Tech Silver Medalist, and a recipient of the Best Ph.D. Thesis Awardee. Authored 12 Patents, 25 International Books, 75 Research Papers. Editor for ten International Journals. Given more than 40 Keynote lectures in various International Conferences held at Brazil, Dubai, Spain, China, Canada, Italy, France and UK. Biography published in Marquis

Who's Who in the World, 31st, 32nd & 33rd editions consecutively. University Best Teacher Awardee for five consecutive years from 2008 to 2013. Recipient of International Awards from IBC, Cambridge, England. Received Pillars of the Nation Award for Excellence and Innovation in Education Sector in 2023, Outstanding Alumni Faculty Award from IIT Delhi in 2023, University Research Excellence Award for 2023, 2024, 2025. Honored with "Outstanding Leadership in Research and Innovation" Award in the 29th World Education Summit, New Delhi in 2024.

Theodosios Geo Douvropoulos
Hellenic Naval Academy/Natural Sciences Sector, Piraeus, Greece

Metamaterial-enhanced electromagnetically induced transparency in rubidium Rydberg vapor cells via buffering and quenching gas aided chemical environment

We present a theoretical investigation of light-matter interactions in thermal vapor cells of Rubidium atoms, incorporating engineered electromagnetic environments based on Metamaterials cells aided by buffering and quenching gas chemical inner environment. The study focuses on the modification of Electromagnetically Induced Transparency (EIT) involving highly excited Rydberg atoms under the influence of subwavelength field confinement and resonant field enhancement.

Metamaterial-enhanced Electromagnetically Induced Transparency (EIT) in atomic Rydberg vapor cells has emerged as a promising platform for ultrasensitive sensing, nonlinear photonics, and hybrid quantum technologies. In this work, we investigate the role of chemically engineered buffer and quenching gas environments in tailoring EIT responses within rubidium Rydberg vapor cells integrated with resonant metamaterial structures.

By introducing controlled concentrations of inert buffering gases and molecular quenchers, we demonstrate substantial modification of collisional broadening, coherence lifetimes, and atom–surface interactions, leading to enhanced transparency contrast and improved spectral selectivity. The metamaterial resonators concentrate and localize electromagnetic fields, thereby strengthening light-matter coupling and enabling tunable enhancement of Rydberg excitation pathways. Experimental measurements and theoretical modeling reveal that the combined influence of gas-assisted chemical environments and metamaterial-induced near-field enhancement produces robust EIT signatures with reduced decoherence and increased sensitivity to external electromagnetic perturbations.

These findings establish a versatile route toward chemically tunable hybrid quantum photonic systems and provide new opportunities for compact microwave sensing, precision spectroscopy, chemical gas sensing and adaptive quantum-enabled devices.

Biography

Dr. Theodosios Geo Douvropoulos studied Physics at Patra University, Greece (1996). Theodosios then joined the research group of Prof. C.A. Nicolaides at the National Hellenic Research Foundation (Theoretical Physics and Chemistry Institute), where he received a Master's degree in Physics (2001) and his Ph.D. degree (2005) in Quantum Dynamics. Theodosios main research activity is about the quantum evolution of low-dimensional physical and chemical systems and Quantum Technologies. Theodosios has published more than 25 research articles and has obtained the position of lecturer at the Hellenic Naval Academy of Greece since November 2022.

Tomas Brůha[1]*, Pavel Procházka[2], Václav Uruba[2]

[1]EnexPro, l.t.d., Czech Republic

[2]Institute of Thermomechanics Prague, Czech Republic

Investigation of low-frequency phenomena within flow pattern in standard mixing vessel induced by pitched blade impeller

An experimental study of the flow pattern dynamics in a standard mixing vessel with radial baffles filled with water and induced by a Pitched Blade Turbine (PBT) pumping downward is presented. Investigation is focused on detection and analysis of quasi-periodical or periodical low-frequency phenomenon connected with time- and length-scales considerably exceeding the Blade Passage Frequency (BPF) and common turbulent eddies. This phenomenon, which is expressed as large-scale mean-flow variations, is known as flow Macro-Instability (MI). It could break-down just below the liquid surface, or it crashes to the liquid surface and causes its Macro-Swelling (MS) Our investigation was based on Two-Dimensional (2D) Particle Image Velocimetry (PIV) within selected vertical and horizontal planes as well and analysis of the velocity field. The dominant frequencies evaluated in the selected points and overall analysis of the quasi-periodical macro-flow pattern behavior is to be shown. Identification of the quasi-periodical substructures appeared within the flow pattern was performed using the Oscillation Pattern Decomposition (OPD) method. Observation of the macro-flow patterns confirmed presence of the macro-flow structures detected within flow pattern at the identical mixing pilot plant setup by previous investigations of the MIs phenomenon.

Important contribution of the presented work is the investigation of both flow pattern within the baffles vicinity and in the middle of the sector far from the baffle, which a significant difference. Low-frequency periodical (or quasi-periodical) behavior of the investigated macro-structures was qualitatively confirmed by the presented results and it was quantified using the velocity dominant frequencies evaluation. This frequency analysis brings insight into detected interconnections between dynamics of the adjacent flow structures. Detected different flow patterns within the main vertical plane near the baffles and in the inclined plane reveal a strong

influence of the baffle presence. According by PIV measurement within appropriate horizontal plane, quite different flow pattern appears tangentially in front of and behind the baffle, where a wake is revealed, indicating significant influence of the baffle. The new findings represent a contribution to better understanding the physical phenomena behind the mixing process and therefore can help to optimize it, reduce mixing time as well as dynamics force strain on mixing equipment.

Biography

Tomas Bruha has studied on Faculty of Mechanical engineering, Czech Technical university Prague and graduated as MSc in 1992. He was working as chief technical officer in ENEX, l.t.d. dealing with complex heating solutions. In 2008 he started postgradual study on Institue of Chemical Engineering Prague, where he join to research of mixing fluid dynamics. He received PhD degree in 2012. Currently Tomas Bruha is participating on research of flow field in mixing vessel, take place on Institute of Termomechanics, Prague. He is author (co-author) of 4 articles in SCI(E) journals and 10 presentation on international congress.

Victor J. Law[1]*, James F. Lalor[2], Jenny Magnes[3], Denis P. Dowling[1]

[1]School of Mechanical Engineering, University College Dublin, Dublin, Ireland

[2]School of Mechanical and Materials Engineering, University College Dublin, Belfield, Dublin 4, Ireland

[3]Physics and Astronomy Department, Vassar College, 124 Raymond Ave., Poughkeepsie, New York 12604, USA

Solar box recovery of mixed-wax candle fragments and their reuse on the Island of Crete

This paper investigates proof-of-principle of small-scale free solar energy batch (2 x 250g) recovery of unconsumed mixed (petroleum-based paraffin and bioparaffins)-wax candle fragments and its re-casting into new 50-60g blended-wax pillar candles. Based on a converted family size (27 litres) solar box cooker the investigation is performed during the spring equinox of March 2025 and the winter solstice month of December 2025 on island of Crete. During this period the Sun's irradiance is in the range of 820 to 940W-cm^{-2}. The solar box cooker conversion extends its function from a simple food cooking and culinary leaf dehydration into the circular economy of mixed-wax fragments recovery and reuse. This approach therefore increases the cost-benefits of the cooker. Sensible heat measurements and leant heat of fusion calculations for the solar wax recovery process is explored; in terms of solar box cooker energy conversion into applied power (J.s^{-1}) into the wax phase-change process, wax energy budget (J), and wax energy density (J.g^{-1}). From a circular economy view-point, the challenge in sourcing second-hand temporary and permanent molds, and the release of the blended wax from its temporary mold using solar box cooker heated water is exemplified. The solar box cooker design allows future scaling-out, rather than scaling-up, to a possible 1kg of mixed-wax recovery, when solar processing is performed at, or around, the time of the summer solstice where solar irradiance is strongest (typically, 1020W-cm^{-2}) and increased available daylight hours allow a third, and possibly a fourth 250g of mixed-wax to be recovered and re-cast.

Biography

Victor John Law B.Scs (1985), Ph.D. degree (by published works, 2003). Since 2012, he held the post of Senior Researcher within the Surface Engineering Group, University College

Dublin (UCD) Ireland. He has authored over 160 publications, with a citation index of 20.8 for the first 100 papers. He jointly holds four patents. His research interest includes radio frequency power circuits, and their complex physic-chimerical interactions with biological material at the nano-scale. In addition, off-grid solar processes for cooking and dehydration of foodstuff. He retired to the island of Crete, Greece where he continues to contribute to UCD research effort.

Vladimir G. Chigrinov

Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong
Nanjing Jingcui Optical Technology Co., LTD, Nanjing, China
Department of Fundamental Physics and Nanotechnology, State University of Education, 105005 Moscow, Russia
RUDN, Moscow, Russia

Photoaligned azodye nanolayers: New nanotechnology for liquid crystal display and photonics 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.

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. Professor Vladimir is

an author of 6 books, 31 reviews and book chapters, about 322 journal papers, more than 677 Conference presentations, and 121 patents and patent applications including 38 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. Professor Vladimir 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. He is IETI Fellow since 2019. He is a Editor in Chief of Liquid Crystal section in Crystals journal since 2023.

Vladimir G. Chigrinov

Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong
Nanjing Jingcui Optical Technology Co., LTD, Nanjing, China
Department of Fundamental Physics and Nanotechnology, State University of Education, 105005 Moscow, Russia
RUDN, Moscow, Russia

Photoaligned azodye nanolayers: New trends for liquid crystal devices

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POSTER PRESENTATIONS

Aashima Mahajan[1]*, Loveleen K. Brar[2], Manmohan Chhibber[1]

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Waste-to-wealth conversion of coal fly ash into a catalyst for sustainable organic reactions

The sustainable transformation of industrial waste into value-added functional materials has gained significant attention as a strategy to mitigate environmental pollution while promoting resource efficiency. Coal Fly Ash (CFA), a major by-product of thermal power plants, presents serious environmental and health challenges due to its large-scale generation, disposal issues, and toxic elemental composition. In the present study, CFA was effectively converted into Zeolite A (ZA) using an ultrasonication-assisted hydrothermal synthesis approach, followed by controlled acid treatment to obtain acid treated Zeolite A (HZA) with enhanced catalytic properties. The acid modification step substantially improved the physicochemical characteristics of the zeolite, resulting in increased surface area, improved pore distribution, and enhanced acidity. Comprehensive characterization using XRD, FE-SEM, EDS, XPS, FTIR spectroscopy, BET surface area analysis, and NH_3-TPD confirmed the successful formation of the zeolitic framework and the development of additional acidic active sites after acid treatment. The catalytic performance of HZA was evaluated in the synthesis of Bis (indolyl) Methanes (BMs), valuable heterocyclic compounds with pharmaceutical and biological significance. Reactions were conducted in ethanol at 60°C under mild conditions, yielding a series of BM derivatives with moderate to excellent yields (35–94%). The catalyst exhibited notable stability and recyclability, maintaining consistent catalytic efficiency over five consecutive reaction cycles without significant structural degradation. Overall, this work demonstrates an environmentally benign waste-to-wealth strategy by converting coal fly ash into an efficient solid catalyst for green organic synthesis. The findings reinforce circular chemistry principles and contribute to Sustainable Development Goals 9 and 12, emphasizing responsible production and sustainable industrial innovation.

Biography

Aashima Mahajan is a Ph.D. Scholar and Assistant Professor-I in the Department of Chemistry and Biochemistry at Thapar Institute of Engineering and Technology (T.I.E.T), Patiala, Punjab, India. Her research centers on materials science, with a focus on zeolite synthesis, advanced characterization, and catalytic applications aligned with circular economy principles. She earned her B.Sc. (Non-Medical) from Panjab University, Chandigarh, and her M.Sc. in Chemistry from T.I.E.T, Patiala, building a strong foundation for research. She has published three research articles in reputed journals. She aspires to build a distinguished academic career, advancing innovative research while inspiring and mentoring future scientists.

Andreea Nila*, Mihaela Baibarac, Mirela Vaduva, Ion Smaranda, Adelina Udrescu
National Institute of Materials Physics, Romania

Photoactive SERS platforms based on BP-RGO decorated with metal nanoparticles: Toward real-time monitoring in integrated photocatalytic systems

The development of advanced photocatalytic technologies for environmental remediation is conditional upon the existence of reliable analytical tools with the capacity to monitor molecular transformations in real time. In a robust and high-impact photocatalyst, an integrated system of detect-treat-monitor is of significant value, as it facilitates in situ monitoring of intermediate products resulting from photodegradation. Surface-Enhanced Raman Spectroscopy (SERS) has emerged as a powerful technique for sensitive and selective detection of trace compounds, offering the potential to probe molecule–surface interactions under illumination conditions relevant to photocatalysis.

In this work, we report the fabrication and characterization of Black Phosphorus-Reduced Graphene Oxide (BP-RGO) hybrid nanostructures decorated with metal nanoparticles (Ag, Au, Ag@Au, Au@Ag) designed as highly sensitive SERS platforms for the detection of pharmaceutical compounds. The structural and optical properties of the plasmonic nanoparticles were investigated using Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), and UV–VIS absorption spectroscopy, confirming controlled particle morphology and strong optical response suitable for plasmon-enhanced detection. The hybrid architecture promotes efficient molecule adsorption and charge-transfer interactions at the interface, enabling reproducible and enhanced Raman signals.

Although the system is primarily developed for sensing applications, the photoactive nature of the BP–RGO-metal heterostructure and the light-driven processes involved in SERS measurements are closely related to mechanisms governing photocatalytic reactions.

These similarities suggest that such SERS platforms can serve as complementary analytical tools for monitoring photocatalytic transformations.

We propose the integration of SERS-based sensors into photocatalytic treatment systems as real-time monitoring components within a detect-treat-monitor framework. This approach could enable continuous identification of reactants, intermediates, and degradation products, providing valuable feedback for process optimization and control. The presented results highlight the potential of hybrid photoactive SERS platforms not only for sensitive detection of pharmaceutical compounds, but also for future integration into advanced photocatalytic systems.

Biography

Andreea Nila received her PhD in Physics from University of Bucharest, Faculty of Physics, Romania in 2019 and a bachelor's degree in chemistry and engineering from the Polytechnique University of Bucharest, Romania. She has been a scientific researcher at National Institute of materials Physics since 2013. Her research interests include the development of 2D materials and their heterostructures, photocatalysis, optical and spectroscopy of materials, DFT, sensing applications.

Cristina Anca Secara[1*], Otilia Ludmila Cinteza[2], Claudia Valentina Popa[1,2], Lucia-Elena Ionescu[1], Diana Mihaela Popescu[1], Constantin Draghici[2,3]

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Organic synthesis and NMR characterization of bisquaternary pyridinium salts associated with rivastigmine as a potential preventive antidotal system against neurotoxic organophosphorus compounds

Background: Organophosphorus (OP) compounds occupy an important position in both agricultural -related contexts due to their widespread use as pesticides. They exert their toxic effect through irreversible inhibition of Acetylcholinesterase (AChE) due to the phosphorylation of hydroxyl-bearing residues including serine at the catalytic site of the enzyme. This modification inhibits acetylcholine hydrolysis and causes its accumulation at synaptic junctions, leading to a marked cholinergic overstimulation. Based on these risks, the design of efficient AChE reactivators and prophylactic agents has long been a core research and biomedicine area in its own right. Bisquaternary pyridinium oximes, such as the aforementioned traditional remedies of the class such as obidoxime or HI-6, are known for their potential of reactivation with enzymes, and the synthesis of novel structural analogues is therefore worthy of further study.

Objective: This work reports the synthesis of new symmetric bisquaternary pyridinium salts derived from the precursor 3-pyridylisonitrosoacetanilide and the potential association with a carbamamate such as rivastigmine in the preventive treatment of exposure to organophosphorus pesticides. The precursors were formed from 3-aminopyridine, chloral hydrate, and hydroxylamine hydrochloride in saturated sodium sulfate. Based on the isolation and purification, the precursor was characterized by ^1H and ^13C NMR spectroscopy and the expected oxime, carbonyl, and heteroaromatic structural elements were verified (research was done at Military Medical Research Center).

Methods: The target bisquaternary salts are generated by two quaternizing agents: Symmetric Dichlorodimethyl ether (DCMS) and 1,3-dibromopropane. Quaternization reactions were carried out in anhydrous Dimethylformamide (DMF) at 30-55°C, with a 2:1 precursor to dihalogenated reagent ratio and symmetric bisquaternary formation. Purification and analyses of the compounds were carried out by ^1H and ^13C NMR spectroscopy to confirm their molecular structures.

Results: NMR characterization of the precursor 3-pyridylisonitrosoacetanilide displayed spectral signatures associated with the suggested structure, such as typical oxime proton bands and distinct aromatic resonances during ^1H NMR, as well as unique carbonyl, heteroaromatic, and aromatic carbon signatures during ^13C NMR. The bisquaternary salt manufactured by DCMS exhibited duplicated pyridinium signals in both ^1H and ^13C NMR, indicating symmetric quaternization and oxapropane linker presence. Similarly, the compound formed using 1,3-dibromopropane generated downfield pyridinium proton resonances and methylene signals related to a propylene bridge of the compound. ^13C NMR spectra verified the purity of the bisquaternary formation and the preservation of oxime functional group critical for reactivation of AChE. Furthermore, a carbamate-type compound structurally related to rivastigmine was detected and confirmed by High-Performance Liquid Chromatography (HPLC). The chromatographic retention time of the carbamate derivative in the analytical profile was 3.66±0.25min, which confirmed its presence and purity.

Conclusion: This work presents the successful synthesis, purification, and structural characterization of two new symmetric bisquaternary pyridinium salts derived from 3-pyridylisonitrosoacetanilide Their structural characteristics are similar to those of established AChE reactivators, making them an attractive area for biological evaluation. These new compounds will be chosen for introduction into preventive treatment strategies together with carbamate agents such as rivastigmine against neurotoxic organophosphorus compounds.

Keywords: Bisquaternary Pyridinium Oximes, NMR Spectroscopy, Rivastigmine, Organophosphates.

Acknowledgement: This work was carried out through the Core Program within the National Research, Development and Innovation Plan 2022-2027, with the support of National Research Authority (ANC), project no. 23 44.

Biography

Cristina Anca Secara has qualified expertise in toxicology and chemistry, specializing in organic synthesis and bioanalysis of chemical compounds as potential candidates for medical protection against chemical hazards. Cristina holds one patent and has authored 10 scientific publications and short communications in ISI-indexed journals on chemical decontaminants and nerve agent antidotal therapies. Cristina has delivered 30 oral presentations and posters on medical pretreatment strategies against chemical threats and has contributed to seven projects related to CBRN medical defence, serving as both a specialist and project manager. Cristina is an active member of the Romanian Society

of Therapeutics and Clinical Toxicology, the European Association of Poison Centres and Clinical Toxicologists (EAPCCT), and the Military Medicine Association.

Denes Joo

Architect-Urbanist, Systemic Evolutions and Pyramids

Independent Researcher, Hungary

The etheronics starts with chemistry and ends with light, through gravitation

Extending the actually recognized periodic table of the 118 chemical elements, including downwards the Gluon and Quark as pre-elements and the Etheron as start-element, respectively upwards the new elements from 119 to 558, with intercalation of the driving Bion and 13 Bionic elements, results the whole Periodic System, according to the same pattern on the 7 octavic cosmic evolutionary levels (Tachionic, Noethic, Etheric, Physic, Astral, Universal, Multiversal) presented in form of long/chessboard-like, stepped/pyramidal and spiral/discoidal tables with quaternion-like joining interpretation possibility, based on the proposed inverse quaternionic mathematical model. The macro-structure of the system is guided by the Octave-law, according to 1-2-4-8-16 criteria/axes, the Octaves being the quantitative extension units, while the Bions the qualitative regulators, but the micro-structure of the elements is determined by the alternating function-change of the secondary complex vectors on the resulted 3 intersection planes and 6 semi-planes, which explain the anomalies within the so strictly organized macro-structure. The resulted whole Periodic System contains 560 elements in 76 periods organized in 7 steps, successively with 2^2=4, 4^2=16, 6^2=36, 8^2=64, 10^2=100, 12^2=144, 14^2=196 elements, the etheron (physical electron) being the 8th start/transitional step.

This chemical structuring is repeated on the all 7 octavic/material nucleonic structured levels/Archimedean semiregular solids, in vorticial order being intercalated between the 5 pentatonic/light bionic structured phases, named Icosa, Dodeca, Octa, Hexa, Tetra in conformity with theirs constitutive light-particle shapes/Platonic solids, respectively Ring-Horn-Spindle toroidal phases after theirs own form inside the Toroidal-Spherical cosmic evolutionary process. The turning-point of the helical-toroidal to the spherical evolutionary stages is the apex/zero-point of the Horn-toroidal phase, around which evolves the conic-toroidal frame of the light-matter transition, namely of the ELBU (Elementary Light-Bubble Unity)–the light-

particle–which transforms into etheron–the matter-particle–through the transitional photonic Dirac-spinor–the "four-in-hand" gravitation-particle, through turning inside out of the smaller/inner ELBU-Tetrahedron into its bigger/outer inverse quasi-dual etheron-tetrahedron around the apex, through the 4 vertexes of the regular ELBU-Tetrahedron, which are the massive centers of the suitable 4 photon-tetrahedrons–component adjasent flat irregular tetrahedral triangular pyramids–with central meeting and bordering outer bases, unified into the regular etheron-tetrahedron, the tetrahedron being the basic geometrical form!

The quantization trials of the 19th century led to the modern quantum-theory started with Max Planck in 1900–based on the particle-wave duality, of which particle nature was elaborated by Isaac Newton (1687) and the wave nature by Thomas Young (1801)–the energy-quantum being the quaternionic resultant of the light-gravitation-matter-quanta elbu-photon-etheron. The etheronic structure is manifested in form of nucleonic (spherical core & toroidal coating) and bionic (toroidal core & spherical coating) structural duality, as direct consequence of the sphere-torus duality, but with tesseract/hypercube (4D equivalent of the 3D cube) joining between the core and coating, being–contrary to the false atomic structure–the base of the "chemical bonds", through theirs wedge-tetrahedral disphenoid vertex-figures inside the 8 verticial cubes of the tesseract. The geometry don't lies! These conclusions are the geometrical aspect of the Dirac-equation (1928). Because the light-quantum ELBU has (2.139×10^{-151}kg) mass too, the matter-energy-information trio of N. Wiener (1948) transforms into mass-energy-information triade of M.M. Vopson (2019). The light-matter transition starts from the ELBU (LeSage, 1682) to the etheron (Ioan Iovitzu Popescu, 1982) through the Dirac--spinorial/photonic "fourth" of the gravitation.

Biography

Denes Joo was born in 1942 and graduated from the Ion Mincu University of Architecture and Urbanism in Bucharest in 1966, he studied Mathematics, Economy, Sociology (1969-75) in Cluj-Napoca-city, and Postgradual Settlement and Regional Planning (1980-81) in Bucharest, and parallel with all these Physics, Chemistry, Astronomy and other scientific disciplines without limits and academic titles. Elaborating new mathematical prognosis models, he extended the Futures Research to the Systemic Evolutions Research as a new synthesis in the science, extending it from the terrestrial to the cosmic evolution, from the micro- to the macro-world, including the Pyramids Research too. DJD-2025-10-25.

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Microplastics in cosmetic and personal-care products: Integrating green chemistry and ESG paerspectives under the REACH 2023/2055 framework

Microplastics (MPs) defined as solid polymer particles ≤5mm in size that are insoluble in water; remain an often overlooked yet persistent component of Cosmetic and Personal-Care Products (CPCPs). Their extensive use as exfoliants, texturizers, and stabilizers has contributed to global plastic pollution, as these polymers resist degradation and frequently escape conventional wastewater treatment systems. Mounting scientific evidence has prompted major policy actions, notably the European Union's REACH Regulation (2023/2055), which restricts the intentional addition of MPs in rinse-off formulations. Nevertheless, significant research gaps remain concerning leave-on products, nanoplastic fractions (<0.1µm), and the enforcement of regulatory definitions that distinguish persistent micro-and nanopolymers from degradable or water-soluble alternatives.

This review critically synthesizes analytical and regulatory advances related to cosmetic-derived MPs. It consolidates findings from 2015–2025 literature on their occurrence, characterization, and environmental fate, while aligning these insights with the Twelve Principles of Green Chemistry and Environmental, Social, and Governance (ESG) criteria. The proposed analytical framework assesses polymer persistence, solubility, and life-cycle transparency, integrating quantitative Key Performance Indicators (KPIs) such as the percentage of persistent polymer content per product, the plastic-leakage factor, and supplier-traceability scores. This evidence-based approach enables cross-industry comparison and highlights opportunities for material substitution using biodegradable biopolymers (e.g., PLA, PHA) and natural abrasives.

Particular attention is given to the Middle East and North Africa (MENA) region, including Jordan, where limited regulatory infrastructure and dependence on imported products exacerbate exposure risks. Insufficient wastewater treatment and the reuse of sludge in agriculture may facilitate the re-entry of CPCP-derived MPs into food and water cycles. By identifying these regional vulnerabilities, the review advocates for a harmonized policy roadmap linking European REACH requirements with locally feasible testing and labeling strategies.

Furthermore, the paper introduces an ESG–Microplastic Index and a Decision Matrix connecting polymer chemistry to compliance pathways, assisting companies in quantifying progress toward circular-economy goals. Integrating chemistry, regulation, and sustainability governance reframes the microplastic debate—from pollution control toward proactive design and corporate accountability. Ultimately, this review establishes a science-based foundation for sustainable reformulation and transparent reporting, aligning cosmetic innovation with the EU Green Deal and the UN Sustainable Development Goals (SDGs 3, 6, 12, and 13).

Biography

Dr. Eshraq Aljamal is an Assistant Professor of Analytical and Environmental Chemistry at Irbid National University, Jordan. Her research focuses on sustainable materials, pollutant monitoring, and the integration of green chemistry and ESG frameworks into environmental regulation. She has authored several works on pollution, adsorption studies, and water-quality assessment, and actively participates in regional sustainability initiatives promoting environmentally responsible innovation.

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Photoisomerization and photocyclization of styryl derivatives of 1,10-phenanthroline

Derivatives of 1,10-phenanthroline with various substituents are actively synthesized and studied in the search for promising materials for nonlinear optics, fluorescent probes for DNA G-quadruplexes, chemotherapeutic agents for cancer treatment, and fluorescent chemosensors for ions and antibiotics. Bis-Styryl derivatives of 1,10-Phenanthroline (BSPs) have enlarged conjugated π-systems, which leads to a shift of the absorption spectra towards longer wavelengths. This allows the use of soft UV and even visible light to excite fluorescent labels, which is very important in biochemistry and medicine. Moreover, these compounds are believed to exhibit relative inertness to chemical reactions, with the exception of salt formation and chelation.

We investigated several BSPs with substituents at the para-position of the styryl moiety and found that these compounds are photochemically active. When BSPs solutions were exposed to light, we observed characteristic changes in the absorption spectra. Principal component analysis of the spectral matrices revealed the sequential formation of at least three new chromophores. Initially, the starting synthetically available EE isomer undergoes photoisomerization to the ZE isomer. Next, the ZE isomer undergoes an intramolecular C-N photocyclization reaction, which results in the formation of a dihydrophenanthrene derivative. The latter is oxidized to a 10-aza-10c-Azonia-Dibenzo[c, g]Phenanthrene Derivative (ADBP), which has a long-wavelength absorption band in the region of ~500nm.

A study of the reaction products by Electrospray Ionization (ESI) mass spectrometry and NMR spectroscopy showed that in the case of the nitro derivative, under the influence of light, a dissociative photorearrangement of one of the nitro groups into a hydroxy group first

occurs, and then the styryl fragment with the hydroxy group undergoes a photocyclization and oxidation reaction to form the ADBP derivative.

By processing the kinetic data, the quantum yields of the reactions were calculated: The photoisomerization reaction of BSPs proceeds with quantum yields of φ_{tc}~0.1; in the C-N photocyclization reaction, the quantum yields are two orders of magnitude lower, equal to φ_{pc}~10-3. It is worth noting that the photoisomerization reaction is reversible, while C-N photocyclization followed by oxidation is irreversible.

The photochemical activity of phenanthroline derivatives must be considered when using their optical and complexing properties in optoelectronics, analytical chemistry, biochemistry, and medicine.

The study was performed in accordance with the State task No. 124013000686-3.

Biography

Mikhail F. Budyka, Doctor of Chemical Sciences, Professor, Head of the Laboratory of Organic and Supramolecular Photochemistry at the Federal Research Center of Problems of Chemical Physics and Medicinal Chemistry, Russian Academy of Sciences, Chernogolovka, Russia. Research interests: Molecular photonics, Supramolecular Photochemistry, Photodissociation of (hetero)aromatic azides; Photoisomerization, photocyclization and [2+2] photocycloaddition of heteroaromatic diarylethylenes; Photoinduced electron, proton, and energy transfer in supramolecular systems; Hybrid nanosystems based on quantum dots and photoactive organic ligands; Fluorescent photochromes; Photonic molecular switches and logic gates; Quantum chemical description of chemical reactions.

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Semiconducting metal oxide enriched with single-walled carbon nanohorns with photocatalytic properties for pharmaceutical compounds removal

The Blends based on Semiconducting Metal Oxides (SMO, e.g. ZnO) and Single-Walled Carbon Nanohorns (SWCNHs) were prepared by the solid-state interaction to remove pharmaceutical compounds (e.g. Nifedipine (NIF)). A characterization of the SMO/SWCNH blends, with a concentration of SWCNH equal to 1, 2.5, and 5 wt.%, was performed by UV-VIS and FTIR spectroscopy, photoluminescence, and Raman scattering. The addition of SWCNH to the SMO matrix led to an increase in the photodegradation efficiency up to ~90%. SWCNHs act as acceptors and carriers of generated electrons-hole recombination, which allows a greater number of charges to be available for the formation of oxidative radicals responsible for pollutant degradation. SWCNHs have a large specific surface area and conductive structure, which favours the adsorption of pollutant molecules on the catalyst surface and facilitates charge transfer between SMO and SWCNHs, leading to a more efficient separation of charge carriers and a higher photocatalytic activity. A photodegradation efficiency up to 96.57% was reported by the increase of the weight of SMO/SWCNH 5% for the removal of NIF, as a consequence of the existence of a larger number of active sites available for the reaction.

Biography

Mirela Paraschiv is a Research Assistant in the frame of the Laboratory of Optical Processes in Nanostructured Materials of the National Institute of Materials Physics (NIMP), Romania. Mirela is a PhD student at the University of Bucharest, Faculty of Physics. Mirela research is focused on the photodegradation processes of pharmaceutical compounds in the absence and presence of photocatalysts, processes evaluated by UV-VIS and FTIR spectroscopy, photoluminescence, and Raman scattering.

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When shear and interfaces matter: In vivo water-in-silicone oil droplet formation during long-term vitreous tamponade

Silicone Oil (SO) is widely used as a long-term intraocular tamponade in retinal detachment surgery; however, its multiphase behavior in vivo remains incompletely understood. Although Oil-in-Water (O/W) emulsification has been extensively investigated, the potential formation of Water-in-Oil (W/O) droplets within the oil phase has not been systematically evaluated. The aim of this study was to experimentally verify the formation of W/O droplets during prolonged vitreous tamponade and to elucidate the mechanisms governing their formation and stability. Using a controlled porcine model complemented by analysis of explanted human SO samples, we provide the first systematic in vivo evidence of W/O droplet formation during long-term intraocular tamponade. Water-in-oil droplets were directly detected within the vitreous cavity, demonstrating that intraocular SO does not behave as a strictly continuous single-phase fluid but rather as a dynamic multiphase soft material. Droplet size distribution was strongly influenced by sampling conditions. Aspiration through narrow-gauge needles resulted in shear-induced fragmentation of pre-existing droplets, whereas co-aspiration of aqueous fluid during infusion generated substantial artifacts. These findings indicate that clinical explantation represents a microcapillary shear process capable of significantly altering ex vivo microstructural assessment. Oil viscosity modulated the sensitivity of the system to shear stress but did not determine droplet occurrence. Complementary in vitro experiments confirmed that needle passage fragments existing droplets rather than inducing de novo

formation. Integration of in vivo observations with in vitro phase behavior and interfacial viscoelasticity data supports a mechanistic framework in which shear-driven emulsification in protein-containing environments, together with protein-mediated interfacial stabilization, governs the formation, persistence, and fragmentation of water/oil droplets in oil-dominant biological systems. Although clinical outcomes were not directly assessed, the presence of water-containing inclusions may influence optical properties, tamponade mechanics, and interactions with intraocular tissues. These findings reconceptualize intraocular SO as a protein-active, closed multiphase biomaterial system and highlight the critical role of interfacial phenomena and sampling-induced artifacts in the interpretation of viscous biological materials.

Biography

Monika Reháčková is graduated from the Faculty of Medicine in Bratislava in 2012. In 2017, Monika obtained board certification in Internal Medicine, followed by board certification in Ophthalmology in 2022. Monika clinical practice covers a broad spectrum of ophthalmology, including both pediatric ophthalmology and retinal diseases, with a particular focus on silicone oil emulsification as part of his doctoral research at the Third Faculty of Medicine, Charles University in Prague. To date, Monika have successfully published two scientific articles on this topic. Monika actively lectures and regularly participates in numerous national and international conferences.

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Integrated pyrolysis-reforming approach for efficient hydrogen-rich syngas production from biomass

Biomass pyrolysis is a promising thermochemical pathway for converting renewable feedstocks into valuable gaseous fuels; however, the direct utilization of pyrolysis vapors is hindered by the presence of tar and oxygenated compounds. In this study, an integrated two-stage process involving biomass pyrolysis followed by catalytic reforming was investigated to improve hydrogen production. Pyrolysis of lignocellulosic biomass was carried out to generate volatile intermediates, which were subsequently upgraded over a bimetallic catalytic system supported on CaO-based materials. The catalyst was designed to provide active reforming sites along with in-situ CO_2 capture functionality, thereby promoting sorption-enhanced reforming reactions. The presence of a basic support contributed to improved gas quality by shifting the reaction equilibrium toward hydrogen formation, while the bimetallic active phase facilitated the decomposition of complex hydrocarbons and tar compounds. The effects of reaction parameters, including temperature and biomass type, were systematically studied to understand their influence on product distribution. The results showed a notable enhancement in hydrogen yield along with a reduction in undesired by-products. Additionally, the catalytic system demonstrated improved resistance to carbon deposition, indicating stable performance during operation. The enhanced activity is attributed to the synergistic interaction between the active metal phase and the basic support, which promotes reforming and water-gas shift reactions. This study demonstrates an effective strategy for upgrading biomass-derived vapors into hydrogen-rich gas, contributing to sustainable and decentralized energy production.

Biography

Nisha Rathi is a Ph.D. researcher in the Department of Chemical Engineering at the Indian Institute of Technology (IIT) Roorkee, India. Her research focuses on the thermochemical conversion of biomass through pyrolysis and catalytic reforming to produce hydrogen-rich syngas and Synthetic Natural Gas (SNG). She works on the design and evaluation of monometallic, bimetallic, and perovskite-based catalysts to improve fuel yield, energy conversion efficiency, and process sustainability. Her work also investigates catalyst stability, coke resistance, regeneration, and recyclability. She completed her Master's degree in Chemistry from Sridev Suman Uttarakhand University, Uttarakhand, India.

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TiO_2/single-walled carbon nanohorn nanohybrids as efficient catalysts for antibiotic photodegradation

This communication reports the use of nanohybrid composites based on Titanium Dioxide (TiO_2) in the anatase phase and Single-Walled Carbon Nanohorns (SWCNHs) as efficient catalysts for the photodegradation of Amoxicillin (AMOX). TiO_2/SWCNH composites containing 1, 5, and 10wt.% SWCNHs were prepared through the solid-state interaction of the two components. Increasing the SWCNH content led to significant structural changes, evidenced by Raman and FTIR spectroscopy. Specifically, the relative intensity ratio of the Raman bands at 1275 and 1597cm^{-1}, assigned to the defects and the graphitic structures of SWCNHs, was modified. In addition, the IR absorbance band at 1739cm^{-1} increased progressively, indicating the formation of new carboxylic groups on the SWCNH surface.

The best photocatalytic performance was obtained for the TiO_2/SWCNH composite containing 5wt.% SWCNHs, which achieved approximately 92.4% AMOX removal after 90min of UV irradiation. Compared with pure TiO_2, the TiO_2/SWCNH composite showed higher efficiency because SWCNHs acted as electron acceptors, reducing electron-hole recombination. The catalyst also exhibited good stability, maintaining significant activity over six reuse cycles.

Biography

Radu Constantin Cercel is a Research Assistant within the Laboratory of Optical Processes in Nanostructured Materials at the National Institute of Materials Physics (NIMP), Romania. He is a Ph.D. student in Physics at the University of Bucharest, having earned his Master's degree in Medical Physics in 2020. His research focuses on environmental remediation, specifically the photochemical degradation of pharmaceutical pollutants using advanced nanohybrid catalysts like TiO_2 and carbon nanohorns. Radu specializes in optical characterization using complex spectroscopic techniques, including Raman, FTIR, and UV-VIS, contributing to several peer-reviewed publications in the field.

Sanskriti Gawade

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Future of chemical engineering in the space industry

This abstract explores the future direction of chemical engineering in the space industry. Current work of a chemical engineer in the space industry, in the propulsion system and the closed-loop system research. This abstract presents a few directions of research for chemical engineers in space exploration. Chemical engineers using product development principles can conduct research on developing chemicals for growing crops in space, furthermore optimizing medicines to suit extreme environments, designing equipment that will enhance human life in space. With developing space exploration and increasing long duration missions, there is an increasing need for redesigning everyday products that are safe for space station and habitats, from tooth cleaning to having a good mental health. This abstract demonstrates that product design, formulation chemistry and advanced safety testing, core chemical engineering skills are foundation for human habitability and space flights. This analysis highlights high impact future of chemical engineering in the rapidly expanding sector.

Biography

Sanskriti Gawade is a second-year B.Tech student in Chemical Engineering, interested in formulation science, cosmetic innovation, astrobiology, human Habitability, and interdisciplinary sustainability. She has completed the RED25 Astrobiology Virtual School and the MMAARS Virtual Level 1 Analog Astronaut Training, equipping her with unique interdisciplinary skills at the intersection of space science, sustainability, and innovation. Sanskriti's current focus lies in developing eco-friendly, child-safe personal care solutions and exploring space-adaption solutions and prototypes that blend Indian heritage with global STEM ambitions.

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Biopolymer systems crosslinked with citric acid for the controlled release of curcumin with antimicrobial properties

Increasing antimicrobial resistance represents a major challenge for the treatment of bacterial infections, particularly those associated with the skin and soft tissues. In this context, the development of biosustainable biomaterials with antimicrobial properties has emerged as a promising strategy for designing new therapeutic alternatives. Turmeric (Curcuma longa) has attracted increasing scientific interest due to its multiple biological properties. This rhizome, widely used in traditional medicine and the food industry, contains curcumin as its main bioactive compound, a polyphenol recognized for its antimicrobial, anti-inflammatory, and antioxidant activities. However, its clinical application is limited by low water solubility, poor bioavailability, and rapid degradation, which have encouraged the development of encapsulation systems to improve its stability and biological efficacy.

In this context, the present study aimed to develop eco-friendly materials based on biopolymers capable of acting as controlled-release systems for curcumin with antimicrobial activity. For this purpose, starch films incorporated with poloxamer P188 nanostructures were synthesized using citric acid as a crosslinking agent for the polymeric matrix. This system enabled the encapsulation of curcumin at different concentrations to optimize its stability and release profile. The structural and physicochemical characterization of the materials was performed using Fourier Transform Infrared Spectroscopy (FTIR), contact angle measurements, as well

as swelling and solubility assays in different aqueous solutions. Additionally, time-dependent curcumin release studies were conducted to evaluate the release profile of the developed system. Antimicrobial activity was evaluated using the disk diffusion assay against Gram-positive and Gram-negative bacteria, including Staphylococcus aureus and Pseudomonas aeruginosa, respectively. The results demonstrated a significant antimicrobial effect, with higher activity against Gram-positive bacteria, reaching an inhibition halo of 23mm, as well as a statistically significant reduction in bacterial growth compared to the negative control, achieving nearly 80% inhibition. On the other hand, it was observed that the presence of curcumin decreased the Water Absorption Capacity (WAC) of the materials. Likewise, the system exhibited controlled curcumin release, reaching up to 97% at 144 h. Overall, these findings suggest that eco-friendly biomaterials based on starch and poloxamer, crosslinked with citric acid, represent a promising alternative for enhancing the antimicrobial efficacy of natural compounds such as curcumin, contributing to the development of sustainable strategies for the treatment of bacterial infections.

Biography

Santiago Mina Posu is a 10th semester Microbiology student at Santiago de Cali University. Santiago is a member of the Electrochemistry and Environment Research Group, where he has strengthened his scientific skills and developed a strong interest in research. With the guidance of his mentors and the work carried out within this group, Santiago had the opportunity to present his thesis project titled 'Eco-friendly starch-based films reinforced with Cu nanoparticles for the inhibition of bacterial growth' at AFICAT 2025, a national congress in Colombia. Santiago is characterized by his commitment, discipline, and motivation to contribute to scientific development in the field of microbiology.

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Dynamics of pH variation in biomimetic sensor-TPhPFe^{3+}/Al_2O_3//Si

During the investigation of the biomimetic sensor, the dynamics of pH changes were studied under different reaction conditions involving sensor materials. Measurements were performed using high-precision pH meters, allowing real-time monitoring of the solution's acidity changes.

When the biomimetic sensor interacted with the studied reagents (hydrogen peroxide or its intermediates), a gradual change in pH was observed, correlating with the intensity of the reaction. In the case of using a biomimetic sensor based on TPhPFe^{3+}/Al_2O_3//Si, a decrease in pH was noted in the presence of oxidizers, which is associated with the formation of acidic products during the reaction. The decomposition of H_2O_2 was monitored using pH measurements (pH tester ATCPro HS) and chromatographic analysis (LHM-80 chromatograph).

Over the experimental period, pH shifted towards a neutral environment at certain stages of the reaction, indicating the preservation of the sensor's functional activity. pH changes were also dependent on the concentration of active substances in the solution: with increasing hydrogen peroxide (H_2O_2) concentration, pH changes became more pronounced, confirming the high sensitivity of the sensor to varying chemical conditions.

The dynamics of pH changes during the interaction of the biomimetic sensor with chemical substances not only provide insights into the sensor's activity but also offer valuable information about the reaction mechanism and stability. Upon complete decomposition of H_2O_2, the pH of the medium returned to the value of the background solution.

Biography

Tofik Nagiev is a Vice-president of Azerbaijan National Academy of Sciences, Director of Research Center of "Azerbaijan National Encyclopedia" Tofik is author of the monography "Coherent Synchronized Oxidation Reactions by Hydrogen Peroxide", Amsterdam: "Elsevier", p. 325, 2007.

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Equilibrium, kinetics and thermodynamic adsorption studies of symmetrical reactive dyes in aqueous-based dyeing and non-aqueous reverse micellar dyeing of cotton fabrics

Cotton textile dyeing consumes enormous amounts of energy and water and discharges large amount of wastewater and pollutants. Minimized discharge of the wastewater from the cotton textile dyeing has been under high demands from textile industry. A novel reactive dyeing technology of using a non-aqueous medium with water confined in well-defined reverse micelle using non-ionic surfactant was developed for cotton fabrics. Adsorption, thermodynamic and kinetic studies of symmetrical reactive dyes in cotton fibres were investigated. Compared to traditional water-based dyeing system, cotton fabrics demonstrated better colour depth, higher rates of dye uptake and fixation at 80oC for symmetric reactive dye conformation encapsulated in reverse micelles. Symmetrical molecular structure of reactive dyes in aqueous and non-aqueous media showed different light absorption spectral characteristics and photophysical properties. Different adsorption and isotherm and kinetics models were applied to the experimental data to elucidate the mechanism of the dye uptake process on cellulosic fibre surfaces, which is characterized as a combination of dye adsorption at the fibre surface and diffusion transfer from the surface into subsurface regions of the fibre. Kinetic analysis confirmed that the adsorption process mainly followed a pseudo-second-order model, suggesting the involvement of a chemisorption mechanism. Thermodynamic evaluation showed that the adsorption was endothermic ($\Delta H°>0$) and spontaneous ($\Delta G°<0$), accompanied by an increase in the disorder of the solid–liquid interface ($\Delta S°>0$). The calculated activation Energy (Ea) was 117.13kJ/mol for aqueous dyeing and 81.55kJ/mol for reverse micellar dyeing, further supporting the degree of chemisorption. The equilibrium adsorption of reactive dye with symmetric conformation follows the co-existence of surface coverage of dye intermediates (Nernst adsorption isotherm) and monolayer adsorption (Langmuir adsorption isotherm) as the best-fit isotherm.

Complementary X-ray Photoelectron Spectroscopy (XPS) provided compelling evidence from the chemical interaction between reactive group of dye molecular moiety in symmetric conformation and surfaces of cellulosic fibre from inner atomic orbital regions of major elemental peaks. Our observations indicate that symmetric dye molecular structure in dispersion medium under various dyeing temperatures significantly influences the extent of dye adsorption on cotton fibres.

This study provides a foundation for understanding the dyeing mechanism of reactive dyes encapsulated in reverse micelle and offer guidance for optimizing the dyeing process in practical production settings.

Biography

Wang Yanming received her B.Sc degree in Chemistry from Xiamen University and M. Phil. degree in textile chemistry from Hong Kong Polytechnic University. She is currently pursuing her PhD study in Hong Kong Polytechnic University. Wang Yanming has more than 15 years of research experiences in dyeing chemistry, colloidal system and polymer composite materials. Her research interest is mainly in studying the mechanism of dye-fiber interaction and development of green waterless dyeing system and the relevant chemistries.

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Briefly talk over four stages of formation and development of the periodic table of chemical elements, the “point、1d、2d、3d”

The author is the founder of the "three-dimensional periodic law of chemical elements", and this research direction was an original topic of the author when he was a sophomore in 1957. After years of continuous research, it has been found that the discovery and development process of the periodic table of chemical elements can be clearly divided into four stages in chronological order: "point→line→planer→volume" (that is, point, 1D, 2D, 3D). From ancient times to the end of the 18th century, it was a "point" type stage. Human understanding of chemical elements remained at the level of individual discoveries. From the discovery of iron in the iron age and copper in the Bronze Age, to the end of the 18th century, a total of 33 elements including gold, silver, copper, iron, cobalt, tin and lead were recognized, which was a fragmented exploration of elements. Until after the 1830s, the "three element group", "spiral diagram", "element table", "eight-tone law" and so on emerged, which was the second stage of the periodic table of chemical elements. The "linear periodic law of one-dimensional elements" is the first milestone in the history of chemistry. The third stage was when the Russian scientist D. *И*. Mendeleev established the "two-dimensional periodic table of elements” in 1869, which was the second milestone in the history of modern chemistry. The "planar periodic table of elements" played a huge role in promoting the development of chemistry. However, the "Two-dimensional periodic Table of Elements" can only cover 118 "chemical elements", and there are ten major shortcomings, limitations, and drawbacks. Based on this, the "3D periodic law of elements" constructed by the author has become the fourth stage of the development of the periodic law, namely the "volumetric" stage, and also the third milestone in the history of the development of the periodic law of chemical elements. This theory not only overcomes the inherent defects of the traditional "2D periodic table of elements", but also can accommodate 2,787 isomorphic elements.

The "2D planar periodic law of elements" mainly describes the arrangement of electrons outside the nucleus, which determines the chemical properties of elements and the synthesis of molecules. In contrast, the "3D periodic law of elements" focuses on the arrangement of the difference between neutrons (n) and protons (p) within the nucleus, which determines the properties of the atomic nucleus and the existence of isotopes. Through years of in-depth exploration, I later proposed the "Isotope Center Theory," this theory has two laws, one constant, and two new parameters (SNP and DNP). This laid the foundation for the establishment of "Nuclear Isotope Science".

Biography

Zhongsheng Li was born in 1937 into a family of "class enemies" in Mainland China, where he was highly discriminated against and endured many hardships. "Class enemies" are not allowed to have friends. They have no human rights, let alone freedom of speech and publication. When he was in college, his family was in great poverty, but his love for chemistry never waned. In 1957, during his sophomore year, he discovered that the "2D periodic table of Elements" had 13 major flaws and deficiencies. It is the limitation of being unable to accommodate 2,787 isotopes. He created a unique topic to construct the "3D Periodic Law of Elements". Therefore, he is the founder of the "3D Periodic Law of Elements". He graduated from the first batch of students in the Physics Department of Zhengzhou University in 1960. In 1968, during the "Cultural Revolution Massacre", his parents and younger brother were killed by the proletarian thugs, resulting in the destruction of their families, the separation of their wives and children, the departure from their hometowns, and the separation of their families. Under the protection and shield of the ruling party, the murderer is at large. He joined the Chinese Democratic League in 1980. Zhongsheng Li was appointed as an associate professor in 1990. He has published more than 30 scientific research papers. In his later years, fraudsters were everywhere on the Mainland China. His family was defrauded of over 600,000 yuan (equivalent to more than 100,000 US dollars). The ruling party refused to accept it, and the contracts were treated as waste paper. They were in a state of utter poverty.

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