magnus Group

22-23
MAY, 2023

TOKYO
JAPAN

Joint Event on

Catalysis, Chemical Engineering and Green Chemistry

Venue:
ANA Crowne Plaza Narita 68, Horinouchi,
Narita-Shi, Chiba, 286-0107, Tokyo, Japan

BOOK OF ABSTRACTS

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22-23 MAY

BOOK OF
ABSTRACTS

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

INDEX

Contents

Speakers

Adib Gareyev
Bashkirs State University, Russia

Amelia Christina Atmowidjojo
Kyoto University, Japan

Amira Mohamed Taher Hegazy
Beni-Suef University, Egypt

Anna Wenda-Piesik
PBS Bydgoszcz University of Science and Technology, Poland

Arkadiusz Dyjakon
Wroclaw University of Environmetal and Life Sciences, Poland

Ashanendu Mandal
University of Calcutta, India

Ashkan Bahadoran
Chinese Academy of Sciences, China

Bandyopadhyay Sujoy
Indrashil University, India

Chen-Wei Liu
Industrial Technology Research Institute, Taiwan

Chitra
CSIR- National Physical Laboratory India, India

Dai-Yeun Jeong
Jeju National University, Korea

Dariusz Piesik
PBS Bydgoszcz University of Science and Technology, Poland

Debashrita Mahana
CSIR-National Physical Laboratory, India

Debjani Nag
Tata Steel Limited, India

Devic Gordana
University of Belgrade, Serbia

Diana Rakhmawaty Eddy
Universitas Padjadjaran, Indonesia

Divya Tripathy
Galgotias University, India

Donghee Lee
Saint Petersburg Mining University, Korea

Fabiano Andre Narciso Fernandes
Federal University of Ceara, Brazil

Fouad El Mansouri
Abdelmalek Essaadi University, Morocco

Fu-Der Mai
Taipei Medical School, Taiwan

Ga yeong Kim
Chungnam National University, Korea

Gangaraju Gedda
Presidency University, India

Gheorghe Viorel Christodoulou
Gas and Petroleum University, Romania

Grigory Korablev
Izhevsk State Agricultural Academy, Russia

Speakers

Hagsoo Kim
Fine Chemical Materials Technology Research Center, Korea

Haibo Ge
Texas Tech University, United States

Hans Jurgen Federsel
RISE Research Institutes of Sweden, Sweden

Hao Dang
Tsinghua University, China

Hasan Saygili
Vocational School of Technical Sciences, Turkey

Helmi Hamdi
Qatar University, Qatar

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Semenenko Institute of Geochemistry Mineralogy and Ore Formation, Ukraine

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Shri Mathuradas Mohota College of Science, India

Jinsong Wu
Guilin University of Electronic Technology China, China

Kilivelu Ganesan
Presidency College, India

Long Yu
Henan Academy of Sciences, China

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Mohammed M Bettahar
Lorraine University, France

Nattaphon Hongrutai
Chulalongkorn University, Thailand

Ndzana Arnauld Philippe
Yaounde Urban Council, Cameroon

Olivier Coulembier
University of Mons Belgium, Belgium

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Institute of Chemistry (IQSC), Peru

Ozcan Koysuren
Ankara University, Turkey

Pieter Samyn
Ghent University, Belgium

Rajesh Kumar
B R A Bihar University, India

Rohit Kumar
Indian Institute of Technology (Banaras Hindu University), India

S R Varadhan Christodoulou
Netaji IAS Academy, India

Seong Sik Shin Jennifer Finegold
Korea Atomic Energy Research Institute, Korea

Speakers

Serhiy Pyshyev
Department of Chemical Technology of Oil and Gas Processing Ukraine, Ukraine

Shahid Adeel
Government College University Faisalabad, Pakistan

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Suresh C Ameta
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Manipal University, United Arab Emirates

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University of Engineering and Technology, Peru

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Mississippi State University, United States

Yu-Chuan Liu
Taipei Medical University, Taiwan

Yuehua Li
University of Science and Technology Beijing, China

Welcome Message

Dear congress attendees, it is an honor and pleasure to welcome you to the 15th Edition of International Conference on Catalysis, Chemical Engineering and Technology. Catalysis is a central field of study with a large spectrum of applications. Industrial chemical processes are being constantly improved by implementing more efficient catalysts and making them environmentally more benign. The design of new catalysts and development of new catalytic methodologies are important to reduce the consumption of energy, open new pathways of recycling. Catalysts design requires the precise knowledge of the reaction environment including homogeneous and heterogeneous systems, solid state phases, and biological systems. The understanding of molecular reaction mechanism and surface properties of solids are improved by computational methods. Catalysis is indispensable for enantioselective synthesis of natural products and drug molecules. This congress will be an excellent platform and opportunity for all participants to learn about new catalytic concepts and applications.

Christine Hahn

Christine Hahn,

Kingsville (Texas), United States

Welcome Message

Dear congress participants, visitors, and attendees, I am delighted and honored to welcome you all to the unique and special event of Green Chemistry 2023. Climate change and environmental stressors pose an urgent and increasing mandates upon all of us to promote green chemistry with advanced and clean biotechnologies. The emerging area of green chemistry includes key and potential areas such as green nanotechnology, clean energy sources, hydrogen and alternate fuel, environmental and pollution control, green polymer and materials, green 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.

Hossam A Gabbar
Ontario Tech University, Canada

Welcome Message

Dear Colleagues,

On behalf of the Magnus Conferences, it is my pleasure to invite all of the great scientists, academics, young researchers, business delegates and students from all over the world to attend the 3rd edition of International Conference on Green Chemistry and Renewable Energy (Hybrid Event)", May 22-23, 2023 at Tokyo, Japan.

The Green Chemistry and Renewable Energy Conference shares an insight into the current research and cutting edge technologies that have an impact on the sustainability of human society and the best operation of planetary environments. The exuberant presence of adept, young and brilliant researchers, business delegates and talented technological communities promote an exciting atmosphere where development is pursued to the benefit of all.

We are looking forward to an excellent meeting with great scientists and engineers from different countries around the world and sharing new and exciting results in Green Chemistry and Renewable Energy, 2023, Japan. Welcome and enjoy the Conference.

Leon Burgess
Founding Director of CalAlsil®, Australia

Welcome Message

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 bio feedstock conversion into valuable chemicals.

Stanislaw Dzwigaj

Sorbonne University, France

Welcome Message

Dear congress visitors, welcome to this gathering of scientists and engineers who are breaking new ground in green chemistry, from green hydrogen to renewable biochemistry. My field is hydrogen which is undergoing a revolution this decade as fossil hydrogen is replaced and enlarged by Green Hydrogen made by several different processes, and with massive new applications is several fields of global importance. It is no exaggeration to say that hydrogen and fuel cells will be in your home, where Japan has led the way, on your streets as in Los Angeles and Foshan and changing steel and cement industries worldwide by 2050. Innovations since 1839 have been necessary in this ancient field, but your novel scientific/processing discoveries made lately will have large influences globally if we apply ourselves today and spread the message diligently. I wish you good fortune in presenting and disseminating your discoveries at this meeting.

Kevin Kendall

Hydrogen United in Birmingham, United Kingdom

Welcome Message

Dear congress participants, it is a pleasure to write a few welcome notes. Kinetic-catalytic methods constitute a valuable and powerful tool in analytical chemistry. From its initial moments, in which the control of the processes was done manually with a clock, substantial progress has been made. An important step was the incorporation of flow techniques, such as the FIA (flow injection analysis), since it allowed to automate the determinations (avoiding the use of manual clocks), to carry them out within closed systems (thus avoiding both losses and the incorporation of external contaminants). Subsequently, other flow techniques have been incorporated, such as SIA (sequential injection analysis), MSFIA (multisyringe flow injection analysis), MPFS (multipumping flow systems), etc., adding more features to the kinetic-catalytic methods (versatility, saving of sample and reagents, etc.). One of the most recent contributions has been the incorporation of chips obtained by 3D printers, which have made it possible to have more compact systems.

Victor Cerda

Mallorca, Spain

Welcome Message

Ladies and gentlemen, dear colleagues!

I am privileged to be a speaker on the 15th edition of International Conference on Catalysis, Chemical Engineering and Technology to be held on May 22-23, 2023 in Japan. It is a great chance for the participants to present their results and to share ideas in such broad areas on this prestigious forum.

Catalysis plays important role in almost all chemical and biochemical processes and technologies. It is very important for energy production and environment protection. The importance of catalysis and its practical applications requires further development in catalysis theory, which is a vast field for research and applications. The field of catalysis research and applications is considerably extended by the biocatalysis, either by enzymes or by living cells. To that end, catalysis will be important tool to solve problems with application of renewable resources for chemical and energy, as wellas for green chemistry nbd circular economy.

I am confident that the scientific and practical achievements of the participants will contribute to the further development of fundamental science and applied catalysis. Thus, welcome and enjoy the conference!

V. Beschkov

Venko Beschkov

Sofia Bulgaria

Welcome Message

Dear visitors to Green Chemistry 2023 Congress, it is an honor to write a few welcome notes. Biosensors today emerge from few important directions: chemo luminescence, immunosensor, single molecule detectors, till the last but not the least interdisciplinary domain of bio transistors manufactured in microelectronic factories. They integrate on a single chip many components: bioreceptor, analyte chamber, transducer and sometimes electronics circuit. If the transducer is selected to be a field effect transistor, we meet the Bio-FET class. This general class, repeated entire biosensor lines, like DNA-FET, Enzyme-FET, Immuno-FET, Microbial-FET. The future of biosensors depends on the micro-nano-technologies co-habitation with biomaterials. Additionally, the entire technological chain must adopt green technologies, sustainable methods, frequently selecting green chemistry routes. Your solutions are very expected at this International Event! Welcomes to Green Chemistry 2023!

C Ravariu

Cristian Ravariu

Bucharest, Romania

Welcome Message

Ladies and gentlemen, welcome on board to Green Chemistry 2023. It is an honor and a pleasure to give this short address to highlight how Green Chemistry represents a very promising niche in the development of novel economic and environmentally friendly industrial processes. Without a doubt, severe climate changes have occurred worldwide due to the accumulation of CO_2 in the atmosphere since the Industrial Revolution. Therefore, the concept of a carbon-neutral society by 2050 is evidently overdue. Although renewable energy sources, including solar radiation, wind power, and nuclear power, can result in reduction in CO_2 emissions, these renewable sources do not eliminate accumulated CO_2. In contrast, plants naturally capture accumulated CO_2 in the atmosphere without generating environmental concerns. Therefore, Green Chemistry 2023 represents an exciting opportunity to highlighting different competencies and to establish contacts focused on forging new collaborations in research. Once again, it is my pleasure to welcome you. Enjoy the meeting!

Kenji Sorimachi
Dokkyo Medical University, Japan

Welcome Message

Dear congress attendants. It is an honor and pleasure to welcome you to the 15th Edition of the International Conference on Catalysis, Chemical Engineering and Technology. Heterogeneous photocatalysis using titanium dioxide represents a very important issue from the point of view of fundamental and applied science, offering new opportunities to combine science and technology for environmental purposes. The technology is optimal to remove especially recalcitrant pollutants from water such as heavy metals and metalloids, which cannot be treated by conventional methods. This low-cost technology is able to increase the knowledge of young generations and also to offer sustainable ways of controlling pollution in water, air, and soils. I hope you enjoy this relevant Conference.

Marta I Litter

School of Habitat and Sustainability, University of Gral San Martín, Buenos aires, Argentina

Welcome Message

It is my great honour and pleasure as a Committee Member to invite you to join with a contribution to the 15th Edition of International Conference on Catalysis, Chemical Engineering and Technology (CCT 2023) which will take place on May 22-23, 2023.

The Conference will include Plenary and Keynote Speeches and Invited Talks which will be given by Distinguished Scholars and Experts from academic institutions and industry, and oral presentation by delegates and poster presentations by young junior participants.

Devoted to the rapid development of Catalysis, Chemical Engineering and Technology, this conference will provide excellent opportunity to meet distinguished scholars and experts and to exchange new ideas and application experiences, to establish research relations and collaborations for future research and projects. The conference has a wide variety of Catalysis and Chemical Engineering from Green Chemistry, Catalytic Materials to Reaction Chemistry and Engineering.

International scientific activities are big scientific platforms for the scientists, colleagues, and young academicians from all over the world, to interact and communicate with each other.

I believe that 15th Catalysis, Chemical Engineering and Technology Conference will provide this opportunity for delegates from different cultures and countries. Also, this conference will be performed successfully, in favour of the qualified scholars and experts and with their valuable presentations. Also, the conference will be very beneficial for young delegates by encouraging them and improving their confidence of presenting research in an international platform.

I am pleased to invite prospective scholars, academicians, and engineers to submit their original contributions to this important conference, where you are sure to have a meaningful experience with scholars and experts from different cultures and different countries, from all around the World.

Osman Adiguzel

Firat University, Elazig, Turkey

Welcome Message

Dear congress visitors, it is an honor and pleasure to write a few lines on welcome notes for CCT-2023. On behalf of the whole organizing committee, I warmly welcome all the delegates attending this congress meeting and thank them all for their active participation. Research in the field of Catalysis under Materials Chemistry has witnessed an exponential growth throughout the globe and the potential of its manifestation has been observed by 15th Edition of International Conference on Catalysis, Chemical Engineering and Technology" (Hybrid Event) during May 22-23, 2023 in Tokyo, Japan by gathering renowned scientists under one roof. The overall goal of the congress is to exchange breakthrough ideas in the field of Nanocatalysis to promote top level research by focusing on the recent trends as well as future prospects. We look forward to an excellent meeting with internationally renowned scientists and hope that the congress visitors are highly benefitted by their experiences and frontier research work in Advance areas of Catalysis, Chemical Engineering and Materials Chemistry.

Tokeer Ahmad
Jamia Millia Islamia, New Delhi, India.

Keynote Speakers

Anne M Gaffney
University of California, United States

Anthony Halog
The University of Queensland, Australia

Cristian Ravariu
University Politehnica of Bucharest, Romania

Christine Hahn
Texas A&M University-Kingsville, United States

Donatella Termini
University of Palermo, Italy

Helena Belchior Rocha
ISCTE-Instituto Universitário de Lisboa Portugal, Portugal

Hossam A Gabbar
Ontario Tech University, Canada

Kenji Sorimachi
Dokkyo Medical University, Japan

Kevin Kendall
Hydrogen United in Birmingham, United Kingdom

Leon Burgess
Technology Director CalAlSil, Australia

Madhusudan Hiraman Fulekar
Parul University, India

Marta Litter
University of General San Martin, Argentina

Osman Adiguzel
Firat University, Turkey

Stanislaw Dzwigaj
Sorbonne University, France

Tokeer Ahmad
Jamia Millia Islamia, India

Venko Beschkov
Bulgarian Academy of Sciences, Bulgaria

Victor Cerda
Sciware Systems, Spain

Yarub Al-Douri
American University of Iraq, Iraq

Thank You All...

ABOUT
MAGNUS GROUP

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

Participation from 90 different countries and 1090 different Universities have contributed to the success of our conferences. Our first International Conference was organized on Oncology and Radiology (ICOR) in Dubai, UAE. Our conferences usually run for 2-3 days completely covering Keynote & Oral sessions along with workshops and poster presentations. Our organization runs promptly with dedicated and proficient employees' managing different conferences throughout the world, without compromising service and quality.

PUBLISHING PARTNER

CCT 2023 is collaborated with Open Chemistry which is a peer-reviewed, open access journal that publishes original research, reviews, and communications in the fields of chemistry in an ongoing way. Our central goal is to provide a hub for researchers working across all subjects to present their discoveries, and to be a forum for the discussion of the important issues in the field. There are no submission charges. In order to sustain the production of our fully-refereed open access journal, each article accepted for publication in Open Chemistry is subject to Article Processing Charges (APC).

Note: We offer 30% discount on APC for the CCT 2023 conference participants. For more details about the journal, please visit: https://www.degruyter.com/journal/key/chem/html

PUBLISHING PARTNER

Green Chemistry 2023 is collaborated with Open Geosciences which is an international single-blind peer-reviewed open access journal that publishes original research, reviews and news in the emerging field of Earth Sciences. The aim of the journal is to become the premier source of high-quality research from all over the world. Open Geosciences is designed to facilitate the exchange of ideas between experienced and young researchers from different countries. Free language correction is provided for all authors. Additionally, each published article is promoted to researchers working in the same field of Earth Sciences.

For more details, visit: https://www.degruyter.com/journal/key/geo/html

BOOK OF ABSTRACTS

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22-23 MAY

DAY 01

KEYNOTE FORUM

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Development of an efficient acid-free palladium (II) catalyzed hydroarylation of acetylene

Hydroarylation of alkynes is a useful organic reaction to generate aryl alkenes as building blocks for more complex molecules. The direct addition of arenes to alkynes may serve as efficient methodology to shorten lengthy multi-step synthesis of natural products or drug molecules. While the intramolecular hydroarylation is relatively easy to realize, the intermolecular version is far more challenging regarding chemo-, regio-, or stereoselectivity. In the last two decades a large number of catalytic systems containing transition and main group metals have been develop, which still display certain limitations including high catalyst load, large amount of acid co-catalyst, higher temperature, relatively long reaction time, and a narrow scope of subtrates.We have studied the hydroarylation reaction using dicationic PT^{II} and PD^{II} pincer complexes. Initially stoichiometric reactions were performed to elucidate the Friedel-Crafts type mechanism. Screening a series of PT^{II} and PD^{II} complexes, a dicationic PDII complex containing SBF_6– counter-anion was found to be the most active catalyst. Further optimization of various reaction parameters afforded a TON of 200 and completion of the hydroarylation test reaction at room temperature within 24 h in the absence of any acid co-catalyst. The rule of water as co-catalyst will be discussed. Overall, a methodology for direct C-H addition of an arene to acetylene as unfunctionlized alkyne substrate was developed working efficiently under mild reaction conditions and acid-free conditions.

Audience Take Away Notes

- The audience will learn how to use unexpected results and implement in an optimization process
- Faculty in the area of natural product and drug synthesis may use the presented methodology as new tool for synthesis of more complex organic molecules than described in the presentation
- The catalytic system may help to shorten multi-step synthesis of drug molecules by several steps
- The discussed catalytic hydroarylation reaction is a showcase how a catalytic system has been developed iteratively by optimization of various reaction parameters and attention to unforeseen impact of certain reaction conditions such as the amount of water in the system

Christine Hahn

Department of Chemistry, Texas A&M University-Kingsville, Kingsville, Texas, United States

Biography

Dr. Christine Hahn received her Master's (1993) and Ph.D. (1997) degrees from the Martin-Luther University Halle-Wittenberg (Germany). She spent one year as Research Assistant at the University of Wurzburg with Professor H. Werner, shewona fellowship from the German Academy of Sciences Leopoldina for research at the University of Naples. She returned to Germany and joined the group of Professor J. A. Gladysz at the University of Erlangen-Nuremberg. She is currently Associate Professor and Chair of the Department of Chemistry at the Texas A&M University-Kingsville. Her research interests are in the fields of organometallic and homogeneous catalysis.

Catalytic carbon dioxide recycling to chemical products in fuel cells

There are various attempts to save carbon dioxide emissions by carbon collection and storage (CCS) or carbon collection and utilization (CCU). The electrochemical methods for CCU are extensively studied. They are classified in two classes: electrolysis with chemical production and fuel cell applications. The electro-catalytic electrolysis is associated with additional energy input and there is subsequent discharge of carbon dioxide in the atmosphere. That is why the fuel cell applications are preferable, because of the multiple benefits: carbon dioxide saving, useful chemical products formation and carbon-free energy production.

In the present study the performance of fuel cell driven by bicarbonate/carbonate solution is tested. Wastewater of high chemical oxygen demand (COD) as a fuel was used. Different catalysts containing manganese, tin, platinum and rhodium, embedded into activated carbon matrices were used. Chemical products of carbonate reduction were detected: formic acid, methanol, as well as some olefins and aromatic compounds. Best results were obtained by tin-doped activated carbon as catalyst.

Acknowledgement: The work was supported by grant KP-06-N27/1/2018 of the Fund for Scientific Research and by the program HITMOBIL by the Ministry of Education and Science, Republic of Bulgaria.

Audience Take Away Notes

- Other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- This improve the accuracy of a design, or provide new information to assist in a design problem

V Beschkov*, L Liutzkanov, S Stefanov

Institute of Chemical Engineering, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria

Biography

Venko Beschkov, PhD was born in 1946 in Sofia, Bulgaria. He has got his PhD in 1978 and his DSC degree in 1996 in the Bulgarian Academy of Sciences. His present interests are chemical and biochemical processes for environment protection and for utilization of renewable energy sources. He participates in 37 scientific projects and in 20 applied ones. He published over 230 scientific papers, 2 monographs and 14 chapters in selected issues. He has been Head of the Institute of Chemical Engineering at the Bulgarian Academy of Sciences for 21 years (1993/2014) and deputy-minister of environment (1991/92).

Strategy for climate crisis: An artificial forest model

The International Panel on Climate Change concluded that climate change has been caused by human activities that have produced CO_2 since The Industrial Revolution. Thus, it is clear that climate change has been induced by the accumulated CO_2 in the atmosphere. Eventually, glaciers are melting rapidly, and the BBC (British Broadcasting Corporation) News announced on July 4, 2022, that at least seven people have been killed after being caught in an avalanche sparked by the collapse of a glacier in the northern Italian Alps. Serious climate changes have already occurred worldwide. Therefore, the concept of the carbon-neutral society by 2050 is obviously too late, although it seems to be very hard to achieve this social project. Even though the carbon-neutral society could achieve right now, the accumulated CO_2 in the atmosphere has been still left on the earth, resulting in increased serious disasters. Namely, neither solar panel nor wind power can reduce the accumulated CO_2 by themselves. Contrary, our developed method for CO_2 fixation and storage can capture efficiently the atmospheric CO_2, using low concentrations of NaOH and $CaCl_2$. This method converts CO_2 to $CaCO_3$, which exists as limestone and coral, without environmental concerns. A large chamber comprising spray nozzles to capture CO_2 efficiently by mists or droplets of NaOH solution has been designed. Furthermore, a polytunnel made of polyethylene sheets, an “artificial forest” model, which allows CO_2 penetration instead of the chamber has been proposed. This model is definitely practical and economical for direct air capture, and it is consistent with the sustainable development goals (SDGs).

Kenji Sorimachi

Bioscience Laboratory, Environmental Engineering Co. Ltd., Takasaki, Gunma, Japan

Biography

Dr. Kenji Sorimachi completed his PhD at Faculty of Engineering, Gunma University, Japan and postdoctoral studies at the National Institutes of Health, USA. Dr. Kenji Sorimachi is affiliated to Department of Microbiology, Dokkyo Medical University, and then to Educational Support Center, Dokkyo Medical University, where Dr. Kenji Sorimachi is currently working as Professor. Dr. Kenji Sorimachi has authored and co-authored several national and international publications and also working as a reviewer for reputed professional journals. Dr. Kenji Sorimachi is having an active association with different societies and academies around the world. Dr. Kenji Sorimachi made his mark in the scientific community with the contributions and widely recognition from honorable subject experts around the world. Dr. Kenji Sorimachi has received several awards for the contributions to the scientific community. He is the senior author of more than 150 published papers. Dr. Kenji Sorimachi has newly developed the innovative method for CO2 fixation and storage.

Advances in plasma-based waste treatment for sustainable communities

This talk presents advanced approaches for plasma-based 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 of waste treatment. Process engineering techniques for gasification and pyrolysis process are illustrated with waste characterization. The proposed approaches showed 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 waste treatment.

Audience Take Away Notes

- Understand plasma technologies for waste treatments
- Understand ways to reduce GHG from waste treatments
- Learn practical solutions and technologies for waste treatment
- Understand ways to handle radioactive waste
- Understand potential jobs for waste management

Hossam A Gabbar

Professor, P.Eng, 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. Hossam A.Gabbarstudied systems engineering at Alexandria University. Heobtained PhD degree in process systems engineering from Okayama University, Japan. He joined Japan Chemical Innovation Institute (JCCI) and Tokyo Institute of Technology. Dr. Gabbar is a full Professor in the Department of Energy and Nuclear Engineering, in the Faculty of Engineering and Applied Science, at Ontario Tech University (UOIT). He leads the Smart Energy Systems Lab (SESL), and Advanced Plasma Engineering Lab (APEL). He is the recipient of the Senior Research Excellence Aware for 2016, UOIT. He is among the top 2% of worldwide scientists in energy. He is a Distinguished Lecturer of IEEE NPSS.

Advancing (environmental) life cycle analysis for green chemistry and sustainable future

To facilitate the greening of all industries and the upscaling of emerging innovative green technologies, it is now critically urgent and important that we design ecologically friendly products and processes at the source while effectively eliminating hazardous compounds and minimising their potential environmental impacts (e.g. climate change, toxic pollution, and plastic waste) as well as reducing resource consumptions over their life cycles from cradle (material extraction) to grave/cradle (end-of-life). In conjunction with maximising desired products, environmental Life Cycle Analysis/Assessment (LCA) endeavours to identify and quantify the environmental emissions and resource consumptions of any chemical product/process to eliminate its toxicity and hazards to human and planetary health. In line with supporting the transformation in chemical industry and other economic sectors, the aim of this presentation is to explain the basic notion and principles of LCA, its 4 major steps in accordance with ISO 14040, the available modelling tools/software packages that we can use and how it can be applied to assess/evaluate products and process across industrial sectors to make our industries and economies more sustainable, decarbonised, and circular.

Audience Take Away Notes

- The audience will learn the basic principles of LCA and how they can apply this method to quantify the environmental emissions and resource consumptions of their products and their contributions to climate change/or global warming/decarbonization/net zero agenda
- The audience will learn on how to use LCA to calculate their carbon, water, and resource footprints
- Academics will learn on how best to teach LCA to their colleagues and train their students to perform LCA research projects
- Company participants will learn how best to facilitate cleaner production in their organizations and conduct LCA to support the greening of their operations
- They will learn the available free software/modelling tools to support R & D people in redesigning their products and processto reduce its toxicity and environmental impacts
- Incorporation of Life cycle thinking for scientific development for real-world applications and addressing most important challenges in Green Chemistry and Renewable Energy
- LCA as an approach to effectively respond to the United Nations' Sustainable Development Goals

Anthony Halog

Research Group for Industrial Ecology and Circular Economy, School of Earth and Environmental Sciences, The University of Queensland, Brisbane, Queensland, 4072 Australia

Biography

Dr. Anthony Halog is one of the world leading scholars in industrial ecology, sustainable engineering, and circular economy, who is passionate in advancing the methods of systems science and life cycle sustainability analysis and their cross-cutting applications to greening the production of hydrogen, renewable energy, waste to energy, and biochemicals/bioproducts/bioenergy/biofuels. He has been a Visiting Professor/Fellow in several leading research institutions in Japan, Germany, the USA, and the UK. He has given keynote talks worldwide to share his expertise in greening supply chains, circular (bio) economy, and industrial sustainability. He has more than 130 publications related to green chemistry, industrial ecology, and sustainable engineering/manufacturing. He has been a recipient of several research fellowships worldwide including the Japan Society for the Promotion of Science (JSPS) and has been a Visiting Research Fellow at the University of

Tokyo and the National Institute of Advanced Industrial Science and Technology in Japan. Currently, he is leading a 4-year collaborative project of $406,569 funded by the International Climate Change Engagement Program from Australia's Department of Foreign Affairs and Trade (DFAT) on "Optimization of Refuse-Derived Fuels to Decarbonize Electricity Sectors and Achieve Nationally Determined Contribution (NDC) Targets in Indonesia".

BOOK OF ABSTRACTS

22-23 MAY

DAY 01

SPEAKERS

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Dr. Hagsoo Kim*[1,2],Dr. Jinsoo Park[1], Dr. Jinhee Bae[1], Jongsung Lee1, Sunghun Choi[1], Hojun Kim[1]

[1]INCHEMS Co. Ltd., Ulsan-City, South Korea

[2]School of Applied Chemical Engineering, Kyungpook National University, Daegu-City, South Korea

Development of air-stable oxysulfide-based solid electrolytes green technology

Along with the recent rapid growth of the electric vehicle market, the performance improvement of commercialized lithium rechargeable batteries for miniaturization, lightweight and high performance, that is, high safety, high energy density and rapid charging (high c-rate), etc. are also increasing. To improve the safety, energy density and high-rate characteristics of electric vehicles, many R&D groups are concentrating on developing next-generation all-solid-state batteries, and we are working on development source technology to secure manufacturing technology (Green Chemistry) for sulfide-based solid electrolytes, which are core materials (air-stable sulfide solid electrolytes).To commercialize a sulfide-based solid electrolyte with high ionic conductivity and atmospheric stability, synthetic procedure optimization, cost down, interface stability, and composite sheet technology development This is essential, and battery manufacturers are putting a lot of effort into optimizing all-solid-state battery systems. At this conference, a presentation will be made on the manufacturing technology and electrochemical properties of oxysulfide-based sulfide-based solid electrolytes with high ionic conductivity and air stability, which are being studied for commercialization of all-solid-state batteries.

Audience Take Away Notes

- The audience can obtain new application methods by understanding of Manufacturing Technology (Green Chemistry) of air-stable sulfide solid electrolytes
- If the audience interest in solid electrolyte system for energy devices, they can obtain new Green Technology Process
- If other faculty hope to expand their research, they can obtain solid electrolyte field of energy devices

Biography

Dr. Hagsoo Kim studied Material Science at Tokyo Institute of Technology, received his PhD degree in 2010. Over 25 year's experiences in Battery Business ranged from core materials synthesis, cell design, battery development with key customers that is, SDI, LGC, SKI & China battery companies since 1995. He achieved not only technical but also successful business experiences in Li batteries with management as Director (Battery Lab Manager & Technology Expert), is leading commercialization from research, development of new materials & conversion devices for energy. Also, actively cooperation with SDI, LGC, SKI R&D Team regarding battery development projects with Government Projects.

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The organic nGMO soybeans as a raw material in soy milk innovation production

Statement of the Problem: Soybeans are an excellent source of functional ingredients, such as dietary fiber, high-quality protein and polyphenols, mainly isoflavones. The lipid components disadvantageous to the health of the consumer are not present in soybeans, such as cholesterol, or are severely limited, such as, for example, saturated fatty acids. Soy products can be a health-promoting alternative to food of animal origin. In soybeans, as well as in other seeds of legumes (beans, broad beans, peas), there are inhibitors of enzymes digesting proteins, the so-called trypsin and chymotrypsin inhibitors. These are compounds that hinder the use of proteins. Their unfavorable effect causes disturbances in the digestion of proteins. Due to the fact that they are proteinaceous, they are denatured under the influence of temperature, i.e. they are destroyed by e.g. cooking and earlier soaking. The purpose of this study was to develop a technology for obtaining "soy milk" with improved composition, obtained from two organic NGMO soybeans: expanded and sprouted. It was assumed that the use of certain technological treatments and raw material from organic production (nGMO soybean) will ensure the appropriate quality of the obtained products, including microbiological purity, sensory features and lowering the content of anti-nutritional substances, especially trypsin inhibitors. Methodology & Theoretical Orientation: The technology of obtaining soy milk from nGMO soybeans was developed, the quality of which has been confirmed in microbiological, sensory and anti-nutritional tests. Findings: the production technology used has brought the expected results and the final product (expanded nGMO soy milk) was characterized by very good quality features. Conclusion & Significance: Soy products are a very important component of a vegan and vegetarian diet. The ecological nature of the raw material and the need to replace animal protein sources in the standard diet are valid today. Improving the production technology and introducing raw material innovations, in this case organic nGMO soybean, are in line with the above statements.

Audience Take Away Notes

- Developing a technology for obtaining "soy milk" with improved composition, obtained from two organic NGMO soybeans: Expanded and sprouted
- The know-how has brought the expected results and the final product (NGMO soy milk) which has been characterized by very good quality attributes
- Yes, it isInterdisciplinary team (food processing, plant science, microbiology etc.) is feasible to expand this research
- It was assumed that the use of certain technological treatments and raw material from organic production (NGMO soybean) will ensure the appropriate quality of the obtained products, including microbiological purity, sensory features and lowering the content of anti-nutritional substances, especially trypsin inhibitors

- Soy beverage production technology from NGMO soybean seeds extruded shortening the technological process by 10h (in the traditional process, seed soaking takes 12h, in the discussed process - 2h), reduced water absorption due to the elimination of the step of draining and rinsing the soaked seeds
- Soy beverage production technology from germinated nGMO soybean seeds extending production time by 3-5 days by the seed germination period, no soaking stage (-12h)
- Soy beverages meet the standards of microbiological purity, the content of anti-nutritive compounds and obtained high organoleptic ratings in comparative point tests

Biography

Prof. Anna Wenda-Piesikrepresents the scientific discipline of agriculture and horticulture as a research and teaching employee at the Bydgoszcz University of Technology. She is the dean of the Faculty of Agriculture and Biotechnology. Her scientific interests focus on field plant production, especially counteracting the acquisition of weed resistance to herbicides and the directions of soybean cultivation. She is the author of several implementations, e.g. market product entitled: "Non-GMO soybeans from farm to fork, improving practices in cultivation and animal feeding". She is currently working on implementations in the cultivation and use of hemp and soybeans for food purposes. Finally, she received Full Professor in 2019. She has published more than 100original articles and her h-index is 16.

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Evaluation of hydrotaicite-derived Ni catalysts for tri-reforming of methane process for CO_2 conversion

The anthropogenic CO_2 emission into the atmosphere is considered as a prime reason for global warming and climate change. One promising idea for the mitigation of CO_2 emission is CO_2 conversion and utilization (CCU). Tri-reforming of methane (TRM) process offers a unique way to chemically utilize CO_2 to reform methane into synthesis gas. TRM process is a synergy between steam reforming of methane, dry reforming of methane and partial oxidation of methane processes. The major challenge of the TRM process is to develop a highly active and stable catalyst. In this effort, hydrotalcite-derived mixed metal oxides supported Ni catalysts are explored in an experimental study. The catalysts were synthesized by co-precipitation method. These were characterized by XRD, TPD, TPR, TGA, SEM, TEM, XPS and N_2-physisorption to study their textural, physical, and chemical properties. Their performances were examined at 800°C and space velocity of 49200 ML/H.G in TRM reaction. Mg-Al mixed oxide supported Ni catalyst (Ni-Mg-Al) displayed strong resistance against deactivation due to coking and sintering but could not attain high activity. Also, memory effect property of hydrotalcites wasincorporated to prepare different batches of Ni-Mg-Al catalysts. These catalysts showed high CH_4 and CO_2 conversions but lacked stability. Cu- and Zn-promoted Ni-Mg-Al catalysts demonstrated excellent activity and stability. Addition of Cu and Zn resulted in Ni-Cu and Ni-Zn alloy formation respectively which enhanced their catalytic performances significantly. Particularly, Ni-Zn-Mg-Al catalyst was the best among all the hydrotalcite-derived tested catalysts. Addition of Zn to Ni-Mg-Al modified the catalyst electronically. As per the XPS result, partial charge transfer from Zn to Ni made Ni election-rich and hence more capable of strong C-H bond scission. Moreover, geometric modification also occurred in Ni-Mg-Al catalyst upon Zn addition. Zn isolated Ni atom and avoided large Ni ensemble formation. It preferentially blocked the Ni edge sites, mainly responsible for carbon formation. Ni-Zn-Mg-Al attained high activity and was found remarkably stable in an 80-h experimental run.

Audience Take Away Notes

- The audience will learn about hydrotalcite-derived catalysts, which are relatively newer class of catalysts
- Methane reforming using steam is a conventional process to generate synthesis gas and hydrogen. But it produces a lot of CO_2 as well. On the other hand, Tri-reforming of methane process can do the same job and chemically utilize the CO_2However, this process is less explored and studied. My presentation will give some insights on this new process
- Methane reforming is an industrial process. The deactivation of reforming catalysts is a common problem. My experimental results may provide some strategies to deal with such challenges
- My presentation discusses a promising alternative to curb CO_2 emission and utilize CO_2as a carbon source
- My experimental results of the presentation include chemical conversion of industrial flue gas from the electricity-power generation plants, a major source of CO_2 emission

Biography

Dr. Rohit is currently working as an Assistant Professor at the Department of Chemical Engineering and Technology,Indian Institute of Technology (Banaras Hindu University), Varanasi, India. He received his PhD degree in 2021 at Indian Institute of Technology Delhi, India. He has been an awardee of the prestigious Prime Minister Fellowship for Doctoral Research. Also, he was awarded Sumant Sinha Sustainability Leadership award and IIT Delhi Alumni Association Research and Innovation award. His research area mainly deals with heterogeneous catalysis for CO2 conversion and sustainable process development.

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Induction of volatile organic compounds in wheat plants following infection by different Rhizoctonia pathogens

The most popular means of plant protection is the chemical method, but this control is often connected with the need for repeating chemical treatments. Thus, eco-friendly strategies should be developed where, under the European Green Deal, aromatic plants and their repellent properties seem to constitute a good alternative. In earlier studies, we have shown that insect injury, bacteria infestation and pathogen infection induce plant volatile organic compounds (VOCs) emission, which can provide defensive functions to plants. In this study, Triticum aestivum L. (Poaceae) cv. 'Jenga' wheat plants were intentionally infected with one of four *Rhizoctonia* species (*R. cerealis*, *R. solani*, *R. zeae*, *and R. oryzae*). The soil was inoculated by the pathogens during sowing, whereas shoots were inoculated at stage BBCH 33. In greenhouse experiments, we measured VOCs from wheat 3, 7 and 11 days following stem infestation, or 42 days following soil inoculation of *Rhizoctonia* spp. VOC emissions were found to be largest on days 7 or 11 post-stem inoculation (>3 days post-stem inoculation >42 days post-soil inoculation). *T. aestivum* infected by pathogens induced five common green leaf volatiles (GLVs), namely (Z)-3-hexenal = (Z)-3-HAL, (E)-2-hexenal = (E)-2-HAL, (Z)-3-hexen-1-ol = (Z)-3- HOL, (E)- 2-hexenol = (E)-2-HOL, (Z)-3-hexen-1-yl acetate = (Z)-3-HAC], six common terpenes (β-pinene = β-PIN, β-myrcene = β-MYR, Z-ocimene = Z-OCI, linalool = LIN, benzyl acetate = BAC, β-caryophyllene = β-CAR), and indole = IND. We found that *R. cerealis* infested *T. aestivum* emitted the largest amounts of (Z)-3-HAL and (Z)-3- HAC, while *T. aestivum* infested by *R. solani* released the largest amount of LIN (7 or 11 days following stem infestation). VOCs released by the *T. aestivum* after *R. cerealis* (AGD I) and *R. solani* (AG 5) infestations were significantly larger in comparison to *R. zeae* (WAG-Z) and *R. oryzae* (WAG-O) for the volatiles (Z)-3-HAL, (E)-2- HAL, (Z)-3-HOL, (E)-2-HOL, (Z)-3-HAC, β-PIN, β-MYR, and LIN. With the exception of (E)-2-HOL, β-MYR, LIN, BAC, β-CAR, the other VOCs were emitted in similar amounts by infected *T. aestivum* 3 days following stem and soil inoculation. The quantities of induced VOCs were higher at days 7 and 11 than at 3 days post-infection, and greater when T. aestivum was infected with Rhizoctonia on the stem base than through the soil.

Audience Take Away Notes

- Eco-friendly strategies should be developed, and we propose the use of aromatic plants with repellent properties as a viable and beneficial alternative. Assessing the insect dose response to plant volatile organic compounds can reveal a range of concentrations over which herbivore attraction or repellence may occur. This may lead to novel, sustainable methods of pest and environmental control
- New trends and/or solutions in Chemical Ecology are of importance for the future of plant protection. The intensive reduction of typical pesticides lead us to new environmental-friendly approach in plant protection. The audience will learn that the we as the humanity have to focus much more on the on the nature observation than invest funds in new formulas synthetizing.

- Among main target groups are:
- - farmers
- - policy makers (regional, national and EU level)
- - pest control industry
- - scientists
- Farmers will be the crucial end users of the project results. Although they are a diverse target group, the outcomes of the project can be used in any farm. Hence, it must be assumed that all people and companies involved in agricultural plant production will be among the groups of recipients. In essence, there are three main farm groups within the EU are semi-subsistence farms, where a large proportion of the food produced is used to feed farmers and their families, small and medium-sized farms that are generally family-run businesses, and large agricultural enterprises, which more often have some legal form or are cooperatives
- Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms, whereas conventional pesticides directly kill or inactivate the pest. Biochemical pesticides include substances that interfere with mating, such as insect sex pheromones, as well as various scented plant extracts that attract insect pests to traps and are effective in very small quantities. In consequence, biopesticides are usually inherently less toxic than conventional pesticides and generally affect only the target pest and closely related organisms. Moreover, when used as a component of Integrated Pest Management (IPM), these programs can significantly reduce the use of conventional pesticides. Owing to the continuous evolution of the resistance to conventional chemicals, there is a need for intensive research on the biopesticide development. Of note is that the costs for the development and the registration of the biopesticide are comparatively lower. However, a successful biopesticide development can only be obtained through interdisciplinary research involving entomology, genetics, molecular biology, biochemistry, agronomy, plant pathology, analytical chemistry and ecology
- The humanity soon or later will follow the observation and application of the processes in the nature. The market and job opportunities will explode in the coming future
- Yes, it is personally I will be happy to collaborate with any other institutions
- Concerning the significance of the project outcomes, it has to be mentioned, that these will be in line with EU and worldwide policy, global market trends and finally, yet importantly, the real needs of end users. As it was highlighted during International Year of Plant Health in 2020, plant pests are responsible for losses of up to 40% of crops globally, and for trade losses in agricultural products worth over USD 220 billion each year. It is of therefore of utmost importance for all people and entities engaged in food production to have sound plant protection products. Our proposed multitool solution will have a game-changing impact on the IPM market and farming systems. Furthermore, the global bio-insecticides market size is projected to grow at a CAGR of 15.8% from an estimated value of USD 2.2 billion in 2020 to reach USD 4.6 billion by 2025. The increasing area under organic cultivation and growing concerns toward the impact of pesticide use on biodiversity is leading to the growth of the bioinsecticide industry. The role of IPM practices in biological crop protection has been gaining importance worldwide
- The presentation might help other scientific departments in grant application or in solid communication and collaboration with presenter
- While numerous factors influence pest management decisions, reported barriers include, among others: (i) the absence of non-chemical alternatives, (ii) lack of knowledge on pesticides and alternatives,

(iii) biased information from chemical companies, and (iv)an insufficient advisory service on judicious pesticide use. A crucial way to mitigate these barriers would be the dissemination and communication of project results as well as integrating the farmers' communities within the project from the very beginning (regional centres for pest risk management as a citizen science approach)

- List all other benefits
- I want to tackle the natural plants' defense system with the cooperation to Asian scientific groups

Biography

Prof. Dariusz Piesik studied at the PBS Bydgoszcz University of Science and Technology (present name). He received his PhD degree in 2000 at the same institution. After two postdoctoral fellowships at Montana State University, USA (1, 5 years) and INRA Versailles, France (2 years) he received D.Sc. in 2009 and obtained the position of an Associate Professor at the PBS. Finally, he received Full Professor in 2018. He has published 70 research articles in SCI (E) journals and hid h-index is 18.

Debjani Nag
R&D, Tata Steel, India

Role of catalyst in metallurgical industry

In present day, around 70% of the steel is produced through blast furnace (BF)/basic oxygen furnace (BOF) process. In this process iron oxide is reduced primarily by using carbon which essentially generates carbon dioxide. Over the years several technological interventions have substantially improved the performance of the process still the carbon requirement is substantial. In Indian context for production of 1 ton of crude steel through BF-BOF route, typically 2.5-ton carbon dioxide is produced. In Tata Steel India BF-BOF route is the most prominent process for steel production. Tata Steel has ambitious target to become net – neutral by the year 2045. Carbon direct avoidance and carbon capture and utilization are the two folds approach Tata Steel has taken to reduce the overall carbon footprint reduction. In carbon direct avoidance, hydrogen will be used for reductant. Production of high volume of hydrogen at affordable price and also development of useful chemicals from captured carbon dioxide is the key. Catalyst can play a crucial role in capture and utilisation of CO_2 and also production of affordable green hydrogen. Catalyst also needs to play a role to improve the process efficiency specially to reduce the reaction temperature of different metallurgical reaction which in turn save energy and reduce carbon footprint. This presentation will discuss about the problem faced by steel industry and how catalyst can help to mitigate those problems.

Audience Take Away Notes

- Understanding of importance of catalyst in metallurgical industry
- It can open new ideas of catalyst development keeping industrial problems in mind
- Challenge for all catalyst chemist

Biography

Dr. Debjani Nag joined R&D, Tata Steel in 2008 after completing M.S in chemical engineering from IIT, Bombay. Subsequently, she completed her doctoral study from IIT-ISM. Her research interests are- advanced characterization of coal and coke, carbonisation, utilization of non-coking coal, different pre-carbonization techniques in coke making, catalyst development for sustainability and process improvement. She has published more than 30 nos. of research papers in reputed journals and also has over 28 patents.

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Time-evolving growth of 3D-nanocrystalline carbon from the electro-reduction of acetic acid with in-situ electrodeposited Ag at ambient conditions

Nanocrystalline carbon thin films containing Nano diamond and diamond-C (progressive intermediates in the graphite-to-diamond phase transition) were produced by a low-energy production method, consisting of the in-situ electrochemical reduction of acetic acid/Ag(NO3) using a relatively small negative potential of -1.1 V vs Ag/AgCl at ambient conditions. After applying the negative potential, ultra-thin layer of Ag was firstly deposited and subsequently competitive electrodeposition of Ag and electro reduction of acetic acid resulted in formation of crystalline solid carbon and Ag-C products on the electrodes. A combination of microscopic, structural, and spectroscopic characterization results showed that the Ag-C product layers gradually developed into nanocrystalline carbon films with some large 3D-polyhedra carbon and Nano diamond with average crystallite size □26 nm as the reaction time increased from 15 to 140 min. The nanocrystalline carbon-film growth rate was calculated to be ca. 8 μm.h–1 without the production of any gas or liquid products.

Audience Take Away Notes

- Nanocrystalline diamonds (Nano diamonds) are valuable materials for various applications, whereas low-energy synthesis methods have remained a substantial challenge. In this work, we reveal the nanocrystalline carbon-containing both Nano diamonds and micron-size diamond-C structures by a concurrently electrochemical reduction of acetic acid with electrodeposition Ag on copper foil substrate at ambient conditions with relatively low negative potential (-1.1 V vs. Ag/AgCl)
- The growth of Ag-C layers developed into nanocrystalline carbon thin films with average Nano diamond crystallite size ~26 nm during 15□140 reaction time. Furthermore, large 3D-polyhedra of carbon and diamond-C structures can be observed on the surface electrocatalyst once the reaction time increases. The obtained products are unique, and the process allows fast growth rate of nanocrystalline carbon-film at ca. 8 μm.h–1

Biography

Nattaphon Hongrutai, Ph.D. candidate in chemical engineering at Chulalongkorn University, Thailand. I joined the research group of Prof. Joongjai Panpranot in 2020. I also joined the research group of Prof.Magda titirici as Visiting Ph.D. student at Imperial College London in 2022. We are interested in electrochemical reduction and characterization of the electrocatalyst.

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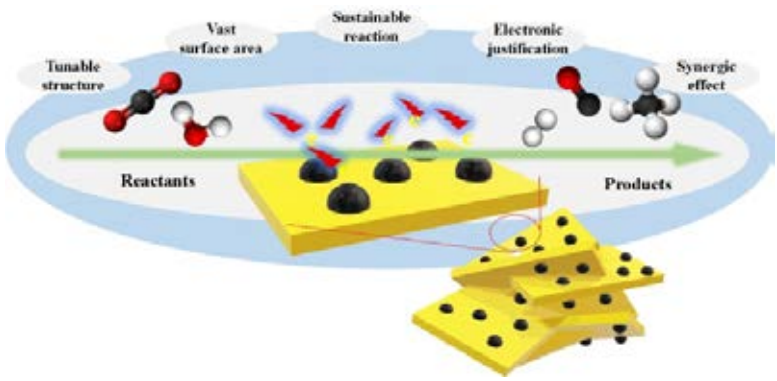
High-entropy transition-metal sulfide nanoparticles deposited on ultra-thin g-C_3N_4 nanosheets for efficient CO_2 photoreduction

Progression towards a sustainable and efficient CO_2 photoreduction reaction (CO_2-PR) is hindered by overcoming challenges such as the development of affordable and cost-effective catalysts. Among the various materials applied for CO_2-PR during the last decade, almost no heed has been paid to the high-entropy materials. High-entropy transition-metal sulfides (HETMSs) feature homogeneous multi-metallic compounds as single-phase solid solutions with no less than five types of cations in a sulfide structure. Unfortunately, their synthesis process is unfavorable because thermodynamic immiscibility of metallic elements prevents the achievement of high specific surface area and efficient electronic configuration. Herein, through the sulfidation of a self-templated glycerate-assisted metal-organic structure, hierarchical nanoparticles of high-entropy transition-metal sulfide (np-HETMS) were synthesized and grown on ultra-thin g-C_3N_4 nanosheets (UCN). The peculiar morphology and the synergic electronic interaction of multi-metallic constituents confirmed the synthesis of an appropriate hybrid nanostructure (np-HETMS/UCN) for highly efficient CO_2-PR. The crystalline investigation of synthesized np-HETMS exhibited the formation of a crystalline-amorphous system in the term of unique single-phase pyrite (CoFeNiMnCu) S_2. The attained amorphous structure was much more conducive to advancement in charge transfer to and from active sites, effective orientation toward CO_2 adsorption and facility of atomic disorder for unique electronic structure. In addition, the np-HETMS in the hybrid nanostructure presented superior light-harvesting encompassing the entire solar spectrum, efficacious photon utilization using charge dissociation and steering, therefore serving as active centers for substantial involvement in CO_2-PR. As anticipated, the capability of np-HETMS/UCN nanocomposite in realizing competitive syngas production compared with other state-of-the-art nanomaterials demonstrated the high performance of our strategy. According to the long-lasting experiment and time-equivalent consecutive cycling runs, the architecture of the np-HETMS/UCN nanocomposite demonstrated considerable resistance to catalyst inactivation/destruction. The innovative architecture of np-HETMS was based on the requisite of efficient CO_2-PR, shedding light on the applicability of high-entropy materials in photocatalysis.

Graphical abstract



Audience Take Away Notes

- This research broadens the audience's perspective about general limitations in designing and developing sustainable CO_2-photoreducing reactions
- This research introduces a possible solution to improve the catalyst: high-entropy configuration
- This research presents an unprecedently procedure for synthesizing high-entropy metal sulfide in favor of CO_2-PR
- This study will be helpful through
- Individuate the gaps in a research area and find solutions to overcome efficiency/sustainability challenges.
- Acquire familiarity with state-of-the-art materials synthesis strategies
- This research maintains
- The fundamental theory and applications of sustainable photocatalysis
- The new generation of synthesis route for the inclusion of high-entropy materials in catalyst
- The engineering strategy can be applied to the other domains
- The strategy behind the design of our final hybrid nanocomposites can be expanded in similar fields and assist other researchers to improve the performance of their catalysts accordingly

Biography

Dr. Ashkan studied materials science at Shanghai Jiao Tong University (SJTU), China, and graduated with a PhD in 2022. He then joined the research group of Prof. Massimmiliano Galluzzi at the Chinese Academy of Science (SIAT-CAS) as a postdoctoral researcher. He has published more than 30 research articles in SCI journals. His research interests include nanotechnology, materials science, and renewable energy, focusing on developing new materials for green energy and solar energy conversion applications.

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A study on cascade cycle natural gas liquefaction process using polar sea temperature

Recently, in order to achieve the global objective of reducing greenhouse gas emissions, renewable energy technologies are growing rapidly. There are still several challenging challenges that need to be overcome, such as low energy efficiency, intermittency, grid infrastructure, cost, and more.

Nowadays, demand for natural gas as an alternative energy source is growing at a time when it is unknown when renewable energy technologies will be able to fully replace fossil fuels. As demand for natural gas increased, the global liquefied natural gas (LNG) market also expanded significantly. Accordingly, several new LNG production projects are under development worldwide. Particularly in the Arctic region is believed to contain significant deposits of natural gas. According to estimates from the US Geological Survey, the Arctic region may contain up to 1,669 trillion cubic feet of technically recoverable natural gas resources, which accounts for approximately 25% of the world's total. There are several LNG (liquefied natural gas) projects being planned or developed in the Arctic region nowadays. There are notable examples such as the 'Yamal LNG' and 'Arctic LNG 2' projects in Russia. In addition to these projects, there are also plans for other LNG projects in the Arctic region, including Canada and Norway. Based on this background, the concept of a liquefaction process using seawater temperature in the polar region was established as a means of increasing productivity in LNG production facilities while reducing harmful emissions. Research was conducted using the Cascade cycle liquefaction process, which is a three-step liquefaction cycle utilizing propane, ethylene, and methane refrigerants in that order. The flow rate of natural gas flowing into the LNG production facility was arbitrarily set at 1000 kg/h. Since the seawater temperature can only be used in the first-stage liquefaction cycle using propane refrigerant, the power consumption of the compressor and condenser in this cycle and the flow rate of the propane refrigerant were measured. As a result, the study found that the power consumption of the compressor and condenser in the existing Cascade cycle, operated in an environment up to 40 degrees Celsius, was 35.3kW and 95.86kW, respectively, with a propane refrigerant flow rate required for cooling of 927.2kg/h. However, when the polar seawater temperature was used in the liquefaction process, the operating environment was -2 degrees Celsius, and the power consumption of the compressor and condenser was reduced to 6.321kW and 33.63kW, respectively, while the required propane refrigerant flow rate was 292.7kg/h. To summarize, the study found that utilizing polar seawater temperature in the first-stage liquefaction cycle using propane refrigerant reduced power consumption by 29.35% and propane refrigerant flow by 30.11% when compared to the existing Cascade cycle operated in an environment up to 40 degrees Celsius.

Audience Take Away Notes

- The audience can gain knowledge about the design of the Cascade cycle LNG liquefaction process and the natural gas cooling system that utilizes the ocean temperature difference. This information can be used to conduct in-depth research on the LNG industry in the polar region

- The utilization of a natural gas cooling system that employs cold seawater in the polar region is expected to assist the audience in determining the power consumption and flow rate of propane, ethylene, and methane refrigerants required for the Cascade natural gas liquefaction process facility in the polar region
- The design of the Cascade LNG liquefaction process can serve as a basis for lectures on its fundamental concepts. The process itself utilizes a cooling system that takes advantage of the temperature difference in the polar region, resulting in high efficiency through a design method that employs simple ideas and variables. This applied concept is beneficial for both lectures and research
- The natural characteristics of the polar region can be utilized to increase the efficiency of natural gas liquefaction, as opposed to using power, without requiring complicated additional processes. This solution may simplify the designer's job, making the process more efficient

Biography

Mr. Donghee Lee studied Oil and Gas Engineering at St. Petersburg Mining University, Russia graduated as MS in 2018. In 2021, he completed the LNG design expert training course supervised by Gyeongnam Techno Park in Republic of Korea, and in 2022, he completed the chemical engineering course for plant experts supervised by the Education Institute Construction in Republic of Korea. He is currently pursuing his doctorate at St. Petersburg Mining University in Russia, and at the same time, he is conducting research on non-destructive testing of lubricating oil and pipes in a research team at HAEJIN LS, an official partner of Shell Korea.

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Bioenergy cooperatives as a sustainable solution of households heating in rural areas using local biomass resources

The energy crisis across the Europe, as well as the continuously growing trend to reduce the usage of fossil fuels caused that more and more attention is paid to produce energy from local renewable resources, especially in rural areas. Moreover, the EU Directives promote the increase of the engagement of local society in energy production, through the creation of energy cooperatives that should lead to self-sufficiency of the region and reduction of energy poverty amongst the residents in these areas. In terms of the households heating in rural areas, the use of biomass is proposed as a relatively cheap fuel that can be harvested in sustainable way from local resources. The heating systems in rural area, due to the residents scattering, are complex and should be realized with care taking into account the specific local possibilities, the investments costs, energy policy of the given country as well as social acceptance/attitude. Therefore, different solutions may be applied to provide the heat form biomass to the final users. The European BECOOP project (financed by the EU) aimed to unlock the bio-energy cooperatives creation/development potential across Europe. As a result, the selected cases of the bioenergy cooperatives applying direct and district heating, as well as the logistic operations and the biofuels production have been analysed. The four strategies (taken place in Italy, Spain, Greece and Poland) have been presented and described pointing the crucial bottlenecks responsible for a final success of the local biomass utilisation for energy purposes. It was found that the main factor influencing the practical implementation and creation of an energy cooperative is the readiness of the local community for active bottom-up involvement in the process of its creation and the support and involvement of local authorities, whose participation is a kind of guarantee of the implementation of the project and building social trust between the stakeholders of the cooperative.

Audience Take Away Notes

- The sustainable use of local biomass for energy purposes limits the demand for fossil fuel
- Short biomass logistics chain is characterized by lower environmental footprint, economic benefits, and local development
- Energy cooperatives lead to the reduction of energy poverty in rural areas and increase of social integration
- The engagement of local society is crucial for effective energy cooperative development
- Energy cooperatives increase the local energy security and self-sufficiency of the region

Biography

PhD Arkadiusz Dyjakon(associate professor) works in the Department of Applied Bioeconomy at the Wroclaw University of Environmental and Life Sciences (Poland). He received his PhD in 2003 in the Institute of Heat and Power Engineering (Wroclaw University of Technology). His scientific activity is related to the use of biomass and other RES for energy purposes, as well as, environmental, economic, social and technical aspects in power engineering. He worked in such institutions as: TU Delft (The Netherlands), ECN (The Netherlands), and EDF R&D (France). He is engaged in foreign projects (FP7, H2020, InterReg and others). He is an author and co-author of over 120 publications.

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The organocatalysis: An efficient tool in ring-opening polymerization - valuable interests of DBU & TBD superbases

The term “organocatalysis” or organic catalysis describes the acceleration of chemical reactions through the addition of a substoichiometric quantity of an organic compound. The interest in this field has increased spectacularly in the last few years as result of both the novelty of the concept and, more importantly, the fact that the efficiency and selectivity of many organocatalytic reactions meet the standards of established organic reactions. Organocatalytic reactions are becoming powerful tools in the construction of complex molecular skeletons. The diverse state-of-the-art examples show that in recent years organocatalysis has developed within organic chemistry into its own subdiscipline, whose “Golden Age” has already dawned.Organic catalysis in ring-opening polymerization (ROP) has become a powerful alternative to more traditional metal-based catalysts. The field has developed to a point at which there are not only excellent low cost and easy to use organocatalysts for day-to-day polymerizations, but the ability to precisely control the synthesis of advanced polymer architectures and ROP monomers that are extremely challenging to polymerize with other catalysts now exists. Among the most successful and widely studied were the families of amidines and guanidines. Specifically, the commercially available base 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU) has proven to be a valuable ROP catalyst and has been applied by a wide range of researchers. Extension of these studies to examine other organic bases revealed that the 1, 5, 7-triazabicyclo [4.4.0] dec-5-ene (TBD) is even more active for ROP that, in turn, present other interesting observations and opportunities in ROP. This presentation will highlight the key advances made in our laboratory by using both DBU and TBD superbases. To fit with the time allowed for the presentation, two examples will be illustrated, i.e.the use of DBU and TBD superbasesto (i) switch on demand a controlled polymerization reaction reversibly “on” and “off” via the reversible fixation of gaseous $CO_2$and (ii) to promote the “one-pot, one-step”preparation of multi-block copolymers by simultaneous “O-alkyl” and “O-acyl” scissions of lactones.

Audience Take Away Notes

- Organocatalysis offers a number of opportunities in polymer synthesis
- Organocatalysis has become a powerful alternative to more traditional metal-based catalysts
- Multi-block copolymers, representing fascinating architectures, could now be prepared in a “one-pot, one-step” process involving simultaneous and independent “O-alkyl” and “O-acyl” cleavage scissions of 4- and 6-membered lactones
- The ability of superbases to interact with CO_2, juxtaposed with their catalytic power in ROP, allows to switch on demand a controlled polymerization “on” and “off”,representing a useful tool in modern polymer chemistry

Biography

Olivier graduated from the University of Mons (UMONS) in 2005 and moved to Stanford University and the IBM Almaden Research Center to undertake periods of postdoctoral research under the supervision of Prof. Waymouth and Dr. Hedrick. In 2008, Olivier returned to Belgium as Research Associate of the F.R.S.-FNRS before being appointed as a Professor of Chemistry for UMONS in 2017 and Senior Research Associate of the F.R.S.-FNRS in October 2020. Olivier is currently working in the Laboratory of Polymeric and Composite Materials at UMONS.He has (co)authored 144 scientific papers in international journals, 4 patents and 4 book chapters.

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Development of slow releasing fertilizer with water retention function using starch-based hydrogel

This presentation will discuss our recent achievement of developing slow releasing fertilizer with water retention function using starch-based hydrogel, that was fabricated by reactive extrusion. The new development of reactive extrusion, in particular application twice initializations to increase both graft and reaction efficiencies were introduced. The slow releasing and water retention behaviours were discussed on based on the starch-based hydrogel.

Audience Take Away Notes

- Audiences will be able to use the methodology to develop new kind of slow releasing fertilizer with water retention function.
- This new concept and methodology will help audiences to open a new direction in their job.
- Other faculties could use the new concept and achievement to expand their research.
- This provides a practical solution to the well-recognized problem of the balance between graft and reaction efficiencies.
- It will improve new information to assist in solving the challenges from agriculture.

Biography

Prof Long Yu is currently Principal Scientist, Institute of Chemistry, Henan Academy of Sciences, and Professor in South China University and Technology. Former Director of Sino-Singapore International Joint Research Institute, He received his PhD from Monash University, Australia. He used to work in CSIRO, Australia as Principal Scientist for 18 years. He has had more than 180 papers published and citation time is more than 15000 (h-index 59). He has been selected as a Fellow of Royal Australian Chemical Institute in 2002, and currently been pointed as Editorial Board of 8 journals. He has chaired many international conferences and given many plenary/keynote/invited talks.

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Development and characterization of CuO and ZnO/CuO based CO gas sensors

Human population and industrialization are increasing in our society. So air pollution has become a serious issue in our environment. Carbon monoxide (CO) is one of the most toxic gases, which is colorless, tasteless and orderless. Metal oxides are very appealing materials due to their distinct physical and chemical properties, and are useful in a wide range of applications in today's digital society, including solar cells, microelectronics, optoelectronics, spintronic and various chemical sensors. Cupric oxide (CuO) is one of the important p-type metal oxides with bandgap energy of 1.21 eV and is preferred for gas sensor fabrication [1]. CuO thin films of varying thickness ranging from 25 to 300 nm have been synthesized on alumina substrate by the thermal oxidation of Cu metal films deposited by vacuum evaporation method. The optimal oxidation conditions for the thermal oxidation of Cu films are 400 °C and 5 h, which convert Cu thin films to CuO via solid-state reaction [2]. From x-ray diffraction, CuO films are found to have polycrystalline nature with monoclinic crystal structure. The surface morphology of CuO evolves from coarse granular features to finer secondary grain formation with increasing CuO film thickness. The gas sensing characteristics of CuO films were examined using 106 ppm of CO gas at various measurement temperatures. It is found that the CuO film thickness of 200 nm exhibits a higher CO response of 52 % at 375 °C, where a minimum response/recovery time of 3.9 min. /5.7 min was observed at 400 °C. Again ZnO/CuO heterostructure improved the sensing properties, which can detect at a lower temperature of 150°C and maximum a CO response of 180 % was achieved at 375 °C. The fast and selective CO detection at low ppm levels was observed in ZnO/CuO heterostructure. The experimental conditions, the critical change in surface morphology and CO characteristics of CuO and ZnO/CuO structures will be discussed in detail.

Keywords: ZnO/CuO, Thermal Oxidation, PVD process.

Audience Take Away Notes

- Audience will get knowledge about the current situation and the importance to develop portable gas sensors
- Prepared ZnO/CuO heterostructure gives importance to improving the sensing properties of the sensor device
- The fabrication process of a heterostructure sensor device and study of sensing characteristics is very simple, which can help other faculty to improve the properformance

Biography

I, Ms. Debashrita Mahana completed my Master's Degree in Physics at the Central University of Haryana, India. Then, I joined the Ph.D. program under the supervision of Dr. M. Senthil Kumar in the Environmental Sciences and Biomedical Metrology Division at the National Physical Laboratory, New Delhi, India with a CSIR fellowship. Currently, I am working as a Senior Research Fellow (SRF) in the field of Copper oxide sensor devices and their properties for gas sensing applications.

Oumaima Mabrouk[1,2], Helmi Hamdi[1,2]*, Sami Sayadi[2], Mohammad A Al-Ghouti[1],Mohammed Abu-Dieyeh[1], Reginald Kogbara[3], Ali Al-Sharshani[4], Osman Abdalla[5], Sabah Solim[4], Nabil Zouari[1,2]

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Agricultural reuse of gas-to-liquid sludge to promote fiber crop cultivation under extreme desert conditions

The limitation in conventional agriculture in Qatar is mainly due to challenges related to desert pedo-climatic conditions including short field cultivation period, prolonged hot season, limited rainfall, and depletedsoils. Gas-to-liquid (GTL) sludge, a less common nutrient-rich by-product of GTL wastewater treatment process, could be considered as an organic amendment for improving the properties of depleted soils. In addition, growing non-food crops using alternativeorganic materials is a sustainable recycling pathway to prevent landfilling and contamination risks. In this study, four soil treatments were considered forcotton cultivation (Gossypium hirsutum var. MAY 344) under open field conditionsof Qatar. These treatments include the use of chemical fertilizers, cow manure compost, and GTL sludge added to soil at 1.5% and 3%. Overall, GTL sludge application promoted plant developmentand cotton yield compared to conventional amendments. In this regard, there was a dose-dependent enhancement of soil fertility parameters and cotton cumulative fiber yield (4.68 and 5.67 t/ha for BS 1.5% and BS 3%, respectively). However, the produced fiber quality was likely to be more dependent on the selected cotton variety and prevailing climate conditions rather than soil enhancement. In this regard, the produced cotton fibers were characterized by high maturity and reflectance (whiteness) rates as well as acceptable strength. On the other hand, the adverse environmental effects generally related to wastewater sludge reuse were not significant in this study. Detected heavy metal concentrations in soil at the end of cultivation cycle were within the acceptable limits, which do not pose an environmental issue under the described experimental conditions. Bacteriological contamination with pathogens did not occur since GTL sludge does not originate from sewage. Leachate analysis showed no risks for groundwater contamination for the addressed parameters as well.

Audience Take Away Notes

- Cotton production could be possible under the extreme hot desert conditions
- GTL sludge has a high fertilizing potential
- Cotton quality seems more related to selected varieties rather than cultivation conditions
- Fiber crop cultivation could be a sustainable solution for sludge recycling

Biography

Dr. Helmi Hamdi is currently a Research Associate Professor at the Center for Sustainable Development, College of Arts and Sciences, Qatar University. He obtained a Master's degree in Agricultural Engineering from the National Institute of Agronomy, Tunisia (2000), and a PhD in Environmental Science and Resource Management from Okayama University, Japan (2006). As of April 2023, Dr. Helmi Hamdi has published two books, three book chapters and 60 peer-reviewed papers, conference papers, and research reports in the fields of sustainable crop production, reuse of alternative inputs in agriculture, soil quality monitoring, and nanotechnology applications in agriculture.

Diana Rakhmawaty Eddy[1*], Geometry Amal Nur Sheha[1], Yusi Deawati[1], Solihudin1, Muhamad Diki Permana[2], Takahiro Takei[3], and Iman Rahayu[1]

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Synthesis of tio$_2$ (anatase-brookite)/Ag$_2$o/Ag$_2$Co$_3$ composites for photo degradation of metformin under visible light

The presence of pharmaceutical products such as metformin at unusual concentrations in aquatic systems can disrupt human health and the ecosystem. Photo catalytic technology using TiO_2 semiconductors can fix this problem. TiO_2 can be modified to become anatase-brookite and combining it with Ag_2O/Ag_2CO_3 so that it will be able to prevent electron recombination and be active in visible light. The objective of this research is to analyze the phase composition, thermal properties, morphology, and optical properties of the TiO2 anatase-brookite/Ag_2O/Ag_2CO_3 and determine the effect of the Ag_2O/Ag_2CO_3 percentage on metformin photo degradation. The methods include was synthesis TiO_2 anatase-brookite using a son chemical process, synthesis TiO2/Ag_2O/Ag_2CO_3 using sono chemical process and in situ phase transformation, characterization using XRD, FTIR, TGA, SEM-EDS, and UV-VIS-DR as well as photo degradation of metformin under visible light. The result of the research showed that higher mass percentage ratio between TiO_2 and Ag_2O/Ag_2CO_3 would create more Ag_2CO_3 phases, the thermal stability of the composite material is better than bare materials; the morphology showed that a spherical Ag_2O/Ag_2CO_2 surrounding agglomerated TiO_2, the composite material is active in the ultraviolet region up to visible light. The best photo catalytic activity for metformin photo degradation was produced by 1:4 $TiO_2/Ag_2O/Ag_2CO3$ material with photo degradation efficiency is 58.9% under visible light.

Biography

Dr. Diana Rakhmawaty Eddy studied Chemistry at Universitas Padjadjaran, Indonesia and graduated BSc in 1997. She then joined at the Department of Chemistry, Universitas Padjadjaran as a lecturer at the Materials Functional research group. She continue studied at Institut Teknologi Bandung, Indonesia and graduated as MSc in 2004. She received her PhD degree in 2008 at Osaka Prefecture University, Japan. Her topic research about Photo catalysis, Materials Functional, and Composites. She obtained the position of an Associate Professor at Universitas Padjadjaran, Indonesia. She has published more than 51 research articles in SCI(E) journals.

Vandana Sakhre*, Saurabh S Nambiar, Emediong Peter Akpan
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Synthesis of bio plastics and their characteristics

There are increasing environmental concerns for plastic (oil-based polymers) in society today, and there has been an effort to introduce more environmentally friendly materials like Starch-based bioplastics because it is obtained from a renewable resource and is relatively cheaper than other biodegradable polymers. This research investigates corn and rice starch use to increase the tensile properties of various bioplastics used for packaging applications. The specific use of rice and corn starch is prompted by the high amounts of amylose polysaccharides found in them compared to other starch sources. The ingredients used were starch or flour, Vinegar, water, and glycerol. These samples were made in 50/50 compositions of either rice or corn starch and the other starches used. The test carried out analyzed the thickness measurements, surface microscopy, water-solubility, water content, tensile strength, and biodegradability of the bioplastic. The results show an increase in the tensile strength of the samples, but water solubility and absorption were also increased. Using blends of rice or corn starch with other starches offers better performance than the conventional bioplastics from one starch source.

Audience Take Away Notes

- The audience will be able to know the bio-plastic synthesis techniques
- They can also be able to understand the various raw materials to make PLA
- They will be able to know the characterization of bio-PLA

Biography

Dr. Vandana Sakhre has over **24 years of experience in teaching, research, and industry**, which includes 19 years as an Assistant Professor, 2.5 years of Industrial experience, and 3 years as a Research Fellow of CSIR Labs. While teaching she has developed various labs including Heat Transfer, Mass Transfer, and Chemical Reaction Engineering and Process Dynamics & Control labs. The advanced separation and research lab for the M. Tech program was also developed. Currently, **Dr. Vandana is working with the Manipal Academy of Higher Education, Dubai campus** as an Associate Professor since 2017. She is handling the chemical engineering department as the Program Coordinator and the coordinator of a student project and research work. She is presently working on the BASF project as an externally funded project and she did a few internally funded research projects. She is dedicated to teaching, learning, and research. Dr. Vandana has worked on **AI techniques for the synthesis and control of chemical separation processes, especially Reactive Distillation (RD).** She is also engaged in research on sustainability and environmental management.

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CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Chen-Wei Liu*, Ting An Lin, Keh-Perng Shen

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Development of chemical recycling method for circularity of thermoset composite waste

The growing of thermoset composite waste with valuable carbon fibres has cumulating every year from variousapplications such as sports equipment, aerospace and automotive. Except bound for landfill, there are some different ways to recycle the fiber composite waste.The ideal key solution must be a cost-effectively and green recycling method without causing negative environmental impact.Developing method for chemical recycling of thermoset composite to high value carbon fiber and organic oligomers is also an important issue. In this work, we propose anefficient strategy for chemical recycling of fiber composite waste via using chemical degradation formula.The experiment results show that the fiber composite waste is successful recycling without changing fiber length. Moreover, the chemical degradation agent used in this process can be recycled and reused. From thermogravimetric analysis (TGA) results, the surface of carbon fiber are very clean and no resin left. The residual rate of resin is less than 1%. Besides carbon fiber obtained from chemical recycling method, therecycling process also recovers valuable oligomers from thermoset composite waste. Additionally, a brief analysis of their environmental and economic aspects are discussed based on sustainable values of reclaimed fiber.The ultimate goal for recycling of waste thermoset composite is to increase the economic value of the recycled products, to bootstrap an industrial eco-system with a viable business model.

Audience Take Away Notes

- Understand the currently status for recycling of thermoset composite waste
- Introduction of efficient strategy for chemical recycling of fiber composite waste
- Recognize the potential application of reclaimed fiber in sustainable values products
- Brief introduction ofthe environmental and economic aspects forchemical recycling method

Biography

Dr. Chen-Wei Liu, he graduated from Institute of Materials Science and Engineering (IMSE) at National Central University (NCU), Taoyuan, Taiwan. He then joined Industrial Technology Research Institute as a researcher. His research focuses on interdisciplinary aspects of electrochemical catalysis for fuel cell, environmental chemistry for air pollution control and waste recycling for composite materials.He has published more than 40 research articles in SCI journals.

Hao Dang*, Weigang Ma

Key Laboratory for Thermal Science and Power Engineering of Ministry of Education, Department of Engineering Mechanics, Tsinghua University, Beijing, China

Using electric field to regulate the flow of nano-confined liquid

In recent years, membranes, porous polymers and carbon nanotube arrays with nano-channels have shown great potential in solar desalination. Water will exhibit distinctive mass transfer behavior in the nano channels of these materials under the temperature difference caused by solar energy. It is of great significance to enhance the thermophoresis of nanoscale confined liquid for improving the efficiency of seawater desalination. Unfortunately, it is not clear how to enhance mass transfer through non-contact method at present, but it is very expected in technology. In this work, we propose a feasible strategy to enhance the thermophoresis of confined nano-liquid via using external electric field. Moreover, this strategy is demonstrated by a striking case, namely the electric field-intensified thermophoresis of the confined nano-liquid within carbon nanotube, with the aid of molecular dynamics simulation. The interfacial water molecules undergo a configuration transition from the disorder-like to the ordered network-like under the directional electric field-induced hydrogen bond interactions. The electric field also influences the moving parameters of water molecules in CNT significantly. The friction coefficient □decreases with the increase of electric field intensity E. The order parameter of water molecule movement increases about twice. As a result, thermophoresis depicts a regular movement under electric field and the velocity increase as high as 99% is also achieved. This work illustrates a great promising potential in seawater desalination, cellular uptake and drug carrier, and nanofiltration membranes.

Audience Take Away Notes

- Recognize the potential application of MolecularDynamic simulation technology in green nanotechnology
- Understand the research status of the confined water mass transfer in nanoscale
- Understand the mechanism of mass transfer regulation of confined water using electric fields. And provide some opinions different from previous researchers

Biography

Mr. Dang studied Energy and power engineeringat the University of Science and Technology Beijing and graduated as BA in 2020. He then joined the research group of Prof. Ma at Tsinghua University, Beijing. He has published 8 SCI journals in the first two years of his master's career.

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Enhanced hydrogen and oxygen evolution reactions utilizing pure plasmon-activatedwater

To resolve the growing issue of global environmental pollution and meet the goal of reducing carbon emissions, renewable fuels, such as hydrogen, are being consideredas green energy sources. Utilizing electrochemical hydrogen evolution reactions (HERs) to split water is the most commonly employed method to prepare hydrogen for renewable energy. In HERs without a catalyst, the reaction efficiency is low because of the inability to activate one of the most important steps of the reaction, the breaking of O–H bonds during the dissociation of H_2O.This relatively large energetic barrier can be easily overcome by utilizing expensive commercial catalysts, like platinum (Pt) and palladium (Pd), to facilitate the dissociation of water. At present, the most common approaches for HERs have focused on cheap, earth-abundant catalysts with different chemical compositions and structures. The efficiencies based on the developed catalysts are compared to Pt-based HERs to evaluate the corresponding performances. On the other hand, oxygen evolution reactions (OERs) are an oxidation process for preparing oxygen by water electrolysis, which represents an efficient and clean technology for energy conversion and storage.Although we know that the activity of water critically depends on dynamic hydrogen bonds (HBs) among its molecules, the known properties of water are always based on inert bulk water with strong HBs. That is because we are still not very clear about the detailed structure of water molecules at the molecular level. Moreover, the effects of HBs of reactant water in HERs and OERs on the corresponding reaction efficiency are less understood and discussed. In this work, we propose an alternative strategy for OERs and HERs, focusing on water itself, utilizing Au-free condensed water (PAW-C) from heated trace Au-containing plasmon-activated water (PAW). Compared to active PAW, the electron-doping structure of PAW-C was reduced, while the degree of reduced hydrogen bonds (HBs) in PAW-C was enhanced. Encouragingly, compared to deionized water (DIW)-based 0.1 M KOH solutions, the measured current densities of OERs on a catalytic Pt electrode were significantly higher by average magnitudes of 45% and 23% for the PAW-C-based and PAW-based 0.1 M KOH solutions, respectively. Compared to the DIW-based 0.1 MH_2SO_4solution, the measured current density of HER on a catalytic Pt electrode was significantly higher by an average magnitude of 20% for the PAW-C-based 0.1 MH_2SO_4 solution (an average higher magnitude of 15% for the PAW-based solution). Moreover, this proposed strategy was applicable to inert carbon and stainless steel electrodes for OERs.

Audience Take Away Notes

- Enhanced hydrogen and oxygen evolution reactions utilizing active pure PAW water
- The proposed strategy being applicable to inert and catalytic electrodes for OERs
- Active and stable PAW-C as a green solvent applicable to more-effective OERs and HERs

Biography

Dr. Yu-Chuan Liu, he graduated from Institute of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan. His stduy fields include preparation and related application of plasmon-activated water, and chemical engineering.He has published more than 150 research articles in SCI journals.

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Green energy production via active pure water with reduced hydrogen bonds

From the perspective of sustainable development of the earth, the use of environmentally friendly water in various fields of science and harvesting solar energy for available energy generation are very worthy developments. We recognize that the properties of water and its associated activities depend to a large extent on the strength of hydrogen bonds (HBs) formed among water molecules themselves. However, because our understanding of water at the molecular level remains uncertain, today all well-known properties of water are generally described as properties of inert, bulk water due to the tetrahedral hydrogen-bonded network. Some recent studies showed that the local HB structure of water confined in nano-sized spaces or at interfaces can change, thus affecting properties of the water, but since such a small amount of water only exists at the nanoscale, its applicability is greatly limited. Recently, various free-standing and long-lived functional waters that can be fabricated in small quantities have been proposed in the literature to increase practical applications in various fields. It was reported that this treated water can remain in a metastable state, which means that its unique properties can be maintained for a period of time. For example, electrospinning spray-engineered water and cold atmospheric pressure plasma-activated water were prepared as alternative green disinfectants. Some researchers also developed micro-sized water droplets for green reduction reactions, while magnetized water was also developed into active water to create interesting synthesis reactions. The development and utilization of these active waters differ from the traditional view of solvent water as a bystander, which does not really participate in reactions. In this work, we propose an innovative application of solar energy- generated active pure water (APW) with reduced HBs to enhance chemical reactions and physical procedures. Compared to conventional deionized water (DIW), the generated APW possessed a lower specific heat of ca.0.96. The swelling degree of artificial skin in APW significantly increased by ca. 29%. Moreover, the density of an ethanol/APW solution significantly increased by 0.21% due to more free water molecules being available in APW to form stronger HBs with ethanol. Encouragingly, efficiencies of hydrogen evolution reactions performed in an APW-based acidic solution and oxygen evolution reactions performed in an APW-based basic solution significantly increased by 42% and 17%, respectively, compared to DIW-based solutions.

Audience Take Away Notes

- Solar energy-generated active pure water (APW) with reduced hydrogen bonds
- Enhanced hydrogen and oxygen evolution reactions utilizing APW
- APW can create a more-effective green process in physical and chemical fields

Biography

Dr. Fu-Der Mai, he graduated from Institute of Chemistry, National Tsing-Hua University, Hsinchu, Taiwan. His stduy fields include preparation and related application of nano gold particles, and Secondary Ion Mass Spectrometer (SIMS) related researches. He has published more than 80 research articles in SCI journals.

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Development of starch-based materials and applications

This presentation will introduce our achievements in developing starch-based materials, including both fundamental issues like gelatinization, phase transition, chemical and physical modifications and application challenges like weaker mechanical properties, moisture sensitivity and instability. Based on the natural behaviors and modifications of starches we have developed and commercialized various starch-based materials, including disposable and edible products like edible film and medical capsules, various packaging trays and foams. The new directions will be discussed based on our achievements and experience.

Audience Take Away Notes

- Audiences will be able to use these new scientific knowledges in their job. For example, various phase transition during thermal processing starch, including gelatinization, retrogradation, degradation and decomposition would also happen in other polysaccharides or polymers containing hydroxyl groups
- Since this presentation discussed both fundamental scientific issues and application challenges audiences would benefit from the results in their job in either way
- Other faculties could use the results in this presentation to expand their research or teaching in different natural polymers, especially starch, cellulous and other polysaccharides
- The achievements, in particular reducing moisture sensitivity of starch-based materials provide a practical solution to the well-recognized problem of natural polymers containing hydroxyl groups

Biography

Prof Long Yu is currently Principal Scientist, Institute of Chemistry, Henan Academy of Sciences, and Professor in South China University and Technology. Former Director of Sino-Singapore International Joint Research Institute, He received his PhD from Monash University, Australia. He used to work in CSIRO, Australia as Principal Scientist for 18 years. He has had more than 180 papers published and citation time is more than 15000 (h-index 59). He has been selected as a Fellow of Royal Australian Chemical Institute in 2002, and currently been pointed as Editorial Board of 8 journals. He has chaired many international conferences and given many plenary/keynote/invited talks.

BOOK OF ABSTRACTS

22-23 MAY

DAY 02

VIRTUAL ROOM 01

KEYNOTE FORUM

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Application of metal single-site zeolite catalysts 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 metal single-site zeolite catalysts active in different catalytic processes such as oxidative dehydrogenation of propane into propene, selective catalytic reduction of NOx to N2, production of 1,3-butadiene or hydrogen from renewable sources, including ethanol obtained from biomass. Their catalytic activity strongly depended on the speciation and amount of metal incorporated into zeolite structure as well as their acidity.

Audience Take Away Notes

- The audience will be able to understand as control of preparation of catalyst systems
- They will see that catalytic activity depend on dispersion of metal in the framework of zeolite
- The researchers will be able, after my talk, do their own catalyst preparation using similar method

Stanislaw Dzwigaj

Sorbonne University, 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 Reactivite de Surface Universite 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.

Optoelectronic characterization of quinternary alloy

The Cu2Zn1-xCdxSnS4 quinternary alloy nanofibres with different Cd concentrations were grown on glass substrate using the electrospinning technique. The structural properties of Cu2Zn1-xCdxSnS4 quinternary alloy nanofibres were investigated by X-ray Diffraction (XRD), Field Emission-Scanning Electron Microscopy (FE-SEM) and Atomic Force Microscopy (AFM). Optical properties were analysed through UV-visible Spectrophotometry (UV-Vis) and Photoluminescence Spectroscopy (PL), which revealed that there is a decrease in band gap from 1.75 EV to 1.61 EV, with the increasing Cd concentration from x = 0 to x =1. The current–voltage measurements exhibited a power conversion efficiency of 3% under the solar illumination with intensity of 100 mW/cm2. Electrical properties supported that the Cu2Zn1-xCdxSnS4 quinternary alloy can be used as an absorber in solar cells. The bulk modulus, refractive index and dielectric constant, were also investigated.

Audience Take Away Notes

- Elaborate the industrial application of optoelectronics
- It will help the researchers and scientists
- Present the advantages of optoelectronics
- Avoid the disadvantages of optoelectronics

Yarub Al-Douri

Engineering Department,
American University of Iraq,
Sulaimani, Iraq

Biography

Prof. Dr. Yarub Al-Douri is from American University of Iraq, Sulaimani. Al-Douri has initiated Nanotechnology Engineering MSc Program and Nano Computing Laboratory. He has received numerous accolades including World's Top 2% Scientists by Stanford University, USA 2022, 2021 & 2020, OeAD Award, Austria 2020, JSPS Award 2019, AUA Award 2019, IFIA 2019, TWAS-UNESCO Associateship (Twice) Award 2015 & 2012, the total is 70 awards. Al-Douri is Associate Editor of Nano-Micro Letters (Q1), Editor-in-Chief of Experimental and Theoretical NANOTECHNOLOGY, Editor-in-Chief of World Journal of Nano Science and Engineering.

TiO_2 photocatalytic removal of hexavalent chromium and arsenic

Marta I. Litter[1, 2*], Jorge M. Meichtry[2, 3, 4]

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[4]DQRA Chemistry of the Environmental Remediation, Chemistry Management, National Atomic Energy Commission (DQRA-GQ, CNEA), Av. Gral. Paz 1499, San Martín, Buenos Aires province, Argentina

The presence of heavy metals and metalloids in water represents nowadays one of the most important environmental problems. These species have infinite lifetimes, and chemical or biological treatments present severe restrictions or are economically prohibitive. Hexavalent chromium, mercury, uranium, arsenic, or lead are on the list of priority pollutants of most environmental agencies, with more and more exigent limits of discharge or concentration in drinking water. From the beginning of the development of heterogeneous photocatalysis, the transformation and deposition of metals or metalloids were visualized as processes with promissory potential application to remove these pollutants from water. Three types of mechanisms can be considered for these processes, all of them taking place through successive monoelectronic electron transfer steps: (a) direct reduction by photogenerated electrons; (b) indirect reduction by intermediates generated from electron donors (reducing radicals); (c) oxidative removal by holes or hydroxyl radicals. This presentation is an overview of the work performed in our laboratories with the cases of hexavalent chromium and arsenic being treated in profundity. In the case of hexavalent chromium, direct reductive photocatalysis and indirect reduction by intermediates coming from ethylenediaminetetraacetic acid (EDTA) or citric acid added as electron donors are the main processes governing the removal of Cr (VI) by TiO2 photocatalysis. In the case of arsenic, removal can proceed by oxidation of As (III) to As (V), a very much studied process. However, reductive photocatalysis has been less studied and can take place under specific conditions, leading to the removal of as species by the formation of as (0) on the surface of the photocatalyst. While for As (III) direct reduction by photogenerated electrons is possible, As (V) reduction only proceeds in the presence of an electron donor such as methanol. The mechanisms taking place in these cases will be postulated in this presentation and the possible application to real systems will be discussed.

Audience Take Away Notes

- An understanding of the mechanistic pathways involved on chromium and arsenic photocatalytic removal will help the audience to use the concepts to optimize experimental conditions on lab-Scale and/or operational parameters on field scale to improve the rate and yield of the removal processes
- Same answer as before. Additionally, the presentation will emphasize the problem of pollution of water by heavy metals and arsenic and the effects on human health of these elements, especially in drinking water
- The experimental setup for the experiments is very simple and can be implemented easily in other university laboratories

Biography

Prof. Litter is Dr. in Chemistry (Buenos Aires University, Argentina), with postdoctoral studies at the University of Arizona, USA. She is a Senior Researcher at the National Research Council and a Full Professor and Consultant at the National University of San Martín (Argentina). She has more than 250 publications in journals, books, and book chapters. She received the Mercosur Prize (2006 and 2011), the Charreau Prize for Regional Scientific-Technological Cooperation, the Prize for Latin American Women in Chemistry

- Photocatalysis is a very simple and low-cost technology, as TiO2 is a very stable, reusable, and cheap material and solar light can be used to start the pollutants removal process
- Reactors can be easily designed, and scaling is even possible
- Photocatalytic processes use concepts from several disciplines such as physics, chemistry, chemical engineering, and environment. Thus, it is an interdisciplinary subject that can improve the knowledge of the state of the art of this theme by the audience

(2021), and the Houssay Prize (2022). She was designated pioneer in photocatalysis in Argentina and is a Member of TWAS, ACAL, and the Argentine Academy of Environmental Sciences.

Designing materials for nanocatalysis

Multifunctional nanostructures as nanocatalysts find the possibility for their applications in water splitting processes for hydrogen generation as a renewable source of green energy. The studies of some multifunctional nanoparticles by chemical synthesis reveal the formation of monophasic nanostructures with fairly uniform distribution of nearly spherical particles, high specific surface area and visible optical band gap. Photocatalytic generation of hydrogen in water splitting process by using as-prepared nanoparticles has also been studied under the visible light irradiations which showed a significant H2 evolution reaction rate. The development of nanostructured catalysts has also been preferred to carry out the heterogeneous catalytic organic transformations because of greater number of surface-active sites for catalytic processes, high catalyst recovery rate, especially their environment friendly nature and their ease of synthesis. Besides the advances in Nanocatalysis, certain challenges including not well-defined morphologies due to loss of control over it and loss of catalytic activity during operation need to be addressed. Herein, we discuss some nanocatalysts for certain organic transformation reactions with enhanced activity as well as in water splitting reactions for hydrogen production.

Tokeer Ahmad

Department of Chemistry, Jamia Millia Islamia, Jamia Nagar, New Delhi, India

Biography

Prof. Tokeer Ahmad did his masters (chemistry) from IIT Roorkee and Ph.D. from IIT Delhi. Presently, he is full Professor at Jamia Millia Islamia, New Delhi. Prof. Ahmad has supervised 10 PhD's, 74 postgraduates, 9 research projects, published 130 research papers and two books with research citation of 4520, h-index of 40 and i10-index of 84. Prof. Ahmad is active reviewer of 112 journals, delivered 105 Invited talks and presented 121 conference papers. Prof. Ahmad has received DST-DFG award, ISCAS Medal, Inspired Teacher's President Award, Distinguished Scientist Award and elected as Member of National Academy of Sciences India. Prof. Ahmad has been figured in World Top 2% Scientists by Stanford University, USA and has also been conferred the prestigious Maulana Abul Kalam Azad Excellence Award of Education for the outstanding contribution in the field of education.

22-23 MAY

DAY 02

VIRTUAL ROOM 01

SPEAKERS

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Mohammed M. Bettahar*, Jean Barriol Institute, L2CM, CNRS
Faculty of Sciences and Technology, Lorraine University, Vandoeuvtre-les-Nancy, 54506, France

The hydrogen spillover effect influencing parameters

In this investigation we examine the various parameters influencing the mechanisms of formation and diffusion and role in hydrogenation reactions of hydrogen spillover over oxide supported metal catalysts. The exact role of oxygen vacancies is questioned. Attention is paid to the reactivity scaling of oxide supports.

Biography

Mohammed M. Bettahar held his PhD degree in Physical Chemistry in Paris. He worked for the French CNRS as Attaché de Recherche in Paris and Research Director in Caen. He pursued his career as Full Professor in Algiers then in Nancy. He is Professor Emeritius in Lorraine University since 2015. Main research topics are related to Nanomaterials and Catalysis (Selective Hydrogenation or Oxidation, CO2 or CH4 transformations, Hydrogen Storage). Currently his research focuses on Nanomaterials for biofuels and biochemicals fabrication.

V. Navakoteswara Rao*, J M Yang

Nano-convergence Technology Division, National Nanofab Center, at Korean institute of science and technology (KAIST), 291 Daehak-to, Yuseong-gu, Daejeon City 3441, Republic of Korea

Monodispersed core/shell nanospheres of ZnS/NiO with enhanced H^2 generation and quantum efficiency at versatile photocatalytic conditions

Hydrogen gas is a cleaner fuel and generates electrical energy in proton exchange membrane fuel cells with high efficiency and the best alternative energy for alternative 1. The present investigation is the first to elucidate the synthesis of mono-dispersed ZnS/NiO-core/shell nanostructures with a uniform thin layer of NiO-shell on the ZnS-nanospheres as a core under controlled thermal treatments. NiO-shell thickness was varied to be 8.2, 12.4, 18.2, and 24.2 nm, while the ZnS-core diameter was fixed as 96±6 nm. The crystalline phase and core/shell structure of the materials were confirmed using XRD and HRTEM techniques, respectively. Optical properties through UV-vis spectroscopy analysis revealed the manifestation of red shift in the optical properties of core/shell materials, while the XPS analysis of elements elucidated their stable oxidation states in ZnS/NiO core/shell structure. The optimized ZnS/NiO-core/shell showed1.42 times higher H2 generation (162.1 mmol.h-1.g-1cat) than the pristine ZnS-core (113.2 mmol.h-1.g-1cat) and 64.5 times higher than the pristine NiO-shell (2.5 mmol.h-1.g-1cat) owning to the many reasons (a) uniform core-shell structure (b) monodispersed nanospheres, (c) high surface area and more number of active sites and (d) Vacant 3d orbital. The quantum efficiency at wavelengths of 420, 365 nm, and 1.5 G air mass filters was found to be 13.5, 25.0, and 45.3%, respectively. Water splitting was also performed without adding any additives, which resulted in an enhanced H2 gas evolution of 1.6 mmol.h-1.g-1cat under sunlight illumination. Photo-electrochemical measurements revealed a stable current density and minimized charge recombination in the system. The performed recyclability and reusability tests for five recycles demonstrated the excellent stability of the developed photocatalysts. Based on the characterization properties we proposed the plausible photocatalytic water splitting mechanism for superior photocatalytic hydrogen generation under solar light irradiation as shown in Figure, here majorly three steps occur i.e, (i) photon energy absorption (ii) charge carrier migration, and (iii) redox reaction NiO shell thickness protects from the photo-corrosion and charge carrier recombination, finally give good yield hydrogen fuel conversion efficiency.

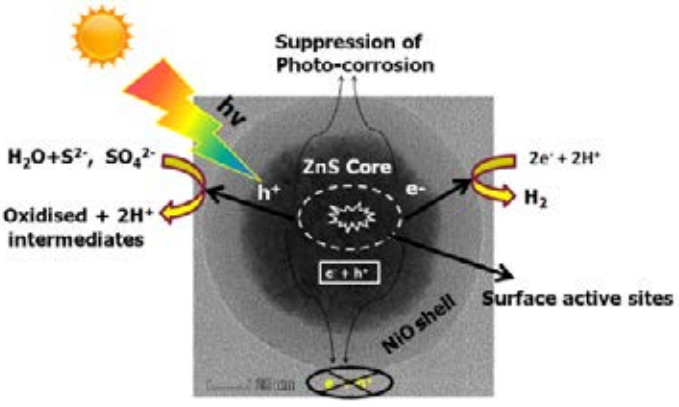


Figure: Plausible reaction mechanism for the photocatalytic H2 gas production over ZnS/NiO core/shell (ZCNS-2) via water splitting under direct sunlight irradiation.

Keywords: Hetero junction, Nanohybrid, photocatalyst, Wurtzite, and cubic.

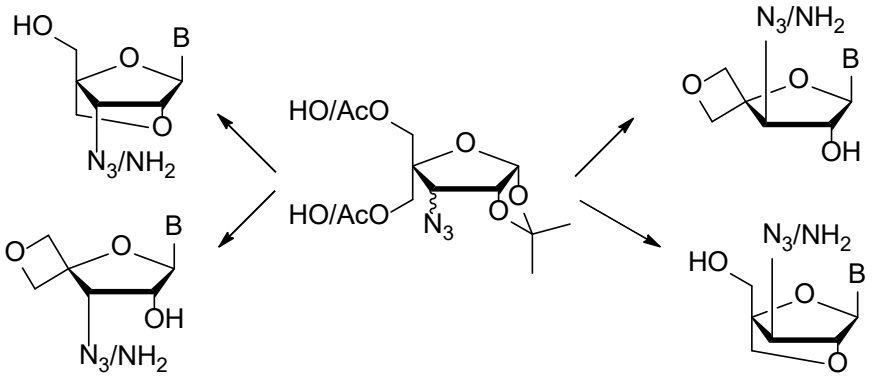
Biography

Dr. V. Navakoteswara Rao was awarded a Bachelor of Science (Maths, Physics, and Chemistry) in April 2011 from Sri Venkateshwara Arts College, Tirupati affiliated with Sri Venkateshwara University, Tirupati. He has obtained a Master of Science in the Department of Chemistry in April 2014 from Sri Venkateshwara University, Tirupati. Further, He has received a Bachelor of Education in Physical Science and Mathematics Methodology in November 2015 from Sri Krishna Devaraya University. He qualified Council of Scientific Industrial Research (CSIR-UGCNET) All India Rank 43rd rank in chemical sciences 2014 and Graduate Aptitude Test in Engineering (GATE-2018) with a GATE score is 340. He was selected and MNRE: YVU-CECRI Project worked as a Junior Research Fellow as well as enrolled Ph.D. on "Hierarchical Composite Nanostructure Photocatalyst For Water Splitting Under Solar Light Irradiation" under the supervision of Prof. M.V. Shankar in Nanocatalysis and Solar Fuels Research laboratory during March 2016 to April 2018 as a Junior Research Fellow. Later he was upgraded from Junior Research Fellow to Senior Research Fellow (May 2018 to March 2019). To continue doctoral research V. Navakoteswara Rao was awarded Senior Research Fellowship by the Council of Scientific Industrial Research (CSIR-SRF) Pusa; New Delhi, India. In order to, he has selected prestigious followership which is the Brain pool program-2021 working as a senior scientist at the Korea Advanced Institute of Science & Technology (KAIST), Daejeon, Republic of Korea. He has authored 40 publications, 1 book (Monograph), 2 book chapters, and presented papers in 27 international and national conferences he won two best poster presentation awards in National/International conferences and a cumulative Impact factor is 315.5 with H-Index 19, I-10 Index-25, and Cite score is 1255 (Various journals Had been cited).

Dr. Rajesh Kumar
Department of Chemistry, R.D.S. College (B.R.A. Bihar University),
Muzaffarpur-842002, India

Chemo-enzymatic approach to synthesis of modified nucleosides

Over two decades, a large number of nucleosides have been synthesized, which demonstrated potent antiviral and antitumour activities and have become cornerstones of treatment for patients with cancer or viral infections. Oligonucleotide-based antisense strategies represent a unique paradigm for the treatment of a wide variety of human diseases. In order to discover new class of nucleoside derivatives with enhanced biological activities, the modifications in the sugar moietiy have been attempted, which provide a remarkable level of control over nucleoside sugar puckering and its biological activity. Herein, we report; (a) the selective biocatalytic acetylation studies on modified 3′-azido-4′-C-hydroxymethylated sugar derivatives with an aim to develop an efficient and easy method for the synthesis of ribo-azido/amino LNA monomers and xylo-azido/amino spiro-oxetano nucleosides and (b) the selective biocatalytic deacetylation studies on modified 3′-azido-4′-C-acetoxymethylated sugar derivatives with an aim to develop an efficient and easy method for the synthesis of ribo-azido/amino spiro-oxetano nucleosides and xylo-azido/amino LNA monomers.



B = Nucleo Bases (T, U, C & A)

Biography

Dr. Rajesh Kumar received his Master of Science degree in organic chemistry from University of Delhi in 2010. He joined the same department for a PhD and completed his Ph.D in 2017 and during Ph.D, Dr. Kumar visited University of Southern Denmark as a Research Assistant for nine months. After completion of Ph.D, he joined as Assistant Professor in chemistry at B.R.A. Bihar University, India. He has published 25 research papers in reputed national and international journals such as The Journal of Organic Chemistry, Theranostics, Carbohydrate Research, RSC Advances etc. His research interest lies in Nucleic acid chemistry, Biotransformations, Catalysis, Green Chemistry, and heterocyclic chemistry.

Xin Cui*, Xue Xu
Department of Chemistry, Mississippi State University, Mississippi, U.S.A

Selective and sustainable catalysis for transforming C-H bonds

The development of green approaches to access new functional molecules has been impacting and improving the quality of lives. Processes with the best possible step and atom economy have been a preeminent goal of synthetic chemistry. Seeking new reactivity and selectivity in catalysis provides enormous opportunities for the construction of molecular complexity. Research in our laboratory focuses on developing next-generation inorganic and organometallic catalysts, and their applications in synthetic and medicinal chemistry. We are particularly interested in organometallic and mechanistic study-guided development of new patterns of selectivities for bond activation, bond formation, and tandem catalysis. Among ongoing directions, our group has been developing ruthenium (II)-catalyzed C-H functionalization processes as mechanistically unique and operationally practical tools for the stereoselective functionalization of various sites of arenes and alkenes. With the specific directions, we aim to gain new understandings and enrich selective and sustainable access to new molecules that have close relevance to bioactive compounds, chiral organic materials, synthetic building blocks, and future ligand toolboxes for catalysis.

Audience Take Away Notes

- The audience will learn about recent development in sustainable methods for converting C-H bonds to functional molecules
- The practical, energy and material-saving design of the catalytic processes would encourage industry applications for drug molecule synthesis
- The application of co-catalysis for this development in controlling the stereoselectivity and reactivity for C-H functionalization would inspire the design of new green synthesis with minimum energy consumption and waste generation

Biography

Xin Cui received his B.S. in chemistry and Ph.D. from the University of Science and Technology of China. He received his postdoctoral training at the University of South Florida. After a one-year as an assistant professor at Baruch College at the City University of New York, he joined the Department of Chemistry at Mississippi State University in 2016. He is currently an Associate Professor of Organic Organometallic, and Inorganic Chemistry.

Maryam Meshksar, Mohammad Amin Makarem*
Department of Chemical Engineering, Shiraz University, Shiraz, Iran

Application of biomaterials in catalysis synthesis

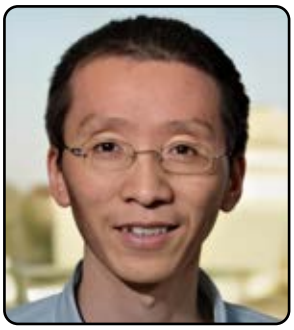
Using biological templates to acquire porous structure catalysts has fascinated researchers as they present specific features, including being performable under moderate conditions, being energy-preserving, being environmentally-friendly, and requiring little equipment. They also offer the merits of being abundant, safe, and affordable. Moreover, compared to conventional chemical templates, they offer developed synthetic materials that appropriately control the phase, morphology, and inorganic crystal orientation. During the last decade, obtaining biomorphic porous catalysts using plant-based materials, including wood, plant fibers, cellulose fibers, and green leaves as bio-templates, has been dramatically paid attention. Among various bio-templates, green plant leaves, simply available and diverse, are considered the most favorable for producing porous materials. They have illustrated complicated and surprising aspects, owing to the interconnected structure of thylakoid stacks in the chloroplasts, the porous fabrication of cuticles and veins, and the immense surface area of leaves. As a result, the main purpose of this research is comparing the structure of bio-templated catalysts with common ones without templating materials in terms of their textural and structural characteristics and morphology.

Audience Take Away Notes

- Characteristics of biomaterials and their unique porous structures
- Methods of using green materials for synthesis of catalysts
- Bio-templated catalysts structure and properties

Biography

Dr. Mohammad Amin Makarem is a research associate at methanol institute, Shiraz University. His research interests are gas separation and purification, nanofluids, microfluidics, catalyst synthesis, reactor design and green energy. In gas separation, his focus is on experimental and theoretical investigation and optimization of pressure swing adsorption process, and in the gas purification field, he is working on novel technologies such as microchannels. Recently, he has investigated methods of synthesizing bio-template nanomaterials and catalysts. Besides, he has collaborated in writing and editing various books and book-chapters for famous publishers such as Elsevier, Springer and Wiley, as well as guest editing journals special issues.



Haibo Ge

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

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.

Audience Take Away Notes

- This study could potentially be used for others to build small molecules in an efficient way
- This study could potentially be used for others to carry out late-stage functionalization of natural products or drug molecules
- This research could also be used by others to expand their research

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.

Viorel Gheorghe[1*], Catalina Gabriela Gheorghe[2], Andreea Bondarev[3], Constantin Nicolae Toader[4]

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[4]Scientific Research Center for CBRN Defense and Ecology, Oltenitei no 225 Bucharest, Romania

Growth kinetic of sclp-cultures for cbm and toxicological risk assessment

Short Riot control agents such as o-chlorobenzylidene malononitrile (CBM) are considered chemical weapons if used as a method of warfare in the chemical arsenal. Due to the toxic potential of the substance, it is the most widely used riot control agent, distributed as a spray by police brigades. CBM is used as a temporary incapacitant for people who are violently aggressive or to disarm the enemy in military operations. In this research article, the performance of ecotoxicology tests regarding the influence, evolution and response capacity of pure cultures of microorganisms adapted to laboratory conditions in the presence of o-chlorobenzylidene malononitrile were pursued.

Audience Take Away Notes

- From this study the audience will learn how the presence of a certain toxic substance in water can give it a toxic character. The tests performed determined the toxicity of a chlorobenzylidene malononitrile, a substance frequently used in military operations, on biological cultures, present in aquatic microfauna
- Knowing the inhibitory concentration and the time when disturbances occur in the biomass equilibrium, measures can be established to oppose the toxic effect of the analyzed substance
- The information obtained from the tests can help the specialized laboratories to make more efficient the bioremediation processes of the contaminated areas
- The experiments determine the number of cells subjected to the chemical stress generated by the toxic substance, depending on the concentration applied to each individual biocenosis, as well as establishing the most effective microbiological culture that can be used to remove the analyzed substance
- The Tests performed can be extremely useful in the field of medicine in order to streamline the recovery process of patients who have suffered physical injuries through exposure in the contaminated areas

Biography

Col (ret.), Ing, PhD Candidate Viorel Gheorghe graduated from the University of Transylvania – Mechanical Engineering. He worked for more than 25 years in the public safety system. He served for more than 10 years with International Organizations like European Union and United Stations responsible for the Rule of Law. Since 2017 he is conducting a research in the area of the impact of the toxic substances against the environment at the Doctoral School within the Gas and Petroleum University of Ploiesti, Romania.

T. Shiyani[1, 2*], Charu lata Dubey[1]
[1]School of Nanosciences, Central University of Gujarat, India
[2]Saurashtra Research Institute, Rajkot, India

Solar fuel generation using hybrid electrodes

Hydrogen is the lightest materials. The generation of hydrogen is cheap. We have demonstrated the generation of green hydrogen using hybrid electrodes through water splitting process. The hybrid photoelectrodes made up of organic natural dye and inorganic ZnO have been fabricated and characterized using electrochemical method. They have been used for solar photoelectrochemical energy conversion. The hybrid photoelectrodes can be used to generate solar power as well as solar fuels. This technology may lead the generation of solar power and solar fuel (hydrogen and oxygen) for future clean energy sources and hydrogen mobility.

Audience Take Away Notes

- The audience will learn about solar energy conversion using hybrid electrodes
- The presentation will help to the audience to explore this area at commercial scale and it may help to develop technology
- Yes, this research may be expanded to use in teaching and research
- Yes, it provides a practical solution to a global problem, i.e. alternative to fossil fuels
- The presented work will be the solution of current global problem, i.e. global warming
- Environment friendly materials
- Cheap electricity and green hydrogen

Biography

Tulshi Shiyani studied Ph.D. in Nanosciences at Central University of Gujarat, India and MS in Physics at Saurashtra University, India. He then worked at the research laboratories at Indira Gandhi Centre for Atomic Energy, Indian Institute of Technology Kanpur, and Pandit Deendayal Petroleum University. He has established a not-for profit research organization, Saurashtra Research Institute, Rajkot, India to carry out various education and research works in renewable energy. The author is a chief editor in Science & Engineering letters, which is published by Galaksi publishing. He has published many research articles, books and chapters.

Sujoy Bandyopadhyay
Department of Chemistry, Indrashil University, Kadi, Mehsana, Gujarat, India

Conjugated porous organic polymers: Fluorescence-based sensing, photocatalysis and energy storage

Starting from the grand old activated charcoal to zeolites, porous materials have been utilized for environmental and technological benefits for mankind. Of late, porous organic polymers (POPs) have emerged as a new class of functional materials with applications ranging from gas adsorption, gas/liquid separations, catalysis, light harvesting to chemo/biosensing. A combination of porosity and π-electron conjugation leads to the development of a new field of conjugated porous organic polymers (CPOPs). In this context, we have designed a new core of tetraphenyl-5,5- dioctyl-cyclopentadiene (TPDC), and fabricated CPOPs in the form of solid, soluble in organic solvents and nanoparticles. The soluble CPOP and the aqueous dispersion of nanoparticles employed for nitroaromatics sensing by amplified fluorescence quenching. Tunable surface area and fluorescence were achieved in TPDC-based polymers by varying the comonomers and polymerization conditions. Mesoporous to ultra-microporous CPOPs with surface area 73 to 1010 m^2g^{-1} were fabricated using 4, 4-difluoro-4-bora-3a, 4a-diaza-s-indacenes (BODIPY) core and explored for catalytic photooxidation of thioanisol. Further, the systematic investigations with a series of heteroatom containing CPOPs led to the construction of pyrene and 4, 4′-diaminobiphenyl based CPOP with specific capacitance ~ 456 Fg^{-1} at 1 mv s^{-1} scan rate. Addressing the cardinal issue of solution processability, a general design principle is also presented in the thesis with a special emphasis on carbazole-BODIPY based CPOPs for visible-light-driven reactive oxygen species (ROS)-mediated metal-free organic transformation.

Biography

Dr. Sujoy Bandyopadhyay earned his MS in Chemistry from Vidyasagar University in India. He later joined Prof. Abhijit Patra's research group at the Indian Institute of Science Education and Research in Bhopal. He obtained his PhD from the same university in 2018. After completing a one-year postdoctoral programme at Hanyang University under the supervision of Prof. Hyosung Choi, he was hired as an Assistant Professor at Indrashil University. He has about 15 research articles.

Suresh C Ameta
Department of Chemistry, PAHER University, Udaipur-313031 (Raj) India

Photocatalysis: An emerging approach for conservation of environment

The main threat to the environment and living systems today is anthropogenically induced water pollution. Each year, different kinds of organic pollutants are discharged by industries in nearby water resources. The removal of these pollutants is a daunting task and hence, development of advanced water treatment technologies is the need of the hour. In such a scenario, photocatalysis has emerged as a sustainable technique that utilizes light energy to drive chemical transformations. Over the past few years, the field of photocatalysis has made great progress with inclusion of metal or non-metal doping reutilization, cocatalyst, Z-scheme, nanocomposite, quantum dots etc. Due to eco-friendly characteristics such as mild protocols, atom economy and recyclability, photocatalysis is being extensively explored to reduce carbon footprints also. The use of non-renewable energy has resulted in dramatic increase in atmospheric CO2 concentration, which in turn, led to global warming. In current circumstances, the use of photocatalysts to transform CO2 into synthetic fuels may have a greater significance. Thus, one can use photocatalysis as a promising green technology for conservation of environment.

Audience Take Away Notes

- Researchers can know the importance of this newly emerging technique for waste water treatment
- They can develop their own systems for removal of different pollutants
- Yes, faculty can utilize this in their research work for treatment of waste water and polluted air
- Yes, it can provide a particular solution for the removal or degradation of contaminants

Biography

Prof. Suresh C. Ameta served as Professor & Head, Department of Chemistry, North Gujarat University, Patan (1994) and M. L. Sukhadia University, Udaipur (2002-2005). Presently, he is working as Professor of Eminence in PAHER University, Udaipur. Prof. Ameta had been President, Indian Chemical Society, Kotkata (2000-2001). He was awarded Life Time Achievement Awards by Indian Chemical Society, Kolkata (2011), Indian Council of Chemists, Agra (2015) and Association of Chemistry Teachers, Mumbai (2018). Indian Chemical Society, Kolkata has published a Special issue of its Journal in December 2008 to felicitate him on his 60th birthday and has instituted an Award in his name as Prof. Suresh C. Ameta Award from 2003. He has pointed out some problems in h-index and proposed a complimentary index as Ameta or A-index for improving h-index further.

Vasily Lutsyk[1, 2*], Vera Vorobjeva[1], Anna Zelenaya[1], Maria Parfenova[1]

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Phase diagrams 3D computer models as a novel tool to design the catalytic materials

The method of assembling an isobaric phase diagram from surfaces and phase regions represents the construction of a 3D object in the coordinates "concentration (x-y) - temperature (T)" in such a way that the result is a 3D computer model of the phase diagram constructed exclusively geometrically, as if without the use of thermodynamics, which is certainly not the case. Therefore, for brevity, the described approach is positioned as a geometric one, unlike the thermodynamic calculations in CALPHAD-technology. The thermodynamic description of a ternary system requires all the necessary data from special databases. A geometric 3D model can be constructed with a minimum of information: based on hypothetical data, a virtual prototype model is constructed, which gradually turns into a perfect model of a real system phase diagram as new information becomes available. The prototype takes into account all surfaces and phase regions, including those that then are degenerated in a phase diagram of real system. Such degenerations lead to the errors, sometimes serious, and the use of a prototype helps to avoid these inaccuracies. Compounds are another problem that researchers encounter when using thermodynamic programs. The corresponding calculations cannot be performed if the required parameters are unknown, whereas geometrically a 3D model can be constructed from "invented", virtual values of temperature dependencies of its homogeneity boundaries, replacing them later with real ones. The computer models of phase diagrams have been elaborated on the basis of PD DESIGNER and NEDITOR software of the authors. They allow, in addition to the obvious tasks of excellent visualization, to perform calculations of mass balances at all stages of crystallization, to restore the history of the formation of microstructure by studying the qualitative and quantitative composition of coexisting phases, and, in general, to find out the conditions for the formation of a material with specified properties. Based on the models of phase diagrams, commercial products will be developed in the form of a special program for each system, equipped with options for visualizing both the phase diagram itself and the results of crystallization calculations occurring in the corresponding system. Work on each system will be carried out in 4 stages: 1) Critical analysis of the initial data; 2) Construction of 3D computer models for various variants of phase diagrams; 3) Development of a final, verified and consistent 3D model of the phase diagram (assembled from surfaces and phase regions) describing the formation of microstructure; 4) Digitization - creation of commercial products - 3D computer models of verified phase diagrams with the patent support. Thus, completed 3D model of each phase diagram will be made in the form of an independent object (including a commercial product protected by a patent), which can be offered to users in the form of a complete description of all possible phase transformations in a ternary system equipped with extensive capabilities for visualizing all fragments of the phase diagram and the results of calculations of crystallization processes occurring in the system.

Biography

Dr. Lutsyk - head of Materials CAD Laboratory in IPMS SB RAS, professor of Buryat State University. Session Organizer and Chair “Phase Diagram - Tool of Materials Science” - the 2d, 3d, 4th, 5th Conferences on Competitive Materials and Technology Processes IC-CMTP, (Hungary, 2012, 2014, 2016, 2018). Invited Lecturer: 3d Conference HighMatTech (Ukraine, 2011); 2d & 4th Conferences on Competitive Materials and Technology Processes IC-CMTP (Hungary, 2012, 2016); 12th Conference on Fundamental and Applied Aspects of Physical Chemistry (Serbia, 2014); Conference on Oxide Materials for Electronic Engineering OMEE-2017 (Ukraine, 2017), 9th Global Conference on Materials Science and Engineering CMSE-2020 (Ukraine, 2020).

Jeevan Dontulwar

Department of chemistry, Mohota College of science, Nagpur, Maharashtra, India

Synthesis and applications of biodegradable polymers based on starch and dextrin

The biodegradable polymer is the next generation and newly emerging field in green materials. It has been used more than 50 years for various applications. The synthetic flexibility and elastic features of these polymers to consider in accordance with make them attractive for numerous therapeutic approaches. The biodegradable polymer mainly classified to synthetic and natural polymers. The natural polymer gives many advances over synthetic polymer. Many biodegradable polymers are produced from feedstock derived either from petroleum or biological resources. The biodegradable polymers are designed to degrade upon disposal by the action of living micro-organisms. Biodegradable polymers are used in agriculture, medicine and other areas. However, starch and dextrin are carbohydrate based biodegradable polymers have been used for many applications such as surfactant and detergent. The starch and dextrin based biodegradable detergent can be easily prepared as it comes under renewable sources over petroleum-based polymer. In view of above application, in the present time it requires to generate alternative biodegradable water-soluble polymers such as detergents and cosmetics etc. In addition, the various liquid-based bio-detergents act as ecofriendly polymer were showing significant surfactant results which decrease surface tension of water, foam volume etc. In above opinion, here I will present the various synthesis methods for biodegradable based detergent which are mainly prepared using starch, dextrin-based compound. The novel and ecofriendly methods were followed to formulate the biodegradable detergent. The various characterization techniques and methods were used to identify it. This work also explains various biodegradable polymers with details on properties, mode of its degradation and the potential biomedical applications associated with them.

Audience Take Away Notes

- Audience will explore in the field of green chemistry and learn more towards biodegradable polymer
- The listener may explore to setup their own creativity to synthesis new recyclable polymer which will help to get job in green company work on environment protection
- Yes, the faculty can expand their research and teaching in the field of biodegradable based polymer

Biography

Dr. Dontulwar studied Master of Science (MSc) in chemistry at the Rashtrashant Tukadoji Maharaj Nagpur University, Nagpur, India in 1995. He then joined as ad hoc faculty in Priyadarshani College of Engineering and teaches to Undergraduate student. After that he joined research group at Rashtrashant Tukadoji Maharaj University and completed his doctorate degree with title “Studies in Novel Eco Friendly Polymers” in 2007. He published more than 30 research articles in international and national journal. After Doctorate he joined as a Principal and Professor for five years at Jawaharlal Nehru Arts commerce college wadi Nagpur. Currently he is working as a Professor and Principal at shri Mathuradas Mohota College of Science, Nagpur.

Megha Gang, Shweta Vyas*

Department of Pure & Applied Chemistry, University of Kota, Kota, Rajasthan, India

Agrowaste-based nano-biosorbent for removal of cadmium ions (Cd II) from aqueous media

Among the various harmful pollutants, toxic heavy metals are the one which are responsible for serious problems in our eco-system. The non-biodegradable nature of heavy metals and bio-accumulation at very low concentrations generate hazardous impacts on flora and fauna. Many techniques viz. reverse osmosis, ultra-filtration, electrochemical deposition, ion exchange, chemical precipitation, etc. are utilized for removal of heavy metals at the cost of high currency or involvement of sophisticated instrumentations. However, adsorption by activated carbon has been used comparatively at lower cost, if its production can be done by low-cost waste materials. The present work deals with the implementation of some principles of "Green Chemistry" and "Nanotechnology" to develop low-cost activated carbon-based nanocomposite for the effective removal Cadmium (Cd II) from contaminated water. In this concern, we have explored the use of Ice-apple fruit shell waste for the production of activated carbon and prepared Iron Oxide nanoparticles from waste orange peel extracts in an eco-friendly way. The nanocomposite/nanosorbent Ice-apple Fruit shell waste activated carbon loaded with Iron Oxide (Fe_3O^4) Nanoparticles (ION@IFSAC) is then developed by simple immersion method and its removal efficiency is determined by conducting batch adsorption studies, isothermal studies and various factors affecting the adsorption are also run to optimise the conditions. Maximum removal efficiency of (ION@IFSAC) for the adsorption of 10 ppm of Cadmium (CD II) ion from water was 92% at 400C.

Audience Take Away Notes

- Low cost agrowaste based nanosorbent is prepared
- Cadmium (II) ion can be removing from water in effective manner
- Other pollutants can also be tested viz. heavy metals, dyes, drugs, etc
- Wastewater treatment can be done in effective manner
- Pilot-plant for water treatment can be developed
- It can manage solid waste and resolve the problem burning of crop residues

Biography

Dr. Shweta Vyas studied Chemistry at the JNV University, Jodhpur and got doctorate in 2003. She then joined the research group of Prof. S.R. Vadera at the DRDO, Jodhpur as JRF to develop nanocomposites for camouflage materials. She has CSIR<UGC_NET exam in 2002 and currently working as an Assistant Professor at University of Kota since 2012. One scholar completed her Ph.D. under her guidance and four are pursuing. She has published 29 research articles in reputed journals.

Shidong Zhao[1*], Xufeng Lin[2]

[1]China University of Petroleum (East China), Qingdao, Shandong, China
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Kinetics of hydrogenation of dibenzyltoluene as hydrogen storage carrier

Hydrogen energy is a pollution-free and efficient energy, but safe and efficient hydrogen storage technology is the key to realize the utilization of hydrogen energy. Liquid organic hydrogen carrier (LOHC) technology is more efficient in terms of safety and storage and transportation efficiency. As an industrially mature heat transfer oil, dibenzyltoluene (DBT) can be perfectly applied to the current mode of transportation of petroleum products, and has more advantages as a hydrogen storage liquid. In this paper, dibenzyltoluene was used as an organic liquid hydrogen carrier to study the hydrogenation kinetics of dibenzyltoluene on ruthenium catalyst. The apparent kinetic model was established by analyzing the influence of reaction temperature, pressure, catalyst dosage and other process parameters on the mass transfer reaction process. The study shows that the initial reaction stage is a first-order reaction, and the main reaction resistance is the reaction resistance on the solid surface of the catalyst.

Audience Take Away Notes:

- Dibenzyltoluene hydrogenation over Ru/Al_2O_3 catalyst was studied in the temperature range 110–150 °C and the pressure range 3.0–5.0 MPa. The whole reaction process is controlled by the surface reaction of the catalyst particles
- The mass transfer resistance at gas–liquid interface and that from the bulk liquid phase to the surface of the catalyst particles can be ignored
- The apparent activation energy of dibenzyltoluene hydrogenation at the initial stage of the reaction is 9.992 kJ/mol. This is lower than the activation energy of complete hydrogenation of dibenzyltoluene

Biography

Shidong Zhao studied chemical engineering and technology at China University of Petroleum (East China), graduated with a bachelor's degree in engineering in 2009, and then worked in Shandong Chambroad Petrochemicals Co., Ltd. In 2017, he was admitted to the Department of Chemistry at China University of Petroleum (East China) to study for a master's degree in chemistry. In 2019, he became a doctoral candidate of Professor Xufeng Lin, and his research direction was organic liquid hydrogen storage.

Orlando Elguera Ysnaga

D.Sc. with Major in Analytical and Inorganic Chemistry- Universidade de Sao Paulo (Brazil)/ B.Sc. with Major in Chemical Engineering- Universidad Nacional de Ingenieria (Peru)

Review of research topics for scaling-up of sonochemical reactors (sono-reactors)

This study is aimed to review the topics of chemical engineering to take in consideration for the scaling-up of reactors, in order to perform processes based on the application of the sonochemistry at industrial level. Sonochemistry is an emergent technology, defined as chemistry made with ultrasound. The characteristic ultrasound frequencies are in the range of 1-10MHz, and in particular for sonochemistry in the sub-range 16-100 KHz. Chemical effects of ultrasound exist when there are changes in the pathways of reactions, yields and/or selectivities of the products due to the ultrasonic activation. At laboratory level, the sonochemistry has shown fantastic results, because it is based on the phenomenon of acoustic cavitation in liquids, thus, producing very high temperatures (some thousands of Kelvin degrees) and high pressures (some hundreds of atmospheres) during very short times (from tenths to hundreds of microseconds). Cavitation is the phenomenon with the most important effect for intensification of physical and chemical processing. Under these conditions, the yields of sonochemical reactions increase drastically, and their selectivities are improved, thus generating new mechanisms of reaction involving inorganic and organic syntheses. It is not easy to reproduce experimental results of quantification of sonochemical intensity, which is significant for the efficient scaling-up of sonochemical reactors (sono-reactors) for the progress of industrial applications of sonochemistry. This technology has application at industrial level for the treatment of waste-water and black-water. Sonochemistry can be considered as Green Chemistry, presenting the following advantages: low waste, low consumption of materials and energy with optimized use of non- renewable resources and use of renewable energies. Few studies were aimed about optimum design and scaling-up of sonochemical reactors. The implementation of sonochemistry at the industrial level will be feasible when the use of cavitational energy can be adequately controlled.

Audience Take Away Notes

- It is expected that this review can collaborate in the diffusion and development of this emergent technology, due to the advantages that possess:

  1) Enhancement of the yields of chemical reactions significantly

  2) Improvement of selectivities

  3) Generation of new reaction pathways
- This technology has applications at industrial level for the treatment of wastewater
- Sonochemistry can be considered as Green Chemistry

Biography

D.Sc. /B.Sc. Orlando Elguera studied Chemical Engineering at the National University of Engineering (Lima-Peru) with Master's studies in Chemistry Sciences at the National University of Engineering (Lima-Peru), and with Doctorate of Science with Major in Analytical and Inorganic Chemistry at the University of Sao Paulo (Sao Paulo-Brazil). He performed as Analyst of the Laboratory of samples of Geochemical Exploration and Inorganic Compounds at SGS del Peru S.A.C (almost 5 years). He has experience in the following method of analysis: Atomic Absorption Spectrometry, Inductively Coupled Plasma Optical Emission- Mass Spectrometry and X-ray Fluorescence. He has published 9 research articles in journals.

Fouad El Mansouri[1, 4*], Joaquim C.G. Esteves Da Silva[2], Francesco Cacciola[3], Antonio Moran[4], Jamal Brigui[1]

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[3]Department of Biomedical, Dental, Morphological and Functional Imaging Sciences, University of Messina, 98125 Messina, Italy
[4]Chemical and Environmental Bioprocess Engineering Group, Natural Resources Institute, University of León, 24071 Leon, Spain

Efficient removal of eriochrome black t dye using activated carbon of waste hemp (cannabis sativa l.) grown in northern morocco enhanced by new mathematical models

In the present work, the adsorption behavior of Eriochrome Black T (EBT) on waste hemp activated carbon (WHAC) was examined. The surface of the WHAC was modified by H3PO4 acid treatment. The surface and structural characterization of the adsorbents was carried out using Fourier transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM) analysis. The effect of influential adsorption parameters (pH, contact time, dosage, and initial concentration) on the adsorption of EBT onto WHAC was examined in batch experiments; some adsorption parameters such as pH, concentration and dose were improved by new mathematical models. The adsorption behavior of EBT on the surfaces of WHAC was evaluated by applying different isotherm models (Langmuir, Freundlich, Temkin and Dubinin–Radushkevich) to equilibrium data. The adsorption kinetics was studied by using pseudo-first-order, pseudo-second-order, Elovich and intraparticle models on the model. Adsorption followed the pseudo-second-order rate kinetics. The maximum removal of EBT was found to be 44–62.08% by WHAC at pH = 7, adsorbent dose of 10–70 mg, contact time of 3 h and initial dye concentration of 10 mg.L–1. The maximum adsorption capacities were 14.025 mg.g–1 obtained by calculating according to the Langmuir model, while the maximum removal efficiency was obtained at 70 mg equal to 62.08% for the WHAC. The adsorption process is physical in the monolayer and multilayer.

Keywords: Cannabis waste, Isotherms, Eriochrome black T, Biosorbent, Mathematical models.

Audience Take Away Notes

- The use of inexpensive, easily obtained, and ecological adsorbents
- New bio-adsorbents were made for Colorant adsorption from an aqueous solution
- Adsorptions of EBT dye by the activated carbon of cannabis
- This study provides cost-effective and sustainable production of activated carbon
- Application of mathematical modeling to develop new relevant mathematical models based on experimental results

Biography

Dr. Fouad EL Mansouri is currently working as a Research & Education Fellow at the Abdelmalek Essaadi University. He Obtained Ph.D. in Process Engineering and Environment in Joint PhD Programs between Faculty of Sciences and Techniques of Tangier, Abdelmalek Essaadi University, Morocco and Faculty of Sciences, University of Porto, Portugal. After his Ph.D., he worked as postdoctoral Research associate in Chemical, Environmental and Bioprocess Engineering Group, Natural Resources Institute, University of León in Spain. He has published more than 20 research articles in international journals. He has served as a reviewer for several journals. He also led and contributed in several funded research technicians. Dr. El Mansouri has also a passion for teaching. Currently, he is teaching Water Analysis Methods and hydrochemistry course at post-graduate level of University Abdelmalek Essaadi - Faculty of Sciences and Techniques in Al Hoceima, Morocco.

magnus Group

22-23 MAY

DAY 02

VIRTUAL ROOM 01

POSTER

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Serhiy Pyshyev[1*], Yurii Lypko[1], Oleh Kukhar[1], Bohdan Korchak[2]

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[2]Department of Civil Safety, Lviv Polytechnic National University, Lviv, Ukraine

Methods of used tire recycling with the aim of commercial fuels obtaining

Used tires are stored in dumps and warehouses. They are already a significant environmental hazard today. Environmental pollution by these materials can only increase if measures are not taken to dispose of them. The most ecological method of such disposal is the grinding of used car tires into rubber crumbs. Then this crumb is added to road bitumens as a modifier. But this method of bitumen modification was not widely used due to insufficiently high characteristics compared to other modifiers. In addition, as much as the tires wear out, this method will not be able to dispose of them properly. Another relatively effective ecological method is the pyrolysis of used car tires. This method is the most promising since the amount of tire recycling is limited only by the productivity of the pyrolysis plant. Unlike tire burning, pyrolysis is not such a harmful method. During pyrolysis, pyrogas (which is used as fuel for pyrolysis plants), liquid products of used car tires pyrolysis (LPUCTP), and solid residue (possible use as low-quality carbon black or activated carbon) are formed. LPUCTP, in terms of its physical and chemical characteristics, are similar to boiler fuel and fuel oil. But, as a rule, their quality does not meet the requirements of regulatory documents. We are developing a relatively simple method of LPUCTP usage, which consists of separating light gasoline fractions (boiling temperatures are limited up to 200 °C). The fraction obtained above 200 °C meets the requirements of regulatory documents for commercial fuel oils and boiler fuels (DSTU 4058-2001, PN-C-96024:2011, ISO 8217:2017, etc.). Gasoline fractions contain many aromatic and sulfur-containing compounds. Unsaturated hydrocarbons are also present in the amount of at least 5% by mass. (styrene, limonene). Poor environmental properties and low stability characterize such products, so these types of compounds must be removed. An extraction process was carried out to concentrate aromatic and unsaturated compounds. N-Methyl-2-pyrrolidone (NMP) was used as a solvent. The volume ratio of gasoline fractions and the solvent was 1:1.5. The yield of extract and raffinate is 63.25 and 36.75% by weight, respectively. The raffinate can be used as a component of gasoline, and the extract as a raw material for producing aromatic compounds or fuel in a pyrolysis plant. Therefore, pyrolysis, rectification and extraction processes can be used to dispose of used car tires.

Keywords: Waste rubber, Alternative fuel, Pyrolysis of tires, Extraction.

Audience Take Away Notes

- As a result of familiarizing the audience with the report, they will receive information about used tires recycling. The report will also help specialists to process used tires to obtain hydrocarbon fuels that comply with existing regulatory documents and to get a theoretical basis for further research

Biography

Serhiy Pyshyev studied Chemical technology of fuel and carbon materials at the Lviv Polytechnic National University, Ukraine and graduated in 1994. In 2001 he became an Associate Professor of the Department of Chemical Technology of Oil and Gas Processing at the Institute of Chemistry and Chemical Technologies, Lviv Polytechnic National University. In 2014 Serhiy became a Professor at the same institution. He became a Doctor of Technical Sciences, Chemical Technology of Fuel and Fuel-lubricating materials in 2013. Also, he has been a member of the editorial board of the Journal of Coal Chemistry since 2018, and CHEMISTRY & CHEMICAL TECHNOLOGY since 2021. Besides, he is Co-Chairman of the Organizing Committee, "Advance in Petroleum and Gas Industry and Petrochemistry" (APGIP-11), XI International Scientific-Technical Conference. Serhiy has published over 50 research articles in SCI (E) journals.

BOOK OF ABSTRACTS

22-23 MAY

DAY 02

VIRTUAL ROOM 02

KEYNOTE FORUM

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

CalAlSil® feldspar polymers – Sustainable, high-performance structural nanomaterials

CalAlSil® Feldspar Polymers are a revolutionary water-based ceramic resin, paint, render, plaster and concrete that employs the superior properties of nano-silicates to make easy application structural materials. CalAlSil®'s formulation specialises in producing ready-to-use, single-pack mix designs that have the lowest embodied energy and carbon emissions in the market. This is achieved through the use of ubiquitously sourced alumino-silicates, salts and ceramic oxides. CalAlSil®'s nano-colloids contain sufficient chemical potential to cure by simple evaporation of water which is the solution's solvent. Structural films, renders and concrete sections can be created with Mohs hardness greater than 5. Two-pack formulations have the potential to produce finished materials that have comparative hardness (7) to natural Quartz and Feldspars. The cured microstructure contains continuous layers of chemically bound feldspar minerals that are crosslinked by tetrahedral silica. Pressure casting and vacuum extrusion are two common manufacturing methods that will produce a macrostructural composite with properties that exceed existing composites. Additionally, setting is accelerated using naturally derived alkaline esters, bio-polymers and siloxane chemicals that produce a cross-linked ceramic-organic composite. The versality of the feldspar emulsion and two-pack composites represents a leap forward in structural, fireproof materials. Applications of CalAlSil® feldspar formulations are targeted at the circular economy as they act as universal binder materials for recycling of all forms of waste. By using product from waste streams from other industries like silica fume and coal combustion products, CalAlSil®'s carbon emissions are better than the best Ordinary Portland Cement formulation with high-calcium fly ash and activated magnesia. Since all raw materials are produced at relatively low temperatures, future production of CalAlSil® feldspar polymer resins will be accomplished with a zero-carbon emission profile and the lowest embodied energy profile of any construction material. Therefore, CalAlSil®'s ceramic feldspar is both the sustainable keystone formulation for structural construction as well as being the solution to waste re-purposing for the 21st century and beyond.

Audience Take Away Notes

- CalAlSil® will demonstrate how Alkali-Alumino-Silicate oligomers are the fundamental building blocks of feldspar ceramics which are the green keystone resins for the circular economy
- CalAlSil® represents the cornerstone of composite formation using a variety of waste streams
- The primary message from this presentation is that there is a solution to the carbon and energy intensive building and construction industries' use of materials. Further when understood the green chemistry of hybridized silicates provide the basis for all future formulations for industrial and construction materials

Dr Leon Burgess-Dean

Founding Director of CalAlSil®,
Brisbane, Queensland, Australia

Biography

Dr Leon Burgess-Dean is the creator of CalAlSil. A management professional, innovator, chemist and materials engineer, Leon has over 25 years of experience in procurement management, technical, research and laboratory management of building products and construction materials facilities. In addition, Leon has specialist and extensive experience in developing solutions to difficult problems in construction, manufacturing and capital projects. Leon has a Bachelor of Applied Chemistry with Honours which was followed by a Doctor of Philosophy in Materials Engineering and a Masters of Business Administration completed in 2005. Leon's expertise is in the complex chemical and material interactions between multi-component aqueous environments and heterogeneous brittle materials.

Vegetation as sustainable green material

Plants and plant materials can be used for erosion control and slope protection to reduce risk events; vegetation used for green roofs and walls is also an important bioengineering measure to protect buildings and adsorbing rainwater, containing air pollution and greenhouse gas emissions, and extending roof life. The use of plants for river bank protection and erosion control has a long tradition in Europe. Literature shows that climate is one of controlling factor of the distribution of plant species. Rapid climate change leads to remarkable changes in the distribution and behavior of plants, contributing to modify the ecosystem equilibrium and habitats. Thus many aspects, such as vegetation durability, species selection, should be still investigated. The present lecture focuses on flow –vegetation interactions which are important to analyse the protective action of vegetation, its durability and aspects of maintenance of planted stream banks.

Audience Take Away Notes

- They learn about the potentiality in the use of vegetation as sustainable green material
- Yes this research that other faculty could use to expand their research or teaching
- Yes It would provide a new point of view
- Yes will it improve the accuracy of a design, or provide new information to assist in a design problem

Donatella Termini

Department of Engineering – University of Palermo (Italy)

Biography

Donatella Termini, Ph.D., is currently qualified as Full Professor in Hydraulic Engineering. She received her Ph.D. in Hydraulics and Fluvial Hydraulics in 1996. In June 1997 nominated scientist of Hydraulic and Hydraulic Applications. In 1997 research fellow at the Queen's University - Kingston - Ontario (Canada). From 1998 to 2000 she was a post-doctoral researcher; from 2001 to 2004 she was assistant professor. Associate Professor at since January 2005 and since 2019 as Full Professor in Hydraulic Engineering - Palermo's University (Italy).“2007 Karl Emil Hilgard Hydraulic Prize”, by ASCE. More than 200 papers published in proceedings of national and international congresses and in international scientific journals. She is leader or collaborator of national or EU research projects; Guest Editor of International Journals (Advances in Water Resources – Elsevier; Advanced in Science and Materials Engineering – Hindawi Open access). She is member of International Associations (IAHR, EUROMECH, IAHS, and IEMSS) and Reviewer for many international journals including IAHR, ADWR, JHE-ASCE, ESPL.

Health and environmental risks to cities

This paper aims to undertake some considerations concerning the triangle climate change, environmental risks and health problems, where it will be emphasizing the relationship between environmental and their possible impacts on human health. The economic models adopted have not considered health and environment as a priority, perpetuating some inadequate productive processes that cause avoidable damage to human health and the environment. At the same time, production processes with complex technological risks, incorporating nuclear, chemical and biological technologies, coexist. Unsustainable development patterns have been favoring environmental degradation that also affects quality of life, and the state of health, through significant changes in the natural environment and destruction of diverse ecosystems, leading to changes in the distribution patterns of diseases and in the health conditions of different population groups. Whereas environmental chemistry focuses on the effects of polluting chemicals on nature, green chemistry focuses on technological approaches to prevent pollution and reduce the consumption of non-renewable resources. The generated knowledge in Green Chemistry linking with the SymbioCity approach (pioneer in Sweden urban neighborhoods and already used in other parts of the world), multidisciplinary, with the intention of making an analysis with the various perspectives in order to identify synergies between the different aspects in an integrated planning framework. The integrated plan contemplated indicators such as: land use, soil pollution, energy, water and sewage, garbage, building material, transportation, noise, and green areas. A process based on transparency and openness that makes possible to manage institutional barriers or conflicts of interest with the purpose to improve health, safety, comfort and quality of life for poor people living in urban areas, to address urban challenges related to sustainability and resilience. Linked with knowledge generated in Green Chemistry can help society to acquire a change in habits and behavior, because it can promote the clarification of how certain products and attitudes offer more risks to nature than others.

Audience Take Away Notes

- This vision provides the possibility of an intervention, since it acts in various areas such as health, education, income, community organization, among others, and how these interconnected dimensions can lead to the ecological sustainability of vulnerable communities
- It will help the audience to have an interdisciplinary view and articulate several areas of knowledge in favor of green chemistry emphasizing its use and application
- Yes, it can be reproduced and applied
- Yes, based on the above we believe that it may be part of the solution to some problems

Helena Belchior-Rocha

ISCTE-University Institute of Lisbon (CIES Research Center), Lisbon, Portugal

Biography

Helena Belchior Rocha, has a PhD in Social Work, Professor and Researcher.at Iscte- University Institute of Lisbon in the Department of Political Science and Public Policies and deputy director of the Soft Skills Lab. Integrated researcher at CIES, Center for Research and Studies in Sociology, linked to national and international research projects, namely 2 from Marie Curie Actions and several Erasmus. Author of papers and communications at national and international congresses, in the areas of social work theory and methodology, environment, sustainability, community Intervention, ethics, human rights, social policies and Well-being, education (DL) and soft skills. Member of the Editorial Board of national/international journals.

Plastic trash to monomers and intermediates – PTMI

To address the issue of waste plastics in landfills, a hybrid approach is proposed. This would use low temperature plasma pretreatment followed by catalytic cracking to augment the conversion of waste polyolefins into monomers, intermediates, new polymers and value-added chemicals. Lightweight packaging (LWP) comprises about 50% of total plastics consumption and consists mainly of single and multilayer films and containers. LWP is heterogenous, contaminated and is difficult to recycle. Mechanical recycling is currently the only commercial approach to recycling but is inadequate to address the growing volume of packaging plastics and degrades or downcycles both polyethylene (PE) and polypropylene (PP). In contrast, feedstock recycling converts polymers to monomer feedstock that can be used to make new products that have virgin-like performance in high volume single use packaging applications, thereby creating new value chains for what is currently a waste stream. Current high TRL feedstock recycling technologies like pyrolysis and gasification are highly energy intensive require multiple steps (plastics-syngas-methanol-olefins) and have low selectivity to polyolefin building blocks (ethylene, propylene). Alternatively, plastics upcycling aims at selectively deconstructing polymer in a one-step process directly into monomers and high value chemicals (HVC). Consequently, it is proposed to use a hybrid approach of preconditioning with low temperature plasma followed by catalytic cracking for conversion of waste polyolefins into monomers, intermediates, new polymers and value-added chemicals. This offers improvement in carbon utilization, cumulative energy demand and selectivity to recycled high value products over current benchmark feedstock recycling processes like gasification and pyrolysis. It is suggested to use LTP treatment as a tunable polyolefin functionalization step to increase selectivity of subsequent catalytic deconstruction and reconstruction. The target waste stream is post-industrial and post-consumer packaging waste, mainly LDPE, LLDPE, and PP films. The primary target products from this novel process are C2-C4 olefins (ethylene, propylene, and butylene) which are the raw materials for bulk of the volume of single use plastic production (PE and PP). Aromatic and other HVC precursors like benzene, toluene, xylene (BTX), ethyl benzene and polyols are also expected as by-products from the process. All the products and by-products (C2- C4 olefins, BTX, polyols, HVC) can be upcycled to resins, bulk (Polyethylene, polypropylene) and specialty polymers (polyurethanes, epoxy, polyester, Nylon-6) at different market entry points.

Dr. Anne M Gaffney

University of South Carolina, Columbia, South Carolina, United States of America

Biography

Dr. Anne M. Gaffney is the Chief Science Officer of Idaho National Laboratory and Distinguished National Lab Fellow (2014 – present). She has thirty-four years of experience working in industry inventing and commercializing new technologies for major chemical manufacturing companies including Koch Industries, Lummus Technology, Dow, Dupont and ARCO Chemical Company. She has authored 155 publications and 257 patents. Dr. Gaffney is also a distinguished Joint Appointment Fellow at the University of South Carolina (2018 – present) where she is the Technical Director of the National Science Foundation Center for Rational Catalyst Synthesis. Some of her recent awards include: the 2019 American Chemical Society, Energy & Fuels, Distinguished Researcher Award in Petroleum Chemistry; the 2015 Eugene J. Houdry Award of the North American Catalysis Society; the Chemical Heritage Foundation, Women in Science Inductee, 2014; and the American Chemical Society, Industrial Chemistry Award, 2013. Dr. Gaffney received her BA in chemistry and mathematics from Mount Holyoke College and her Ph.D. in physical organic chemistry from University of Delaware.

Climate change: Mitigation of greenhouse gases in control environment

Climate change is one of the most important Global Environmental Challenge. Addressing Climate Change requires a good understanding and knowledge as well as coordinated Action Plan at National and Global Level. The UNFCCC and the Kyoto Protocol made the provisions for adapting the policy development for Mitigating the Impact of Climate Change. The IPCC was created to provide policy makers with Regular scientific assessment on Climate Change Impact. The effective measures need Sustainable Development Goal adaptation and Environmental Friendly Technologies for Mitigation the impact of Green House Gases. Carbon dioxide is one of the most significant among greenhouse gas owing to its high abundance that contributes to global warming. A greenhouse gas CO2 impact on Rabi crops (Wheat, Oat, and Chickpea) at different environment conditions in Designed and Developed Reactor has been studied. The experiment was designed in control Environmental conditions inside the Chamber wherein Carbon Dioxide, a Green House Gas, induced at a sustainable concentration over a period of plant Growth, at different intervals - time period. The Plant growth of Rabi crops: Biomass (Root & Shoot), Proteins, Lipid, Carbohydrates, Chlorophyll; etc; during each exposure of Carbon Dioxide have been studied. Further, in a separate set of Experiment, Rhizosphere - soil developed was amended in the Soil Pot (3:1) and the Plant Growth was studied in a similar pattern, under the influence of Carbon Dioxide in chamber. Rhizosphere - soil environment was found profound impact of Absorption/Adsorption of carbon Dioxide that enhanced the growth of the Crop plants as well as other ingredients of the Plants studied. The Laboratory Experiment model Developed can be transferred to Agricultural Environment to Increase the Soil fertility and Crop production; where there is exposure of Green House Gases, which would be Mitigating the Impact of Climate Change.

Keywords: Climate Change, Green House Gases, Designed and developed Reactor, Environmental Conditions, Rhizosphere Soil, Mitigation.

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Biography

Madhusudan Hiraman Fulekar, M.Sc. (Chemistry), MPhil. & Ph.D (Environment Science), LLB, MBA (HRD), D.Sc. (Life Science) submitted. He is a Environmentalist and he has worked as a faculty – Delhi Technological University, Delhi and University Department of Chemical Technology, Mumbai. He was also a Professor & Head, Life Sciences (Environmental Biotechnology), University of Mumbai - 2002 to 2011 and as Senior Professor & Dean, School of Environment and Sustainable Development, Central University of Gujarat (2011-2019) & Director Central University of Gujarat. He was also Vice-Chancellor (I/C), Central University of Gujarat, Gandhinagar. At present Prof. M.H.Fulekar is working as Senior Professor cum Joint Director (R&D), Center of Research for Development, Parul University, and Gujarat, India.

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SPEAKERS

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CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Yuehua Li
School of Mechanical Engineering, University of Science and Technology Beijing, Beijing, China

Mass transfer in porous media and the technique of water-heat management for proton exchange membrane fuel cells

The proton exchange membrane fuel cell plays a significant role in energy conservation and emission reduction. Towards the commercialization, this fuel cell still faces the difficulties on low-temperature stat-up and shunt-down, long-time operation without any flooding or drying-out, etc, which should be solved through the investigation on water-heat management and especially the refined mass transfer in porous media. In this speech, the gas and liquid water transportation through gas channel, gas diffusion layer (GDL), especially the catalyst layer will be introduced, which features the catalyst modelling using meso-scale structure meshing and the key finding that the two-phase flow pressure drop of the channel/GDL experiences two ramp-ups where the one related to the well operation phase that no flooding or drying-out occurs. Then, the liquid water amount at gas channel, GDL and CL is estimated respectively and the strategy for operation management through regulating fuel cell temperature, air flow rate, air inlet pressure is proposed to obtain the best performance based on the above-mentioned water estimation method. Finally, the thermal management and fuel cell control methods are presented featuring the leading parameter estimation for the dynamic system for a more accurate model and resulting the better proof at the whole power-range. The results could be a better guidance for the -30 □ start-up without external heating and shunt-down strategy making. Meanwhile, the catalyst layer modelling is beneficial to the application of online and real-time estimation for water amount estimation, secondary reaction assessment.

Audience Take Away Notes

- The gas pressure drop experiences two plateaus with the first ramp-up corresponding to the best stage without any flooding or drying out of the membrane electrolyte assembly
- The oxygen transfer considering Knudsen diffusion and meso-scale effect obtains at the CL through the ionomer and liquid water plays significant role in promoting performance and water amount estimation
- The regulation through changing fuel cell temperature and flow rate gains the best effect for avoiding flooding and drying-out under the guidance of gas pressure drop
- The parameter identification of the dynamic model is the common difficulty and the solution we proposed is beneficial to system design, system control, and fuel cell simulation
- The results could be a better guidance for the -30^{0}C start-up without external heating and shunt-down strategy making

Biography

Dr. Yuehua Li is currently Associate Professor of School of Mechanical Engineering at University of Science and Technology Beijing. He obtained his Ph.D. from Tsinghua University and is engaged in the research of fuel cell water management, health diagnosis, and nonlinear control. He improved the theory of water detection in association with pressure drop, and proposed the water amount detection method for different layers in fuel cell, which is benefit for the cold-start and long-time unattended operation for the fuel cell stack. He published more than 20 SCI papers with h-index 13. He hosts the programs of National Natural Science Foundation, Innovation Foundation of China Aerospace Science and Technology Cooperation.

Jinsong Wu
Guilin University of Electronic Technology, Guilin, China, and University of Chile, Santiago, 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 won 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 is as Vice-Chair Technical Activities (2017-present), IEEE Environmental Engineering Initiative. He was Founding Chair (2011-2017) of IEEE Technical Committee on Green Communications and Computing (TCGCC). He is also Founding Vice-Chair (2015-present) of IEEE Technical Committee on Big Data (TCBD). He received 2017, 2019, and 2021 IEEE System Journal Best Paper Awards. He was the leading Editor and co-author of book "Green Communications: Theoretical Fundamentals, Algorithms, and Applications".

Dr. Dai-Yeun Jeong
Asia Climate Change Education Center, Jeju-Si, Jeju Special Self-Governing Province, South Korea
Emeritus Prof. at Jeju National University, Jeju-Si, Jeju Special Self-Governing Province, South Korea

Carbon neutrality as a strategy responding to climate change

Climate change is one of the most serious environmental problems impacting on nature and humans at a global level. Various action plans responding to climate change are being launched by government, enterprise and civil organization, etc. This paper is for explaining carbon neutrality as a strategy responding to climate change by government, and for establishing what we have to do really for responding to climate change. In order to these objectives, this paper will be composed of four themes as below. Firstly, this paper will review some debates on climate change for better understanding about climate change strategies being launched by government and United Nations at a national or global level, respectively. Secondly, there are three similar terminologies. They are low-carbon, carbon-neutrality, and carbon-free (or carbon-zero). The three terminologies are similar in that their concepts are in the process of continuous scale, but different in their conceptual meaning. In this context, the concept of the three terminologies will be defined, and then their implications will be examined in terms of their contributions to mitigating the status of current climate change. Thirdly, this paper will introduce the practices of carbon-neutrality as a strategy responding to climate change by United Nations at a global level, examine critically the United Nations' framework, and then establish a desirable framework for the carbon-neutrality to be more efficient and effective as a strategy responding to climate change. Fourthly, most strategies require a wide range of conditions in their process being launched such as finance and advanced technologies, etc. In this context, this paper will examine what capacities should be built as the pre-requisites for implementing a carbon-neutrality strategy.

Audience Take Away Notes

- The hot issues being debated in relation to climate change
- A conceptual difference in the three similar terminologies (low-carbon, carbon-neutrality and carbon-free) and their different contribution to mitigating climate change
- The United Nations' framework of carbon-neutrality strategy with a critical point of view, a critical point of view on the United Nations' framework, and a new desirable framework
- Capacity building of government for carbon-neutrality strategy being more efficient and effective

Biography

Dr. Dai-Yeun Jeong is presently the Director of Asia Climate Change Education Center and an Emeritus Professor of Environmental Sociology at Jeju National University (South Korea). He received BA and MA Degree in Sociology from Korea University, and PhD in Environmental Sociology from University of Queensland (Australia). He was a Professor of environmental sociology at Jeju National University (South Korea) from 1981 to 2012. His past major professional activities include a Teaching Professor at University of Sheffield in UK, the President of Asia-Pacific Sociological Association, a Delegate of South Korean Government to UNFCCC and OECD Environmental Meeting, etc. He has published 13 books including Environmental Sociology, and has conducted 95 environment-related research projects funded by domestic and international organizations.

V B Murali Krishna
Department of Electrical Engineering, Central University of Karnataka, Gulbarga, Karnataka, India

An experimental study on electric generators for small-scale renewable energy systems

This presentation deals with an experimental study on self-excited induction generator (SEIG) and permanent magnet synchronous generator (PMSG) comparison of renewable energy source driven small-scale off-grid systems. The considered two generators are very popular for generating applications due to their inherent advantages. In the off-grid system, the load ratings are restricted as per the generation rating and expected to be maintained a good voltage and frequency profiles at a lower cost. In this work, an experimental study is conducted to compare the performance of both the generators to identify the simple, viable, and economical operation for small/pico hydro source driven fixed isolated electric resistor and induction motor loads. In this study, the small/pico hydro energy is emulated in the laboratory by using a V/F ACC drive controlled induction motor to use as input to the generators.

Audience Take Away Notes

- Operating principles of self-excited induction generator (SEIG) and permanent magnet synchronous generator (PMSG) for small-scale electric power generation
- Demonstration of small/pico hydro emulated generating systems
- Performance study on three-phase SEIG under different loading conditions and improve the voltage profile through reactive power compensation
- Performance study on three-phase PMSG under different loading conditions and compare the various key aspects with the three-phase SEIG

Biography

Dr. V. B Murali Krishna received his Ph. D degree in Electrical Engineering from Central University of Karnataka in 2021 and worked as a teaching faculty in the School of Engineering, Central University of Karnataka. Prior to that he received M. Tech with specialization of Power Electronics and Drives from Vignan's University, Guntur and B. Tech in Electrical and Electronics Engineering from JNTU Kakinada. His research areas include renewable energy technologies, distribution generation systems, micro grids, electric generators, system optimization and Machine Learning and Artificial Intelligence. He has published more than 30 articles in Journals/Conferences/Book series chapters.

Dr. Ashanendu Mandal
University of Calcutta, India

Removal of toxic phenol from wastewater using solid waste adsorbents

This research aims for adsorptive removal of phenol from wastewater by solid adsorbents generated from biological wastes viz. guava tree bark, rice husk, neem leaves, activated carbon from coconut coir and industrial wastes viz. rice husk ash, red mud, clarified sludge from basic oxygen furnace, activated alumina. The adsorbents are characterized by SEM, XRD, FTIR and BET analyzers. The experiments of phenol removal are carried out with the variation of initial phenol concentration (5-500 mg/L), initial pH (2-12), adsorbent dose (0.10-20 gm/L), temperature (25-50°C) and contact time (30-600 min). The maximum removal obtained is 97.50%. The kinetics shows that the pseudo-second order model is best fitted for all adsorbents except red mud. The kinetic modelings show that the adsorption mechanism is supportive of film diffusion, intra-particle diffusion and chemisorption for all adsorbents. The isotherm analysis suggests that Freundlich isotherm model is best supportive for guava tree bark, rice husk, neem leaves, activated carbon, red mud and activated alumina, whereas Langmuir and D-R isotherm are best supportive for rice husk ash and clarified sludge respectively. The thermodynamics shows the spontaneity, randomness and endothermic/exothermic nature of the adsorption processes. The ANN modelling using two popular algorithms viz., Levenberg-Marquardt and Scaled Conjugate Gradient establishes that the experimental and predictive data are within allowable range. The scale-up designs are performed for their commercial applications. The regeneration and the safe disposal of used adsorbents are also studied for checking their wider industrial applicability.

Biography

Ashanendu Mandal has graduated as B. Sc in Chemistry and B. Tech in Chemical Engineering from University of Calcutta. He has got his M. Tech Degree in Chemical Engineering from IIT, Kharagpur. He has acquired MBA degree in Finance from IGNOU, New Delhi and has undertaken an Advanced Management Program from IIM Calcutta. He has also acquired the Degree of Ph. D. (Tech) in Chemical Engineering from University of Calcutta. Dr. Mandal has worked in ONGC for more than 34 years and his experience includes commissioning, modifications, safety, operations, artificial lifts, pressure maintenance, EOR and planning in offshore and onshore oilfields. He has also vast experience in marketing of upstream and downstream petroleum products. Dr. Mandal has published technical papers in Chemical Weekly and research papers in international journals. He has visited more than 25 countries for attending training programs and for participating in international conferences as invited speaker or panelist. Dr. Mandal is a lifetime member of Indian Chemical Society and Indian Science Congress.

Chitra[1, 2, 3*], Dheeraj Sah[1, 2], Rahul Arya[2], Sudhir Kumar Sharma[2], Tuhin Kumar Mandal[2], Chander Kant[2], Kalpana Lodhi[2], Parveen Saini[1, 2], Rebecca Yang[3], Sushil Kumar[1, 2]

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Gases and particulate matter emission during extraction of various materials from waste silicon solar panels by thermal treatment process

Due to the rapid and widespread deployment of photovoltaic (PV) modules globally, there will be enormous amount of waste produced approximately 60-78 million tons by the year 2050. To recover resources, promote a circular economy, and subsequently reduce the environmental impact, end-of-life (EOL) PVs must require proper recycling. For recycling various methods of mechanical treatment, chemical treatment, and thermal treatment have been proposed and reported. However, thermal treatment is the most prominent method for recycling EOL PV panels due to the higher recovery rate of materials. In the present study, various types of emissions in the form of trace gases, particulate matter (PM), and toxic elements are recorded and evaluated during extraction of various materials from waste silicon solar panels by thermal treatments. The impacts of thermal treatment on the environment are studied by calculating emission factor (EF) of emitted trace gases and particulate matter (PM), organic carbon (OC), and elemental carbon (EC) and water-soluble organic carbon (WSOC). It was observed that the thermal treatment of waste silicon solar panels leads to the emission of Greenhouse gases as well as other trace gases CO, CO_2, SO_2, NO_x, NO, NO_2, and CH_4 that may harm the environment and human health as well. A total of 13 elements Na, B, Ca, N, Mg, Al, P, K, S, Fe, Cl, Cr, and Ag released during the thermal treatment of waste silicon solar panels observed by XRF spectroscopy. By considering various kinds of emissions during thermal treatment for recycling waste solar panels and their possible impacts on humans and the environment as well, we concluded that waste silicon solar modules must be treated in a closed environment with all safety precautions.

Keywords: Solar waste, Recycling, Thermal Treatment, Emission, Gases, Particulate Matter.

Audience Take Away Notes

- The thermal treatment involved the decomposition of the polymeric layer at a higher temperature resulting in the emission of gases, which may have harmful impacts on the environment and human health as well
- There is not much information/data available regarding the emission of trace gases, particulate matter, and elements emitted from the thermal treatment of waste solar panels. Our study highlights the various types of emissions during thermal treatment these panels. The study will surely create awareness to ensure the safety precautions for researchers during the thermal treatment used for recycling waste silicon solar panels to make the process environment-friendly

Biography

Ms. Chitra is pursuing Ph.D. at National Physical Laboratory New Delhi. She works as a research scholar in the "Photovoltaic Metrology" Department under the supervision of Dr. Sushil Kumar Chief Scientist and co-supervision of Dr. Parveen Saini (Sr. Principal Scientist) in the area of "Recycling of waste silicon solar photovoltaic modules". She also enrolled in cotutelle Ph.D. program under the Academy of Scientific and Innovative Research (AcSIR, India)- Royal Melbourne Institute of Technology (RMIT, Melbourne) with Rebecca Yang (Associate Professor - School of Property Construction and Project Management, City campus, RMIT). She has published six papers in reputed International Journals and a few are in process of publication. She has also attended various national and international conferences, Seminars, and workshops and won best poster awards as well.

Devic Gordana*, Ilic Mila, Bulatovic Sandra, Solevic-Knudsen Tatjana

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Urban sustainability at risk due to soil pollution by heavy metals and oil products

Soil sampling strategies have been established across Europe for the protection of the continent's soils. However, for the territory of the Republic of Serbia, such strategies still do not exist for systematical monitoring of soil that would include collection of samples from the entire territory of Serbia in the same calendar year. Due to a rapid urbanization, most of the urban areas in Serbia are built close to roads or industrial areas, where they are under the impact of pollution sources such as industrial emissions. The current knowledge of the pollution of urban soils was reviewed with special reference to heavy metals, oil products and this study has demonstrated a serious problem of organic and inorganic contamination in urban area of Belgrade. Belgrade, the capital and the largest city in Serbia, is located in southeastern Europe, between latitude 44 and 49° and longitude 20 and 27°, 90–120 m above sea level. Belgrade is situated at the confluence of the Sava and the Danube Rivers. It is an important intersection of roads and industry and the commercial center of the country. With a growing population (around 1.7 million citizens; www.srbija.gov.rs) and economic development, the environmental quality of the urban sediments is becoming more significant in terms of human health. Numerous heating plants, coal or crude oil used for domestic heating and diesel vehicle exhaust are some of the potential sources of pollution in urban sediments and they are major problems in Belgrade. The Thermal Plant New Belgrade is located on the left bank of the Sava, in a residential and medium traffic area of Belgrade with more than 200,000 residents, about 1km from its confluence with the Danube. The Thermal Plant complex consists of storage tanks for crude oil and oil products (mainly gasoline, diesel fuel, mazut) and this plant was contaminated due to break-down of the mazut reservoirs (2009, during a gas crisis) and NATO bombing of the reservoirs (1999). Analysis of sediment samples for toxic and potentially toxic trace elements using chemical and eco-toxicological information would provide relevant data for an Ecological Risk Assessment study at this location. The area of the Thermal plant New Belgrade had not been used for agricultural purposes. Multiple indices have been used to evaluate the extent of contamination by aliphatic hydrocarbons, most of which suggest that anthropogenic input is a predominant contribution in alluvial area of New Belgrade. Multivariate statistical analysis was efficiently used to simplify the data sets on aliphatic hydrocarbons. Background knowledge of the sources, chemistry, and potential risks of toxic organic and inorganic substances in contaminated soils is necessary for the selection of appropriate remedial options. Remediation of soil contaminated is necessary in order to reduce the associated risks, and scale down land tenure problems. Immobilization, soil washing, and phytoremediation are frequently listed among the best available technologies for cleaning contaminated soils but have been mostly demonstrated in developed countries. Apparently, driving forces such as population growth and rampant industrialization have accelerated organic and inorganic pollutants concentrations. Last but not least, it is advisable that further focus on urban soil pollution be given, in order to preserve and protect the natural environment and citizens' well-being, and it is imperative that local authorities preserve urban soil conditions.

Audience Take Away Notes

- Provides deep insight into soil quality evolution in the urban area of Belgrade city
- This research will be beneficial to faculty for teaching and advance research
- Advisable that further focus on urban soil pollution be given, in order to preserve and protect the natural environment and citizens well-being

Biography

Gordana Devic studied at Faculty of Chemistry, University of Belgrade, Serbia, and also she received her MS and PhD degree at the same institution. At present Dr Gordana Devic is working as Senior Research Associate at Institute of Chemistry, Technology and Metallurgy, University of Belgrade, National Institute of the Republic of Serbia. Her main research interests are related with geochemistry, environmental poluution of soil, sediment and water system. As a result of her research activities, she has contributed to about 46 publications, including scientific articles, book capters, conference papers, theses, and abstracts.

Gangaraju Gedda

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Green synthesis of metal/carbon dot nanocomposites for environmental remediation

For environmental remediation, treatment of water is an enormous challenge and a vast number of methods have been investigated for their ability to remove toxic chemicals and species from polluted water. However, the research still continues to find the best strategy for effective water treatment. As an alternative to conventional methods, nanomaterials assisted photocatalyst can provide new opportunities for coping with this challenge by photo degradation of pollutants. Among the various kind of nanomaterials based photocatalyst, metal carbon dot nanocomposites due to their water solubility, significant band gap and band energy, effective light absorption, nano size, high surface to volume ration. Moreover, the synthesis of this nanocomposite not only simple, economical, eco-friendly but also doesn't require any additional reducing, protecting and capping agents. All these assets make them remarkable material for effective removal of various kind organic pollutants, dyes, inorganic pollutants and pathogens. Here, initially we disused about various kind of water pollutant and their impact on environment and human health. Advantages and limitation of various tradition methods for environmental water treatment. We also discussed about photocatalysis mechanism and various kind of photocatalysts with advantages and limitation. Next, we discussed origin, back ground and importance of carbon dots in the development of nanoscience and technology. Fallowed by role of carbon dots in the preparation of metal carbon dot nanocomposite and properties. Next, we discussed mechanism and advantages of carbon dot nanocomposites towards degradation of various kinds of organic pollutants. Finally, we discussed future perspectives of metal carbon dot nanocomposite in Health care and other environmental Applications.

Audience Take Away Notes

- Participants will understand current trends and future perspectives of water remedies using Photocatalysis
- It will create a plat form to produce nanocomposite by green synthesis
- Research can expand their research by using this plat form various applications

Biography

Dr. Gangaraju Gedda has completed his M.Sc. from JNTU-Hyderabad, India and Ph.D. from National Sun Yat-sen University, Taiwan. Fallowed by Postdoctoral fellowship from National Taiwan University of Science and Technology. Currently, he is working as the Associate Professor of Chemistry at Presidency University, Bangalore, India. He has published more than 30 papers in reputed journals and 6 book chapters. His total google citation are 1090 with h index 18 and i10 index 22. He also serving as an Editorial Board member for various international journals. His, Current research work is focusing on development of green nanotechnology for therapeutic applications.

Jan Monieta[1*], Magdalena Szmukala[1], Florian Adamczyk[2]

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The effect of natural deterioration on selected properties of rapeseed oil methyl esters

The article discusses the results of research into properties of rapeseed oil methyl esters of and diesel oil subjected to deterioration process at room temperature for 20 years. The heat of combustion and heating values have been measured in laboratory conditions using an automatic calorimeter. The results show a slight decline in energy properties, with a change of 3.45% on average. An image analysis has been used to evaluate the effects of ageing and combustion quality to compare the two fuels. The main purpose of research on rapeseed oil methyl esters in relation to diesel oil was to determine the energy properties of the tested fuels, i.e., the heat of combustion and the heating value. The side aims of research were to determine selected functional properties of the tested fuels. Changes in density, kinematic viscosity, acid value and water content at the beginning and end of the experiment have also been examined. Deposits formed after combustion in a calorimetric bomb in crucibles and on the injector nozzles in a self-ignition engine have been examined with the use of the weight method and image colors analysis. After a long period of storage, density, and acid number of rapeseed oil methyl esters have been slightly changed, while kinematic viscosity and water content increased significantly to exceed the limit values. The acid value of diesel oil increased by 75% as a result of natural deterioration.

Audience Take Away Notes

- The heating values of rapeseed oil methyl esters were decreased of 3.45% past deterioration at room temperature for 20 years
- The acid number of diesel oil increased by 75% as a result of natural deterioration
- The rapeseed oil methyl ester, stored in room conditions for 20 years, showed a change in color on a color analysis
- Density and kinematic viscosity were very closely related to global color measure, while heating value had significant
- The rapeseed oil methyl ester is suitable for long-term storage and can be used as a fuel

Biography

Dr Jan Monieta studied in Poznan University of Technology in 1978–1983, Faculty of Work Machines and Vehicles, MEng. in mechanical engineering in the field of mechanics, specialty rail vehicles. University of Technology and Agriculture in Bydgoszcz, Faculty of Mechanical Engineering, Ph.D. in 1998 Dissertation title: Control diagnosis of marine diesel engines injectors with utilization of the parameters of the working and concomitant processes. His main research areas cover terotechnology, reliability, tribology and diagnostic of reciprocating internal combustion engines. He obtained the position of an Associate Professor at the Maritime University of Szczecin. She has published more than 180 research articles in journals.

Hasan Saygılı[1*], Gulbahar Akkaya Saygılı[2]

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Environmental performance of hydrochar-derived magnetic carbon composite for heavy metal removal

Recently, hydrothermal carbonization (HTC) is emerging as an efficient and valuable pre-treatment technology for converting waste biomass into highly dense carbonaceous materials that can be used in a wide range of applications across the fields of energy, environment, soil remediation and nutrient recovery. In the present investigation, a one-step synthesis of Fe-modified hydrochar was performed through hydrothermal carbonization (HTC) of biowaste and FeSO4.7H2O. Pomegranate marc waste (PMW) was hydrothermally carbonized at 220oC for 12 h, and the hydrochar (PMWHC) was embedded with iron nanoparticles. The as-prepared composite was characterized by ATR-FTIR spectra, VSM, and SEM-EDX spectroscopy. Isotherm studies were taken place for evaluating the potential of PMWHC for adsorption of heavy metal (lead(II)) ions from artificially stimulated wastewater. The isotherm results indicated that experimental data best fitted to Langmuir, with a determination coefficient approaching one (R2 = 0.99). Maximum monolayer adsorption capacity for this composite was found to be 98.45 mg/g. Thermodynamic studies indicated that adsorption was chemisorptive and endothermic. Isotherm studies were taken place for evaluating the potential of these results show that the PMWHC prepared from low-cost agricultural waste (PMW) with oxygen-rich surface functional groups acts as a better adsorbent for removal of Pb+2 ions and could pave the way for more low-cost adsorbents for metal removal. The results indicate the effectiveness of this facile synthesis strategy in converting low-value biowaste into a functional material with high performance for pollutant removal from aqueous solutions.

Audience Take Away Notes

- Environmental-friendly PMWHC composite was synthesized via an in situ one-pot hydrothermal route
- Removal of Pb^{+2} ions by PMWHC as a bioadsorbent
- The adsorption of Pb^{+2} was in accordance with the Langmuir model
- Magnetic adsorbent showed a maximum adsorbed quantity of 98.45 mg/g for Pb^{+2}
- PMWHC is an efficient and cost-effective adsorbent for the removal of heavy metal from wastewater

Biography

Dr. Hasan Saygili is currently working as an Assoc.Prof. in the Chemistry and Chemical Process Technology Department, Vocational School of Technical Sciences, Batman University, Turkey. He has an experience in the field of carbon-based materials for environmental applications. He holds a PhD in activated carbon production from biowastes from Dicle University, Turkey. His primary research interests include carbon nanomaterials, waste minimization, environmental pollution, hydrothermal carbonization, cleaner production technology and wastewater treatment. He has published 27 SCI papers.

Shahid Adeel[1*], Fazal-ur-Rehman[2], Nimra Amin[2], Muhammad Zuber[3], Somayeh Mirnezhad[4], Meral Ozomay[5]

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[2]Department of Applied Chemistry, Government College University Faisalabad 38000, Faisalabad Pakistan
[3]Department of Chemistry, Riphah International University Faisalabad Campus, Faisalabad Pakistan
[4]Department of Carpet, University of Sistan and Baluchestan, Zahedan, Iran
[5]Department of Textile Engineering, Marmara University Istanbul, Turkey

Ultrasonic-assisted extraction & application of bio-colorant from neem bark (Azadirachta Indica) for green mordanted wool fabric

Green products are rapidly gaining a place in walks of life due to the toxic & hazardous effects of their synthetic counterparts. Among green products, natural dyes are considered one of the sustainable, eco-friendly, and eco-labeled products for all fields. This study explores reddish-brown natural dye (tannin) from neem bark for wool dyeing under ultrasonic treatment. The extract and fabric were treated with US waves for up to 60 min. It has been found that 20 mL of extract (4pH) obtained from 4g of powder has given excellent color yield onto fabric when employed under US treatment for 15 min. Scanned images by SEM & spectra by FTIR of fabric show that the surface has been tunned enough physically without any chemical change to sorb colorant up to the maximum extent at selected conditions. During the shade development process, it has been found that 3% of tannic acid before and during dyeing and 1% of tannic acid after dyeing has developed colorfast shades. In comparison, 7% of turmeric as pre-bio-mordant, 3% after dyeing, and 5% turmeric during dyeing have developed colorfast shades. Ultrasonic waves are recommended to be effective in exploring dyeing-yielding plants for fabric dyeing under mild conditions. In contrast, bio-mordants should be included to make the dyeing process colorfast, green, & global friendly.

Audience Take Away Notes

- The students, academician and stakeholders who love to use natural dyes in their fields
- The traditional art lover, cultural heritage for using Plant derived dyes in textiles, fashion cosmetics
- This is new emerging field, where the chances to create human resource, low level house or domestic job to produce dyed products
- Utilization of waste plant materials for useful work
- For environmentalist to give awareness to use pollution free products

Biography

Dr Shahid Adeel, is the part of Govt. College University Faisalabad, Pakistan since 2009 till now. During his career he has produced till now 115 research papers and 27 book chapters with h index 31 and 3080 citations in field of sustainable textiles. He has completed three research projects in textile dyeing and is the member editorial board of Elsevier Springer MDPI, SAGE publication and many others. He has been honored to complete his PhD thesis with 12 research papers, won student bursary from Society of Dyers and Colourists (S.D.C= UK) and Higher Education Commission Project.

Arnauld Philippe Ndzana
Yaounde Urban Council, Cameroon

Takeover of the FSM sector by the municipality of Yaounde

Yaounde is a city of 3 million inhabitants with autonomous sanitation dominating at 95%. The wastewater management strategy recommends the gradual transition from on-site to collective sanitation by 2035, but its implementation has not found funding. Since 2016, the municipality has initiated an awareness for the structuring of the management of fecal sludge. With the help of international partners, a fecal sludge treatment plant has been built with a capacity of 260 m3 per day, based on the principle of a thickening basin-sludge drying beds-anaerobic basin and optional lagoon. A smart GPS tool has been put in place to track the activities of vacuum trucks. The station has been in operation since October 2021 and receives nearly 300 m3 per day. The effluent is regularly analyzed in the laboratory and its quality is not satisfactory. Research into solutions is underway to improve it, either by using floating aquatic plants on the optional lagoon, or by adding a final aerobic lagoon or evaluating the purifying capacity of the swamp into which the effluent. Experiments in the agricultural use of dried sludge are also underway.

Biography

Ing Arnauld Philippe Ndzana studied civil engeneering in the National Polytechnic School of Yaounde, Cameroon, and graduated in 1990. He then joined the Yaounde City Council as urban planner and has served as technical Director during about fifteen years, and is now technical advisor of the Lord Mayor. He supervised many projets in urban management and sanitation

Shumaila Kiran

Department of Applied Chemistry, Government College University, Faisalabad, Pakistan

Mitigation of direct orange 26 dye using copper nanoparticles synthesized from tilapia fish scales: An environmental remedial approach

The performed work reports the manipulation of a collective local surplus solid (fish scales of tilapia) for the synthesis of copper nanoparticles. Copper nanoparticles were synthesized using tilapia fish scales and were characterized using SEM and XRD. The synthesized copper nanoparticles were used for the remediation of direct orange 26 dye. The maximum remediation (90.2%) was noted at 0.01 g/L concentration of dye, 0.001 g/L of Cu-NPs, pH 8, at 40 °C. The value of TSS for untreated and treated solutions was found to be 0.447 mg/L and 0.40 mg/L, respectively. Similarly, the value of TDS for the untreated solution was found to be 22.35 mg/L while for the treated solution it was 20 mg/L. The percent reduction in COD and TOC were 84.54% and 86.76%, respectively. All data was analyzed statistically. The current study inferred that copper nanoparticles using a tilapia fish scale which is a bio-waste material could be successively used for the detoxification of other toxic dyes as well.

Audience Take Away Notes

- Use of nanotechnology in the green synthesis of metal or metal oxide nanoparticles
- The approach of green synthesis of metal oxide nanoparticles is a cost-efficient, eco-friendly, and easy alternative approach
- Nanoparticles are helpful in the removal of synthetic dyes, hence controlling water pollution

Biography

I, Dr. Shumaila Kiran studied Chemistry at the University of Agriculture, Faisalabad, Pakistan, graduated as MS in 2006. I received her PhD degree in 2012 at the same institution. I obtained the position of an Assistant Professor at the Government College University, Faisalabad, Pakistan in 2012 and currently working as an Associate Professor in the same institution since 2019. I have published more than 75 research articles in well reputed ISI listed international well-reputed journals.

Mehul Tiwari, Divya Bajpai Tripathy*, Anjali Gupta
Division of Chemistry, School of Basic and Applied Sciences, Galgotias University, Greater Noida, India

Surfactants enhanced soil remediation

Surfactants are a class of amphiphilic substances that simultaneously include hydrophilic and hydrophobic components in their molecular structure. Surfactants' distinctive molecular structure makes it possible to increase the solubility of soil pollutants in water, particularly those hydrophobic organic molecules. For soil remediation, a range of surfactants, including anionic, cationic, zwitterionic, and nonionic surfactants, have been investigated and/or used. In the general process for an ex-situ soil cleaning where surfactant aqueous solution, first the contaminated soil that has been excavated is pretreated, combined with water that contains surfactants, and stirred. Once wash, the clay particles are left to settle out, and the eluents can be extracted and recycled for the next round use exploitation. Ex-situ soil washing enables the very economical return of clean coarse fractions of soil to the site while treating a wide range of influent contamination concentrations. Another method for practical application is in-situ soil flushing with surfactant eluents. Through injection wells, flushing solutions, such as liquids containing surfactants, are injected into the contaminated region. By solubilization (for example, the production of micelles with the aid of flushing solutions) or chemical interactions, the soil pollutants are mobilized. The contaminant-bearing fluid is collected and brought to the surface after it has passed through the contamination zone for disposal, recirculation, or on-site treatment and reinjection. Soil washing is one of the few available treatment methods that can completely extract radionuclides, organics, and heavy metals from polluted soils. For soil washing or other remedial treatments, such as surfactant-enhanced bioremediation, surfactant-enhanced phytoremediation, and surfactant-enhanced electro kinetic remediation, surfactant is a frequently used ingredient.

Audience Take Away Notes

- After getting knowledge of types of contaminants and comparison of soil remediation techniques related audience will be able to take decision of what has to be used when and where?
- Comprehensive information on the topic
- This work will help to provide big range of ideas to pursue research in related field
- Yes does this provide a practical solution to a problem that could simplify or make a designer's job more efficient
- Yes will it improve the accuracy of a design, or provide new information to assist in a design problem

Biography

Dr. Divya Bajpai Tripathy is currently as a Professor in the Division of Chemistry, School of Basic and Applied Sciences, Galgotias University, Greater Noida, India. She has 13+ years of research and teaching experience. She has more than 60 research publications in reputed Journals/Book/ Book chapters/Conference proceedings and patent filed to her credit. She has guided 12 Masters Research students. Currently six students are pursuing Ph.D in her supervision. She has been principal the investigator in a DST funded research project under WOSA scheme. She has research collaboration with Prof. Anuradha Mishra, Gautam Budh University, Prof. M.A. Quraishi, King Fahd University, Saudi Arab, Dr. Anjali Gupta, Galgotias University, Greater Noida, Prof. Anuradha Mishra, Gautam Buddha University, and Greater Noida.

Ozcan Koysuren[1*], Hafize Nagehan Koysuren[2]

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Preparation of $B_4C/AgFe_2O_4$ heterostructures for photoreduction of Cr (VI)

It was aimed to couple boron carbide (B_4C) and silver ferrite ($AgFe_2O_4$) nanoparticles in the composite heterojunction structure for the CR (VI) photoreduction application. For this purpose, a polymer precursor, polyvinyl borate (PVB) was synthesized from polyvinyl alcohol and boric acid using the crosslinking reaction. A heat treatment was applied to the as-prepared polymer precursor to convert me to B_4C nanoparticles using the carbothermal reduction process. Then, $B_4C/AgFe_2O_4$ composites were prepared though the synthesis of magnetic $AgFe_2O_4$ nanoparticles in the presence of the as-prepared B_4C nanoparticles using an auto-combustion process. B_4C and $B_4C/AgFe_2O_4$ composite nanoparticles were synthesized successfully, which was proved by Fourier-transform infrared spectroscopy and X-ray powder diffraction analyses. According to field emission scanning electron microscopy and N_2 adsorption-desorption studies, all the samples had a mesoporous surface area and the specific surface area of the prepared samples was close to each other. According to UV-Vis absorption spectroscopy, the composite samples exhibited high light absorption both in the UV light and in the visible light regions. When compared with B_4C, there was an increase in light absorption within the UV-Vis light region. Combining B_4C with magnetic $AgFe_2O_4$ in the composite heterojunction structure provided improvement in the Cr(VI) photoreduction efficiency. The Cr(VI) photoreduction efficiency increased from 65.1% to 98.0% after 120 min of visible light irradiation. According to photoluminescence spectroscopy, combining B4C with magnetic $AgFe_2O_4$ in the composite structure suppressed the recombination of the photoexcited charge carriers on both semiconductors, which might be the reason for the enhancement in the Cr (VI) removal efficiency. Different experiment conditions, like the initial solution pH, the initial solution concentration and the initial catalyst concentration, were investigated for their effects on the Cr (VI) ratio. Under acidic conditions, the Cr(VI) removal rate in the presence of $B_4C/AgFe_2O_4$ increased to almost 99%. The Cr(VI) photoreduction efficiency decreased to 89.9% when real wastewater spiked with Cr(VI) ions was used instead of the simulated Cr(VI) solution. Based on the reusability experiments and the magnetic property analysis, the prepared composites were reusable for the consecutive Cr(VI) photoreduction processes and could be easily separated from the Cr(VI) solution through the magnetic separation technique.

Audience Take Away Notes

- $B_4C/AgFe_2O_4$ is a new example for photocatalyst. The application potential for Cr(VI) removal from the aquatic environment was explored in this study and will be presented at the conference
- Highly toxic Cr(VI) can be converted to less toxic Cr(III) through the photoreduction process
- Combining B_4C with magnetic $AgFe_2O_4$ enhanced the separation of the photoinduced electron-hole pairs on the photocatalyst, leading to an improvement in the Cr(VI) removal rate
- Magnetic $AgFe_2O_4$ enhanced the reusability of the prepared composite photocatalyst
- Application of the Cr(VI) photoreduction in the wastewater treatment is also new topic. The audience could inform about different photocatalyst for the wastewater treatment purpose

Biography

Dr. Ozcan Koysuren received his B.S. degree from Middle East Technical University (Ankara, Turkey) in 2002 and Ph.D. degree from the same University in 2008. Dr. Koysuren started his academic career as a research assistant in the Chemical Engineering department of Middle East Technical University in 2002. He is currently Associated Professor in the Energy Engineering department of Ankara University (Ankara, Turkey). Dr. Koysuren has published 30 research articles in SCI(E) journals.

Igor V. Shevchenko
Semenenko Institute of Geochemistry, Mineralogy and Ore Formation, Kiev, Ukraine

Influence of the sun on water dependence on geometry of solution and its position in space

The variations of solar activity and distribution of solar energy due to the rotation of the Earth around its axis and around the Sun exert a strong influence on the self-organization of water molecules, on the size of water clusters and on their chemical reactivity. As a result, the rate of hydrolytic reactions with participation of water clusters displays diurnal, very large annual variations, and is also modulated by the 11-year cycles of solar activity. The rate of hydrolysis also depends on geographic latitude and has different values in the Northern and Southern hemispheres in winter and summer. In different years of the solar cycle, the difference in the reaction rate can reach 200 times. This phenomenon may be well accounted for by the decomposition of water clusters by muons which are constantly generated in the upper atmosphere by the solar wind. Since the muon flux is anisotropic, its influence depends on the area of a reaction solution which is affected by muons. For this reason, the reaction rate is highly dependent on the geometry of the reaction solution and its position in space. For example, the difference in the rate of hydrolysis of triethyl phosphite in three 5-mm NMR tubes directed North-South, East-West and vertically can be very large. The rate ratios between the tubes vary greatly during the day depending on the position of the Sun in the sky. The rate of hydrolysis in the East-West tube displays the largest daily fluctuations.

Audience Take Away Notes

- The influence of the Sun on hydrolytic processes is of great importance for biology since water is a necessary component of all forms of life. This phenomenon underlies circadian, circannual, and 11-year biological rhythms
- Measurements of the rate of hydrolysis of triethyl phosphite in different places can provide important information about the influence of space weather on the Earth
- Near the Equator where there are no seasonal differences, such measurements may become an independent method for estimating solar activity
- Hydrolysis of triethyl phosphite can be used to track changes in the direction of the muon flux

Biography

Dr. Shevchenko studied Chemistry at the Kiev University, Ukraine and graduated as MS in 1979. He then worked at the Institute of Organic Chemistry in Kiev and received there his PhD degree in 1985. In 1990 he won Alexander von Humboldt scholarship and until 1996 was invited scientist at the Braunschweig University in Germany and at the Sothern Methodist University in Dallas Texas USA. Then he worked in Kiev at the Institute of Bioorganic Chemistry and Petrochemistry and the Institute of Geochemistry Mineralogy and Ore Formation, Ukrainian Academy of Sciences. He has published more than 60 research articles.

Francisco E Rodrigues Jr, Fabiano A N Fernandes*

Department of Chemical Engineering, Ceara Federal University, Fortaleza, CE, Brazil

Cold plasma catalyzed degradation of diazinon in aquatic environment

Pesticides are chemical compounds widely used in crops pest control, ensuring high productivity and product quality control. However, pesticides are toxic and can be bio accumulative. Their excessive use causes environmental and health impacts. In this study, the potential of glow discharge plasma to degrade diazinon present in water was investigated. For the degradation process, a glow discharge plasma (GDP) system was used to process diazinon at several plasma flow rates (10, 20, and 30 mL/min) and exposure times (10, 20, and 30 min). The degradation levels and the identification of the degradation products were analyzed by gas chromatography coupled to mass spectrum (GC-MS). GDP processing efficiently degraded diazinon, reaching a maximum degradation of 8.19 ± 0.92 mg/L, sufficient to bring diazinon-contaminated waters to safe levels. Two parallel degradation routes were proposed for diazinon degradation by cold plasma.

Audience Take Away Notes

- Process for pesticide degradation catalyzed by cold plasma
- Potential application of cold plasma on water treatment
- High degradation power of plasma processes
- The process could be designed for in-line application

Biography

Dr. Fernandes studied Chemical Engineering at the São Carlos Federal University, Brazil, and graduated with a Ph.D. in 2002. He joined Ceara Federal University in 2005 and is currently a Full Professor at the university. His research focuses on non-thermal technologies, including ultrasound, cold plasma, pulsed UV light, and ozone. He has published more than 140 research articles in international journals and is listed as one of the 2% more influential researchers in the world, according to the Stanford Ranking.

BOOK OF ABSTRACTS

22-23 MAY

DAY 02

VIRTUAL ROOM 03

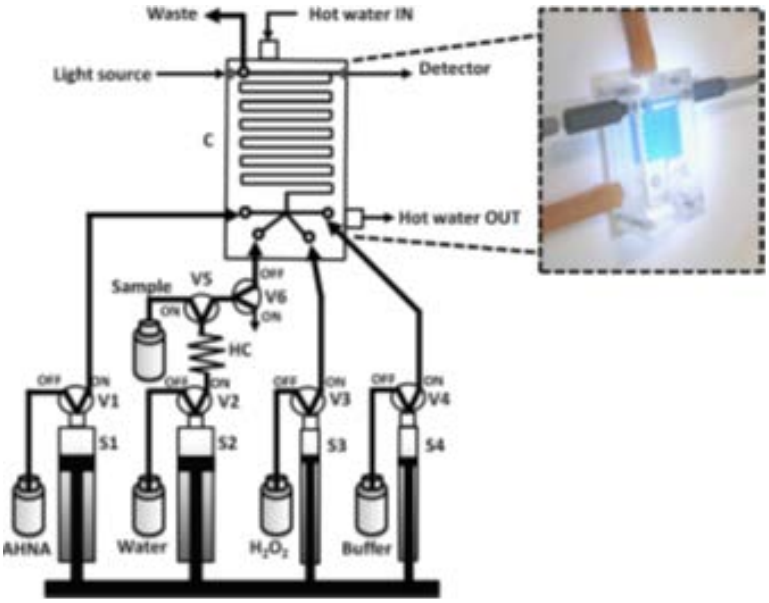
KEYNOTE FORUM

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Automated in-chip catalytic spectrophotometric methods

The development of automatic analyzers based on flow techniques, like FIA, MSFIA, SIA, MPFS, etc., involves the use and continuous innovation of fluidic devices. The new trends go toward miniaturization of sophisticated fluidic platforms, like chips, requiring continuous advances in this field. The availability of a mechanic and electronic workshop together with the know-how to build new 3D fluidic devices provides the tools for the creation of innovative instrumentation and stimulates the creativity of analytical chemists. In this contribution we will present how to build and use of new flow-based fluidic devices, together with the tools required, such as computerized controlled lathes, milling machines, laser engraver machines, low-temperature co-fired ceramics technology and 3D printers, highlighting their strong and weak points. In addition, some flow based methods exploiting innovative fluidic platforms applied in catalytic spectrophotometric methods are presented as a way of example of the possible devices that these tools can provide and their potential applications.



Audience Take Away Notes

- This presentation will help how to build compact flow systems for kinetic-catalytic methods
- The presented chips may be used by other faculties to expand their research or teaching
- It will improve the accuracy of a design, and provide new information to assist in a design of compact systems

Victor Cerda[1*], Sergio Ferreira[2], Piyawan Phansi[3]

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Biography

Victor Cerda, graduated and PhD in Chemistry by the University of Barcelona. Became Full Professor of Analytical Chemistry in 1982 at the University of the Balearic Islands. He has conducted 41 Ph.D. Thesis, written 14 books, and collaborated with 14 chapters in other scientific books. He has published 620 papers and presented 847 contributions in national and international symposia. Has been organizer of more than 15 international symposia. Has been the Head of the Department of Analytical Chemistry and the first Head of the Department of Chemistry of the UIB. Has been Vice-President of the Spanish Society of Analytical Chemistry.

Shape recovery and crystallographic reactions in shape memory alloys

Some materials take place in class of smart materials with adaptive properties and stimulus response to the external conditions. Shape memory alloys take place in this group by exhibiting a peculiar property called shape memory effect, which is characterized by the recoverability of two certain shapes of material at different conditions. Shape memory effect is initiated by successive cooling and deformation treatments, and activated thermally on heating and cooling, with which shape of the materials cycles between original and deformed shapes in reversible way in bulk level. Therefore, this behavior can be called Thermoelasticity. This deformation is plastic deformation, with which strain energy is stored in the materials keeping the deformed shape and released on heating by covering original shape on heating. Two successive crystallographic reactions, thermal and stress induced martensitic transformations govern shape memory phenomena in crystallographic basis. Thermal induced transformation occurs on cooling with the cooperative movement of atoms by means of shear-like mechanism in <110>-type directions on {110} -type planes of austenite matrix, along with crystal twinning on cooling and ordered parent phase structures turn into twinned martensite structures. The twinned structures turn into the detwinned structures by stressing material in low temperature condition by means of stress induced transformation. These alloys exhibit another property called superelasticity, which is performed mechanically by stressing and releasing material in elasticity limit at a constant temperature in parent phase region, and shape recovery is performed simultaneously upon releasing the applied stress. Superelasticity is performed in non-linear way; stressing and releasing paths are different in the stress-strain diagram, and hysteresis loop refers to energy dissipation. The elementary processes involved in such the transformations are lattice invariant shear, lattice twinning and detwinning. It is well known that crystal twinning and detwinning reactions play a considerable role in shape memory effect and superelasticity. Martensitic transformations have diffusionless character and movements of atoms are confined to inter atomic distances.

Copper based alloys exhibit this property in metastable □-phase region, with chemical composition. Lattice invariant shears and lattice twinning are not uniform in these alloys, and the ordered parent phase structures martensitically undergo the non-conventional complex layered structures on cooling. The long-period layered structures can be described by different unit cells as 3R, 9R or 18R, depending on the stacking sequences on the close-packed planes of the ordered lattice. The unit cell and periodicity is completed through 18 layers in direction z, in case of 18R martensite, and unit cells are not periodic in short

Osman Adiguzel

Department of Physics, Firat University, Elazig, Turkey

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post- doctoral research scientist in 1986-1987, and studied were focused on shape memory effect in shape memory alloys. His academic life started following graduation by attending an assistant to Dicle University in January 1975. He became professor in 1996 at Firat University in Turkey, and retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He supervised 5 PhD- theses and 3 M. Sc- theses and published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international level with contribution. He served the program chair or conference chair/co-chair in some of these activities. Also, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Additionally, he joined over 70 online conferences in the same way in pandemic period of 2020-2021. Dr. Adiguzel served

range in direction Z. In the present contribution, X-ray diffraction and transmission electron microscopy studies were carried out on copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections inherited from parent phase due to the displacive character of martensitic transformation. X-ray diffractograms taken in a long-time interval show that diffraction angles and intensities of diffraction peaks change with the aging time at room temperature. This result reveals a new transformation in diffusive manner.

Keywords: Shape memory effect, Martensitic transformations, Thermoelasticity, Superelasticity, Lattice twinning and detwinning

Audience Take Away Notes

- Shape memory alloys are multifunctional materials, and they are used as shape memory devices in many fields from biomedical to the building industry
- This is a multidisciplinary conference, and I will introduce the basic terms and definitions related to shape memory phenomenon at the beginning of my talk. Therefore, the delegates will be familiar with shape memory effect

his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

Nanostructured materials used for the fabrication of an AcHE biosensor for pesticide detection

Nowadays agriculture cannot be conceived without the pesticides usage to protect the crops. The pesticide term includes chemicals substances intended for plant growth factor, defoliant, desiccant or agent for thinning fruit or preventing the premature fall of fruit, substances applied to crops either before or after harvest for preventing, destroying or controlling any pest. Unfortunately, the pesticides pollute a large palette from environment: plants, organisms, soil and water. Using monitoring tools, like chemical biosensors, the use of pesticides can be put under control. Microelectronics offers some convenient transducers. Borrowing micro-technological processes, the enzymatic biosensors can be easily integrated onto the Silicon wafers. This paper proposes a biosensor for paraoxon pesticide detection, as a small piece from a decontamination soil technology plan. The paper reveals the pesticide detection principle, by paraoxon hydrolysis assisted by the Acetyl-cholinesterase enzyme, as key receptor. The key process is must find a compatible enzymatic membrane deposition on the Si-wafers. A good entrapping occurs if the enzyme is captured on a nano-porous thin layer by adsorption combined with other cross-link methods. A main advantage of the Si nano-porous layer directly grown on a wafer consists in strong anchoring to the Si-substrate. Converting p-type Si in Si-porous by anodization, is a solution. Then, some technological steps, with tests and microscopy analysis are presented. Finally, the preliminary tests of the developed biosensor with the ACHE enzyme immobilized onto the Si-porous layer are discussed.

Audience Take Away Notes

- How a biosensor of pesticides using ACHE enzyme and Si-substrate can be co-integrated
- Si nano-porous structure action
- The presented technique can be use to expand the research field of environmental biosensors
- The issue provide a practical solution to co-integrate biomaterials near electronic devices
- The presented solutions could improve the accuracy of a biosensor design

Cristian Ravariu

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Biography

Prof. C. Ravariu studied Microelectronics at the Polytechnic University of Bucharest, Romania and graduated as MS in 1993. He worked as scientific researcher first 5 years at Institute of Microtechnology, Bucharest, then joined the Polytechnic University of Bucharest. After multiple foreign stages in Bioelectronics (Patras, Greece), Nano-devices (EPFL, Switzerland), Organic Electronics (LAAS, France), he received PostDoc degree in 2012 in Romania. Since 2013 he obtained the position of Full Professor at the Polytechnic University of Bucharest, Faculty of Electronics, Romania. He has published more than 250 research articles. Since 2014 he is Chairman of the Romanian IEEE Electron Devices Chapter.

Green hydrogen UK by 2030: Progress and prospects

Green hydrogen is starting an energy revolution in Britain this year [1]. It has been with us for six centuries, and the phrase 'Hydrogen Economy' was coined in 1970 but without much penetration [2] because it was not green then. Real action to go green has been sluggish because hydrogen has previously been isolated in petrochemical plants and has almost all hydrogen production has been fossil hydrogen, predominantly made from coal, petroleum and natural gas. That is changing rapidly by 2030 as the British Government has begun to inject significant funding into the green material, though much less than USA, Germany, Japan and China. The author installed the first UK green hydrogen station in Birmingham University during 2007-8, refuelling 5 fuel cell battery cabs for the 50 PhD chemical engineering students that arrived in 2009. Only 10kg/day were required, contrasting with the first UK large ITM Power station delivering almost 1te/day green hydrogen opened in July 2020. The other 11 hydrogen stations in Britain at present may be slightly green but are still using significant fossil fuel to produce the product. These stations will lower emissions compared to dirty diesel but will not stop climate change. That is the first question asked in this presentation 'What do you mean, Green?'. Then the developments in Birmingham and around the world are summarised, with the key innovations defined. As a sideshow, the remarks of Elon Musk about this technology 'Fool Cell; Mind bogglingly stupid' are humorously demolished. He is amazingly rich, but completely wrong. The future may take another century, yet we are on the exponential way, if we can persuade our politicians that hydrogen needs both batteries and the grid but beats both in the end.

[1] History: The story of Hydrogen, M Kendall, K Kendall, APB Lound, Adelan UK 2022.

[2] Hydrogen Economy, Wikipedia, accessed Jan 2022

Kevin Kendall

Hydrogen United in Birmingham, United Kingdom

Biography

Kevin's main interest over the last 40 years has been clean energy, especially hydrogen and fuel cells. He started his company Adelan Ltd on this track in 1996 with his daughter Dr Michaela Kendall, little recognising that about 100 fuel cell companies worldwide have been burning investor money continuously since then, never making a profit. But, as I said in the 1990s, this market will boom soon. He obtained his 1970 PhD in the Cavendish Laboratory in Cambridge, studying true contact of solids, not much related to the hydrogen fame of Henry Cavendish who called it factitious (ie man-made) air in his remarkable 1766 papers. Kevin's interest in Green Hydrogen blossomed in 2008 when he installed the first UK green-hydrogen refuelling station for vehicles at Birmingham University, Chemical Engineering. Converting fossil fuels into hydrogen fuel seemed such a ridiculous idea at the time, and still is, though the petrochemical giants and our Government continue talking about doing it as they have done for the past centuries. The key idea was to operate a fleet of bio-hydrogen fuel cell vehicles made by Microcab. 50 PhD students were recruited to research the hydrogen fuel cell vehicle performance. Despite this early advance, there are only 12 stations in the UK at present, most of them not working when you arrive to fill-up. This must move to 100 working stations around Birmingham very quickly, then to 1000 by 2030. And only 300 hydrogen vehicles in UK at present need to increase to 1 million by 2030. You might say that Battery Electric Vehicles are best, but hydrogen beats batteries for weight and cost of energy storage by a factor around ten. Adelan also focusses on hot fuel cells using bioLPG as fuel, which beats hydrogen for weight, volume and cost of energy storage. This hot ceramic fuel cell also provides useful heat for many applications, but is not so appropriate for transport applications, and is not so effective as polymer fuel cells at using hydrogen.

22-23 MAY

DAY 02

VIRTUAL ROOM 03

SPEAKERS

JOINT EVENT ON

CATALYSIS, CHEMICAL ENGINEERING AND GREEN CHEMISTRY

Victor Cerda

University of the Balearic Islands, Palma de Mallorca, Spain

Automated flow techiques for environmental analysis

A description of different automated flow techniques will be presented for the determination of several parameters of environmental interest. The main advantages of these flow techniques will be underlined, like high sample throughput, reproducibility, low sample and reagents consumption, etc.

Audience Take Away Notes

- They will learn the advantages of using automated different flow techniques
- By using these techniques they will be able to improve the sample throughput
- It will show how automated flow techniques may contribute to green chemistry by decreasing the size of the sample and reagents volumes

Since the flow techniques are running in closed systems they will provide a good accuracy avoiding loss of samples and external contamination

Biography

Victor Cerda, born in Palma de Mallorca, Spain. Graduated and PhD in Chemistry by the University of Barcelona. Lecturer of several universities: Barcelona, Tarragona, Valladolid. Full Professor of Analytical Chemistry in 1982 at the University of the Balearic Islands (UIB). He has conducted 41 Ph.D. Thesis, written 14 books, and has collaborated with 14 chapters in other scientific books. He has published 620 papers and presented 850 contributions in national and international symposia. Chief Researcher of projects funded by the CAICYT, DGICYT, CICYT, BCR (EU), ALFA (EU), AECI, MCY, and conducted a number of contracts usually related with environmental subjects with different firms (TIRME, MAC INSULAR, ENDESA, etc) and institutions (BCR, Nuclear Security Council, etc). His main research lines are related with the development of new automatic methods in Analytical Chemistry and their application to environmental and pharmaceutical samples. Has been organizer and chairman of more than 15 international symposia. Has been the Head of the Department of Analytical Chemistry and the first Head of the Department of Chemistry of the UIB. Has been Vice-President of the Spanish Society of Analytical Chemistry.

Seong Sik Shin[1, 2,*], Byeonggwan Lee[2, 3], Ga Yeong Kim[1, 2], Hyun Woo Kang[2], Jung-Hoon Choi[2], Ki Rak Lee [2], Hwan-Seo Park [2]

[1]Department of Environmental Engineering, Chungnam National University, Daejeon, Republic of Korea
[2]Radioactive Waste Treatment Research Team, Korea Atomic Energy Research Institute Daejeon, Republic of Korea
[3]Department of Hydrogen and Renewable Energy, Kyungpook National University, Daejeon, Republic of Korea

Effect of transition metal oxides in silver tellurite glass

Iodine (I-129) is a radioactive isotope which has half-life of 15.7 million years. The radioactive iodine is produced by nuclear fission in nuclear power plants. Due to iodine has a long half-life with high mobility in the environment, the iodine should be captured and immobilized. In the off-gas treatment system, silver-loaded zeolite filter has been used to collect iodine as a form of AGI, which has been regarded as a durable compound. However, the AGI itself could not be a final waste form because it could not satisfy the waste acceptance criteria. Therefore, it should be immobilized into a suitable matrix. Among the several matrices, silver tellurite glass is considered as a one of the promising candidates of AGI immobilization matrix. In this study, transition metal oxides such as WO_3, MoO_3 and V_2O_5 were added to silver tellurite glass (AgI-Ag_2O-TeO_2), respectively. Their effect was tested as an iodine immobilization matrix. The melt-quenching process was used to produce the glass samples. The mixtures of the glass precursors were melted at 800°C for 1 h in alumina crucibles with ambient atmosphere. The loss of the elements comprising the glass was not significant from the XRF results. The loading of iodine in the immobilization matrix was approximately 13-15 wt%, excluding the oxygen. The normalized releases of all elements obtained by PCT-A were below the order of 10^{-1} g/m^2, satisfying the U.S. regulations (< 2 g/m^2). Structural analysis was conducted to reveal the effects of the transition metal oxides on the releases of all elements. The release of iodine decreased with the addition of WO_3, MoO_3 and V_2O_5. The transition metal oxides suppressed the release of iodine by densifying the TeO_4 polyhedra. The densification of the TeO_4 polyhedra resulted in the stabilization of the iodine in the glass matrix. The release of silver depended on the type and concentration of the transition metal oxide. The silver release pattern resulted from the addition of V_2O_5 was slightly different from those of WO_3 and MoO_3. However, it was not significantly affected by the increase in the amount of the additives. All the transition metal ions considered in the present study remained stable with the increase in the concentrations of the additives in the silver tellurite glass. It was concluded that densification was occurred by adding transition metal ions such as tungsten, molybdenum, or vanadium into the silver tellurite glass structure. The additives stabilized tellurium ion, a glass network former, to prevent its release from the glass matrix.

Audience Take Away Notes

- Leaching effect for each additive
- Optimization of glass composition containing radioactive iodine
- How to dispose of radioactive Iodine

Biography

Seong Sik Shin graduated from the Department of Nuclear Engineering at Chosun University in February 2021 and entered the master's course at the Department of Environmental Engineering at Chungnam National University in March 2021.

Ga Yeong Kim[1, 2*], Ki Rak Lee[2], Jung Hoon Choi[2], Jae Hwan Yang[1], Hwan SEO Park[2]

[1]Department of Environmental Engineering, Chungnam National University, 99, Daehak-RO, Yuseong-gu, Daejeon, Republic of Korea
[2]Korea Atomic Energy Research Institute, 111, Daedeok-daero989beon-gil, Yuseong-gu, Daejeon, Republic of Korea

Synthesis of Cs pollucite ceramic waste form and long-term leaching behavior

Radioactive cesium (Cs) is representative fission products of spent nuclear fuel with high heat generating. Since radioactive Cs has high solubility and mobility in groundwater, it should be immobilized in a chemically durable waste form. Ceramic waste form has higher thermal stability and lower solubility than glass and cement waste form. Various ceramic waste forms for Cs immobilization have been researched. The Cs pollucite consists of an aluminosilicate framework and Cs ion incorporated in a matrix lattices. Previous studies have shown that pollucite has high chemical durability due to their structure. In this study, Cs pollucite powders were synthesized using Cs_2CO_3 and aluminosilicate denoted Absorbent Product (AP). Batches in which the precursors were mixed were placed in a 1000°C oven for 2 hours and then transferred to a 1200°C oven for 2 hours. The targeted compositions of Cs pollucite powders were 0.1, 0.2, 0.4, 0.5, 0.6 and 0.8 in the weight ratio of Cs_2O to AP. These pollucite powders were pelletized by cold pressing with polyvinyl alcohol (PVA) as binder material. The fabricated Cs pollucite pellets were sintered at 1400 or 1500°C for 5 to 36 hours at ambient atmosphere. The characterization of the pollucite powder and pellets were analysed by XRD, TGA, and SEM-EDS. The chemical durability of pollucite powder was evaluated by PCT-A method and the concentration of elements was determined by ICP-MS/OES. The minimum normalized release of Cs in pollucite waste form was 1.22×10^{-4} g/m^2/day. The optimal condition with well-made ceramic waste form is confirmed low Cs_2O/AP ratio and pelletizing pressure, high sintering temperature and time. The long-term leaching test was performed using the modified MCC-1 method. Allard groundwater and deionized water were used for leachate in the leaching test, and replaced 7 contact periods which is 0.125, 3, 7, 14, 28, 60, and 120 days and analysed by ICP-MS. The Cs pollucite waste form developed in the present study had chemical durability than spent nuclear fuel.

Audience Take Away Notes

- The audience can learn about the research status of waste form for radioactive Cs using the products of the Cs capturing process developed at Korea Atomic Energy Research Institute
- The contents of this study can be referred to develop advanced Cs solidification or waste form technologies
- Engineering design studies can be conducted on the equipment of immobilization process
- Long-term leaching test results can be used in research to find leaching mechanisms of Cs pollucite waste form

Biography

Ms. Kim is master student at Chungnam National University, studying the treatment technologies of radioactive waste at Korea Atomic Research Institute.

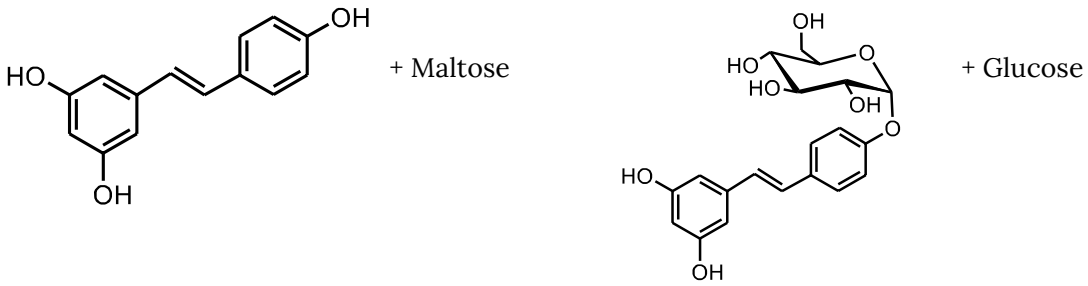
Amelia Christina Atmowidjojo[1*], Michiki Takeuchi[2], Shota Kimoto[1], Shigenobu Kishino[1], Yudai Itagaki[3], Ryotaro Hara[2], Nahoko Kitamura[1], Natsumi Okada[1], Si-Bum Park+, Akinori Ando[1], Makoto Ueda[2, 3,] and Jun Ogawa[1]

[1]1Division of Applied Life Science, Graduate School of Agriculture, Kyoto University, Kitashirakawa Oiwake-cho, Sakyo-ku, Kyoto 606-8502, Japan
[2]Industrial Microbiology, Graduate School of Agriculture, Kyoto University, Kitashirakawa Oiwake-cho, Sakyo-ku, Kyoto 606-8502, Japan
[3]Department of Materials Chemistry and Bioengineering, National Institute of Technology, Oyama College, 771 Nakakuki, Oyama, Tochigi, 323-0806, Japan

Characterization of glycosyltransferase from rhizobium pusense useful for regioselective production of resveratrol 4′-O-α-D-glucoside

Background: Resveratrol is a polyphenolic stilbenoid compound known for its strong anti-oxidative effect; however its bioavailability is limited due to its rapid metabolism and poor water solubility. These drawbacks could be overcome by performing enzymatic structural modification through α-glycosylation. The position of α-glycosylation affects the characteristics of the resveratrol glycoside in which 4′–OH position shows better antiradical properties compared to the 3–OH position. Thus, this study aims to obtain a regioselective enzyme to perform enzymatic synthesis of resveratrol 4′-O-α-glucoside.

Results: In this study, we identified and characterized the regioselective glycosyltransferase (Fig. 1). First, we carried out screening of regioselective glycosyl transferase useful for resveratrol 4′-O-α-glucoside production and identified *Rhizobium pusense* JCM 16209T as a potential strain. Two α-glucosidases of *R. pusense* JCM 16209T (RPG I and RPG II) were identified. Furthermore, we characterized the regioselective glycosyltransferases by cloning and expression in *Escherichia coli*. RPG I showed strong glycosylation activity toward resveratrol with 4′-selectivity of 98.3 %. The enzyme activity was maximized at pH 8.0 and 50 °C, and enhanced in the presence of Cs+ and Li+ ions. The maximum molar yield of resveratrol 4′-O-α-glucoside from resveratrol reached 41.6 % at 30 min, and the concentration of the product was 2.08 MMOL L–1.Novelty to the best of our knowledge, there are few reports on microbial glycosyltransferases that are useful for regioselective glycosylation. This study could be the first step toward developing technologies for the precise synthesis of glycosides.



Resveratrol

Resveratrol 4′-O-α-D-glucoside

Fig 1 Regioselective production of resveratrol 4′-O-α-D-glucoside using glycosyltransferase from R. pusense

Keywords: Resveratrol, Enzymatic catalysis, Regioselective glycosylation, Glycosyltransferase.

Audience Take Away Notes

- **Regioselective glycosylation improves resveratrol solubility and antiradical properties**
- Natural resveratrol is commonly obtained from extraction of Japanese knotweed (*Fallopia japonica*, *Polygonaceae*) or vine shoots (*Vitis vinifera*, *Vitaceae*). Resveratrol has been studied for its potential as antioxidant or anticancer agent. Despite the potentials, its application is limited due to instability against oxidation and its low bioavailability related to its low water solubility. For example, it was found that 75% of the *trans*-resveratrol was excreted in urine while the remaining 25% was quickly metabolized inducing a bioavailability nearly zero. Structural modification of resveratrol by O-glycosylation is a promising approach to ameliorate resveratrol bioavailability
- Bounding sugars to resveratrol through glycosylation leads to a higher water solubility and bioavailability and protects it against oxidation. The structure of resveratrol glycosides determines the degree of the water solubility as well as its antiradical properties. The α-glycosides of resveratrol showed new surfactant properties that are not found in 3- O-β-glucoside (piceid), the most common form in which resveratrol exists in plants. As a result, the water solubility of these α-glycosides is 65-fold higher than that of resveratrol. Moreover, the glycosylation position in 4′–OH was shown to be the best position for the glycosylation to maintain the highest antiradical properties compared to the 3–OH position. Thus, regioselective glycosylation performed in this study could serve as reference to improve resveratrol solubility while maintaining its antiradical properties
- **Regioselective glycodiversification of polyphenol compounds**
- This research contributes to the effort to produce glycodiversified polyphenol derivatives with emphasize on regioselective production. Glycosylation has been developed as a tool for generating biologically potent and novel glycoside compounds with potential application in nutraceuticals, cosmetics, or pharmaceutical industries
- The regioselective glucosidase was demonstrated to be highly regioselective over varying polyphenolic compounds other than reseveratrol i.e. ferulic acid, 6-gingerol, tetrahydrocurcumin, naringenin, and caffeic acid with regioselectivity (%) of 100, 100, 100, 91.8, and 75.6, respectively. The enzyme identified and characterized in this research could be useful to perform regioselective glycosylation with 4′-selectivity for polyphenol compounds

Biography

Ms. Atmowidjojo graduated from Gadjah Mada University, Indonesia in 2020 majoring in Food Technology. She joined the research laboratory of Professor Mohammad Taherzadeh at the University of Boras, Sweden to conduct her bachelor thesis on resource recovery. After her graduation, she joined a think-tank in Indonesia as a research officer in Renewable Energy department. She is currently pursuing her master degree in the laboratory of Applied Microbiology and Fermentation Physiology, Kyoto University, Japan under the supervision of Professor Jun Ogawa. As an aspiring early-career researcher, she has written 7 publications, joined 3 international conferences, and awarded numerous grants and scholarships.

Gareyev Adib
Russian Federation, Tyumen region

Control theory of electric centrifugal pump in oil production

A modern theory of control of an electric centrifugal pump in oil production has been created. Equipment and technology for the development of offshore fields. Currently, oil and gas fields have been discovered on the shelves of 60 countries. More than 500 deposits are being developed off the coast of the United States, about 100 in the North Sea, and more than 40 in the Persian Gulf. Oil has been discovered and is being produced on the shelves of the World and Arctic Oceans. The development of offshore fields in the Arctic Ocean - where the environmental ecology is very fragile - is a complex technological process. Safe operation of an offshore field is possible only through automation of the entire operation process from the well to the oil gathering point. The existing information on the operation of electric centrifugal pumps in oil production has been empirical, compiled for pumping a homogeneous liquid like water. On the basis of such information, it was not possible to explain the complications that occur when pumping multi-phase mixtures, such as formation fluid. Therefore, my research was aimed at finding ways to automate the control of an electric centrifugal pump. In the course of the research, ways of modeling the behavior of multiphase mixtures under high pressure and temperature were developed, about 140 scientific articles were published on the thermodynamics of a centrifugal pump when pumping out multiphase mixtures, and a textbook for engineers was published. It was found that in order to automate the process of controlling a centrifugal pump, it is necessary to learn how to control a set of parameters depending on:

1. Characteristics of the centrifugal pump
2. Properties of multiphase mixtures and
3. Productive formation

The relationship of the three components of well operation is characterized by a set of parameters. In the course of the study, it was proved that the basis for automating the process of controlling the installation of an electric centrifugal pump is its thermodynamic state. Based on the thermodynamic state, it is possible to exclude the process of salt deposition inside the centrifugal pump. I have shown that the prevention of a centrifugal pump in order to remove salt deposits is not an effective method. No centrifugal pump treatments give a completely positive effect like centrifugal pump temperature control. By controlling the temperature of the centrifugal pump, salt deposits are simply eliminated. The temperature control of a centrifugal pump allows you to solve the problems of regulating the operating mode - in a constant or in a periodic mode. The intermittent operation of the centrifugal pump is also the temperature control of the centrifugal pump. It can be easily calculated and installed at the control station. By investigating the operating modes of a centrifugal pump, it is possible to completely eliminate failures associated with a decrease in the electrical resistance of the “cable-motor” system. To date, the share of these failures is approximately 25 - 27% of all failures. Experimental studies, pilot-industrial implementation of such devices at 180 units made it possible to eliminate such failures completely (100%) to increase the operating time of electric centrifugal pump units from 400 to 2600 days (before physical wear) both in constant and in periodic modes. A preliminary calculation shows that when automating the process of controlling a

centrifugal pump, the cost of oil production is reduced to 38 - 42%. Thus, I created a manless technology for controlling the installation of an electric centrifugal pump, which is environmentally friendly, reduces the cost of oil production by up to 40%, while automatically performing studies of the process of oil inflow from a productive formation. Of course, the automatic installation of an electric centrifugal pump has no analogue in the world. The business of manufacturing and selling unparalleled automatic installations in the world is profitable.

Audience Take Away Notes

- The theory of control of an electric centrifugal pump in the production of oil was created
- A theory of automation of the control process of an electric centrifugal pump has been created
- Control theory excludes salt deposits in the cavity of the centrifugal pump
- Control theory allows you to automatically study the potential of the well
- Control theory allows you to create a fully automated oil field
- The control theory allows you to automatically select any operating mode
- Maximum oil production in the area
- Mode with regulation of specific power consumption
- Mode of exploitation of the deposit by separate blocks
- A combination of continuous and intermittent operation
- A combination of a mode with a constant or floating frequency of pump control
- A textbook on management theory has been published for teaching in higher educational institutions for the training of specialists, graduate students and doctors of science. The automatic installation of an electric centrifugal pump is indispensable for the operation of offshore fields, it is the most environmentally friendly way, it has no analogues all over the world!

Biography

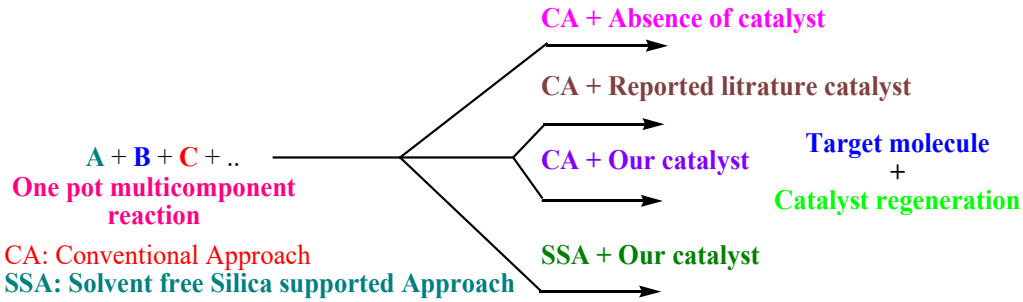
Gareev Adib Akhmetnabievich - graduated in 1975 from the Faculty of Physics and Mathematics of the Bashkir State University. The field of specialty is physics. In 2011 he became a candidate of technical sciences. Works in the field of operation of oil wells with electric centrifugal pumps. About 140 scientific articles on oil wells operation have been published, 8 invention patents have been received, 2 monographs have been written on modern problems of centrifugal pumps operation. A patent for an invention on the automation of control of electric centrifugal pumps has been received in Russia, in China, Taiwan.

Dr. Kilivelu Ganesan

Assistant Professor, PG & Research Department of Chemistry, Presidency College, Tamilnadu, India – 600005

Non-toxic, inexpensive and recyclable second-generation ionic liquids as a catalyst for one pot multicomponent organic reactions

Ionic liquids played a crucial role in replacing toxic organic solvents due to its special properties such as high conductivities, inflammability, chemically inert nature, lesser toxicity, more stability even at high temperature and very low pressure. Flexible di/trimeric substituted imidazolium salts are prepared under conventional/solvent free silica supported approach. Solid supported approach has lot of advantages than the conventional method such as environment friendly, higher yield, shorter reaction time and easy workup procedure1. The antimicrobial screening of various ionic liquids with different anions against clinically important human pathogens. Antibacterial screening of water-soluble imidazolium salts against Gram positive / Gram negative pathogens under disc diffusion and MIC methods. Host-guest interactions were studied between synthesized ionic liquids and human pathogenic bacteria via hydrogen bonding and Vander walls interaction under docking studies.



Audience Take Away Notes

- Researchers could minimize the toxic solvent during their synthesis
- Target molecules are obtained from shortest synthetic approach
- Our approach has more merits than the conventional method so future researchers will follow
- Purification techniques are completely avoided during our current research
- Efficiency of recycled catalyst found to be very interesting

Biography

Prof. K. Ganesan received his Ph.D., degree in dendrimer chemistry from University of Madras, India. He has joined postdoctoral research associate at National Chaio-Tung University, Taiwan in combinatorial medicinal research group, then moved to University of Malaya, Malaysia as postdoctoral research associate in ionic liquids research group. Currently he is working as an assistant professor chemistry in the Presidency college, India which has been fifth place national level and first place in state level college ranked by NIRF 2020. Current research area of ionic liquids, catalysis and bio-organic chemistry. He has received Best Teacher award 2019 from PARE FOUNDATION; Outstanding Faculty in Science 2019 received from Venus International Foundation and Prestigious innovative research development and publishers (IRDP) award 2018 for teaching and research excellence national award.

Korablev Grigory
Department of Physics, Izhevsk State Agricultural Academy, Izhevsk, Udmurt Republic, Russia

Unity and correlations of entropic components in physical and chemical regularities

All phenomena and processes in the nature and world proceed only in two energy directions: either along the force field gradient with minimum energy input (entropy) or against the gradient with maximum energy input (negentropy). The graphs of S-curves and their nomograms characterize the dynamics of change in entropic components depending on the process main parameters. The condition of the system stationary state is the equality or constant of the correlation between its entropy and negentropy (equilibrium dynamics). Such regularities are found in many phenomena and conformational interactions in physical chemistry, nature, engineering and even economics. The examples of their functional contribution are given.

Audience Take Away Notes

- All phenomena and processes in nature and in the world go only in two energy directions
- Graphs of S-curves and their nomograms characterize the dynamics of changes in entropy components depending on the main parameters of the process
- The condition for the stationary state of the system is the equality or constant value of the ratio of its entropy and negentropy (equilibrium dynamics)
- From the standpoint of these ideas, physiotherapy and reflexology can be considered as a technique for equalizing the potentials of two manifestations of energy principles, which, according to modern concepts, are entropy and negentropy
- The established entropy principles manifest themselves in many ways both in nature and in technology, and can be effectively used
- Since these regularities are unknown to the general scientific community, their application in practice is clearly insufficient
- It is necessary to take into account these principles in the technology of preparing hybrid products consisting of two or more components (or fractions)
- This methodology is of particular importance in materials science. For example, when alloying steel.
- Using this entropy technique and its nomogram, it is possible to evaluate the processes of isomorphism and the formation of solid solutions in simple and complex systems
- In a general sense, the entropy methodology provides the basic basis for physical and chemical laws in all major scientific areas

Biography

For many years he worked as the head of the department of physics at the Izhevsk State Medical Institute, and then became the head of the department of physics at the Izhevsk State Agricultural Academy. During this time he published more than 300 scientific articles, more than 80 of them in English in Europe, the USA and India. He has the title Honored Worker of Science. Scientific works are devoted to chemical physics.

S.R.Varadhan
Physics Department, Netaji IAS Academy, India

FTIR band interpretation of hydrocarbon oils and oil spill identiciation

Due to the rapid growth of various technological and industrial revolutions, the earth is facing several problems. Her resources like water and air are critically polluted. Advanced industrialization causes major pollution. Each year an estimated five to ten million tons of oil are jettisoned into the oceans. Eighty percent of this spilled oil remains in the environment, directly affecting the life of the human beings, aquatics and also marine organisms. Whenever oil is produced, stored or transported there exists a potential source of oil pollution either directly by surface drains or indirectly by seepage into the ground. The environmental scientists have estimated that the rivers contain many organic substances causing pollution as a result of industrial activity. For more than four decades Infrared Spectroscopy has been used as an important tool for determining the chemical composition of crude oils and their refined products. More recently infrared spectroscopic methods have been developed to identify the source of oil spill by matching finger prints of known and unknown samples. This application of Infrared spectroscopy has been used mainly by spectroscopists to trace the origin of oil slicks. The applicability of computer analysis of infrared spectral data on several unknown oil samples has been carried out in past. Crude oil is called as rock oil is gifted by the earth. But in return the same factor is adversely affecting her own rich and useful environment. In this connection, the oil spill in the sea and oceans has caused a great environmental impact on the entire marine eco-system. In the present study a modern technique, FTIR spectroscopy is used for oil spill identification. Identification of the oil spill is carried out by matching the finger print bands of the known and unknown hydrocarbon samples

Audience Take Away Notes

- Every Year gallons of oil is jettisoned into the ocean. This investigation is very useful to Environmentalist
- Collection of oil by polished surface from Oil spill is a useful method
- The present investigation can be improved by Attenuated Reflectance Spectroscopy

Biography

Dr.S.R.Varadhan did Post-graduation from Madras University in the Year 1991. He received his doctorate degree in the year 1998 from the same university. After Post-graduation he joined with Dr S.Gunasekaran M.Sc., Ph.D., D.Sc. for research. In the year 1992 he joined as a part-time lecturer. In the year 1997 joined as a Lecturer in the reputed college situated in Chennai. In the year 2009 he was elevated as a Professor in the Omar Mukhtar University, Libya. He also worked as a Professor in Ethiopia. He published useful scientific research works in the journals of international repute.

Amira Mohamed Taher Hegazy
Beni-Suef University, Egypt

Development and validation of two robust simple chromatographic methods for estimation of tomatoes specific pesticides' residues for safety monitoring prior to food processing line and evaluation of local samples

Plant infestation by pets is one of the worst effects of bacteria and fungi on human food. Plants as a primary food resource are critical for human muscle building and mental health. Many farmers worldwide misuse the pesticides' mixtures to keep crops, fruits, and vegetables uninjured, fight grown bacteria and fungi or produce abundant high-quality issues the pesticides' mixtures to keep crops, fruits, and vegetables uninjured, fighting grown bacteria and fungi or to produce abundant high-quality agricultural products. Detecting and analyzing pesticide residual traces could be a crucial issue. Much instrumental weather coupled with Mass or not could be used for the process of estimation. Not only is the estimation of residual insecticides critical in labs of official institutions in the authority of citizen health but also in labs on exporting-importing boundaries between countries. Fresh or processed tomatoes are the most common constituent in our dining tables. Combination of pesticides; acetamiprid, flutolanil and etofenprox are usually used for tomato fruits for protecting them against pest infection. Two specific simple sensitive chromatographic methods are developed for simultaneous estimation of the concerning pesticides' residues using simple economic steps of field sample preparation. The first method is HP- TLC method. Hexane: methanol: acetone: glacial acetic acid (8:2:0.5:0.1, by volume) is proposed as a developing system. The second one is RP- HPLC. Acetonitrile: water (75:25, v/v) is proposed as a mobile phase. The recommended methods are completely validated regarding ICH guidelines. Their means percentages and standard deviations of accuracy range 100.32 ± 0.89 to 99.27 ± 0.9. The methods' repeatability and intermediate precision relative standard deviation percentages range 0.395–0.894. They are successfully applied for estimating the pesticides in pure and commercial forms and field samples.

Biography

Asso Prof. Amira Hegazy studied pharmaceutical sciences and graduated with an MS at Cairo University, Egypt. She then joined the research group of Prof. Raimar Loebenberg (Director of the Drug Development and Innovation Center), School of Pharmacy, University of Alberta, Canada, after receiving a scholarship award from her country for her excellence. She obtained a postdoctoral clinical training program at Harvard Medical School. She has published many research articles in highly reputable and impacted journals. She is an editor at many journals and reviews articles for many top journals.

V. K. Jain*, Sucheta Sengupta, Avshish Kumar and Abhishek Verma

Amity Institute for Advanced Research and Studies (Materials & Devices), Amity University Uttar Pradesh, Noida

Fabrication of heterojunctions on silicon nanowires on Si chip, CdS/p-Si for electricity generation from moisture and n-SnO_2/p-Si for UV detection

Making a heterojunction on silicon nanowire (Si NW) on silicon chip is a promising candidate for preparing many new devices by doing band gap engineering. One-dimensional heterojunction devices are gaining attention because of improved carrier collection which results in improving the overall efficiency of a device. Herein, we report the synthesis of CdS/p-Si nanowires (NWs) hetero-junction device by wet-chemical methods and their potential application for electricity generation from atmospheric moisture. A single CdS/p-Si NWs hetero-junction based moisture enabled electricity generator (MEG) device exhibits a saturated maximum output voltage in the range of 250-300 mV and a saturation current of ~0.2 μA in presence of humid conditions. This primitive module acts as a promising candidate for future energy generation devices constituting of individual units connected either through simple series or parallel connection to scale up high electrical power.

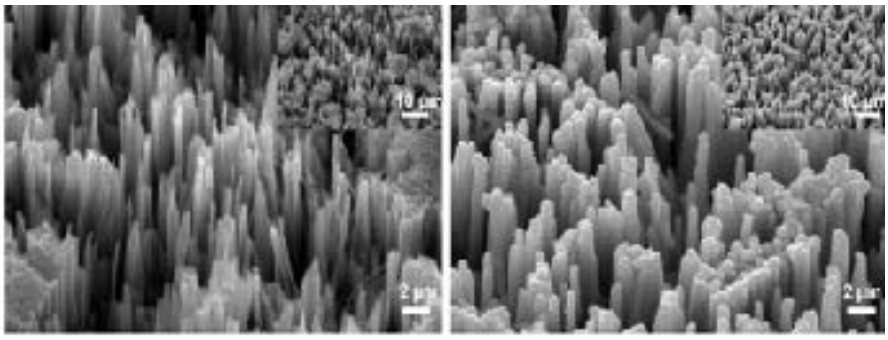


Figure1: SEM images of (b) Si NWs and CdS/ p-Si NW heterostructure. Inset shows low magnification images in both the cases

Generally, UV-sensors are made of silicon carbide, which require high processing time and costs. Herein, we have fabricated and characterized the ultrafast, very sensitive and selective UV sensor using silicon nanowires on silicon chip. The Metal Assisted Chemical Etching of poly-crystalline (pc) - p-Si has resulted into vertically aligned, uniform grown highly dense pc-SiNWs. These NWs on pc-p-Si substrate are decorated by SnO_2 particles by using Electro-deposition technique. The prepared SiNWs/n-SnO2 heterojunction show diode like behaviour under UV-light exposure and shows significantly high rectification ratio, sensitivity, responsivity and detectivity around 172.3 at ±9 V, 64, 0.3456 A/W at 5 V and 8.02869 x 1012 Jones, respectively. The barrier height calculations suggest that the proposed Si NWs decorated with other desired metal oxides, the selective and sensitivity of the prepared heterojunction can be tuned for other required applications such as: IR and terahertz (THz) sensing.

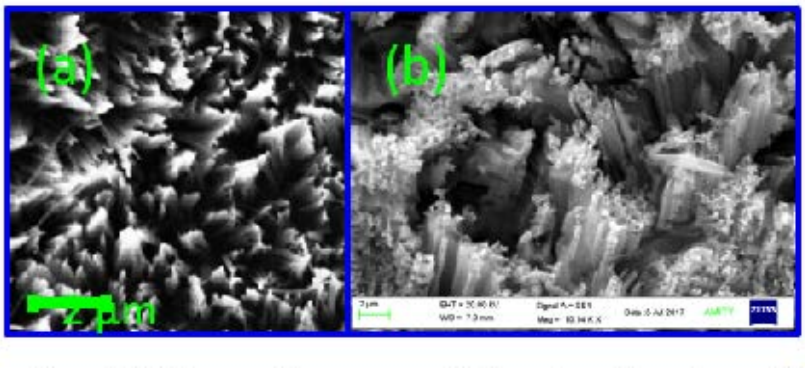


Figure2: (a) SEM images of the as-grown pc-SiNWs on the pc-silicon substrate, (b) SEM images of n-SnO2 decorated pc-SiNWs on the pc-silicon substrate.

Audience Take Away Notes

- This gives a method for making a new type of heterojunction and can tailor the barrier height according to requirement
- To understand the new science when it is in the nanowire form
- Yes this provide a practical solution to a problem that could simplify or make a designer's job more efficient
- Yes will it improve the accuracy of a design, or provide new information to assist in a design problem
- List all other benefits
- It simplifies to use material like silicon instead of taking more complicated material. For example, for making silicon carbide for making UV detector, even silicon nanowires can be used

Biography

Dr. Jain has done his Ph.D. in Solid State Physics from IIT Delhi and was head of the silicon devices and Micro Electro Mechanical Systems (MEMS) division and developed many new technologies. His result of electro-luminescence in porous silicon was considered as the first International observation. He has published more than 200 papers in National & International journals, edited a few books and has filed more than 60 patents. He has received the Technology award in 2002. He has made a multidisciplinary department with most modern facilities in Amity University. He got the Award in 2012 from "Power of Ideas" (DST programme) and from Royal Academy of U.K. He has developed many technologies and some have been transferred to industries. He is working in the areas of photovoltaics, solar energy, thermal heat storage system, sensors, bio sensors, water purification, MEMS, lots of devices have been made using heterojunction Silicon nanowires and surface metallic plasmonic, etc.

Mihaela D. Leonida*, Zainab Mahmoud, Bisera Lozanovska
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Catalase enhanced using two green processes

Catalase (CAT) is a very strong natural antioxidant that metabolizes hydrogen peroxide, an important reactive oxygen species. CAT is used to treat some medical conditions, is used in the food and the textile industries to remove peroxide, and in cosmetic formulations for the skin targeting increased cellular oxygenation and mitigation of ageing effects. Catalase is a tetramer, each unit containing over 500 amino acids and a heme (prosthetic group). Because it is inactivated at high, toxic, non-physiological levels of peroxide, it is difficult to study this enzyme, due to low sensitivity of assays and/or enzyme inactivation. We report here 2 green methods to enhance and stabilize CAT. Being an oxidoreductase, CAT is involved in redox reactions with its prosthetic groups being the centers where electron transfer takes place. Both methods reported herein target the enhancement of the kinetics of electron transfer by increasing the number of effective redox centers within the 3-D structure of CAT. They are both green methods. In the first method, high hydraulic pressure was used to unfold the enzyme in the presence of different modifiers. Upon removal of the high pressure, modifier molecules were entrapped in the renatured structure of catalase. In the second procedure an ionic liquid (IL, green reagent) was used as a partially reversible denaturant of CAT with/without other redox molecules present. After the removal of the IL by dialysis, CAT refolded, entrapping some of the redox units present within its 3-D structure. In both procedures species relevant to CAT were chosen as redox modifiers: Fe^{2+}, NADH, heme/modified hemes, lipoic acid making the green procedures reported herein enzyme-friendly as well. All modified CAT retained activity and were characterized by FTIR, modifier entrapment, and antioxidant activity. The most active samples were tested in biosensors with potential applications in the food, pharmaceutical and cosmetic industries. The reported procedures afforded self-mediated CAT which displayed catalytic effect and linearity in peroxide concentration. The performance of the modified catalases recommends these environmentally and enzyme-friendly procedures for applications to the enhancement of other redox enzymes.

Audience Take Away Notes

- This research could be included in several courses: green chemistry, protein chemistry, analytical chemistry
- For researchers in the field of amperometric biosensors, the methods presented herein offer green alternatives to enzyme “wiring” (for which toxic, expensive reagents are used at the present)
- These procedures replace labor-intensive enzyme conjugation with simple environment- and enzyme-friendly procedures

Biography

Dr. Mihaela Leonida received a MS and a Ph.D. in Chemical Engineering from the Polytechnic University in Bucharest, Romania and a Ph.D. in Bioorganic Chemistry from Wesleyan University in Middletown, CT, USA. At the present, she teaches biochemistry at Fairleigh Dickinson University in Teaneck, NJ, USA. Dr. Leonida’s research interests are in the field of redox enzyme stabilization and bionanomaterials with biological activity. She is the author of several books and over 70 papers published in science journals and conference proceedings.

Victor Ramos Nazario*, Diana Parada Quinaya, Elena Flores Barreda

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Use of stipa ichu as a reinforcement in the manufacture of biodegradable films for food packaging

Stipa Ichu is a Peruvian endemic plant that grows in the Andean regions spontaneously and has no industrial value. It is estimated an annual production of 70,000 tons with a cost of harvesting of USD 0.15. One of the issues associated with its wild growth is that its fibers are highly flammable and can cause forest fires altering the environment. The purpose of this research is to add value to the fibers of Stipa Ichu as raw material to produce microfibers, given its high availability in the country and its high cellulose content. Steam explosion technology was used as the main process, allowing the sustainable and eco-friendly production of this product. On the other hand, cellulose microfibers were used as reinforcement in biopolymeric matrices prepared from starch to provide structural reinforcement and improve the performance of this material in packaging for food products. Thin films were developed by the tape casting method with microfibers incorporated in different proportions, resulting in better mechanical and barrier properties.

Audience Take Away Notes

- Bio based materials
- Scale up of nanocellulose
- New technology of processing fibres, like Stipa Ichu

Biography

Chemical Engineering graduate with interest and experience in aspects related to sustainability. Specifically in sustainable products and Renewable Energies (following mention studies in this field). I consider myself a leader in work and sports teams, in which I am a constant participant.

Pieter Samyn
Ghent University, Belgium

Biomimetics in composite interface engineering: Opportunities for interface monitoring and life-time extension

The need for longer material lifetime and monitoring of the residual life-time of composite materials is a technical problem to be solved as an important contribution to the circular economy. The performance of fiber-reinforced polymer composites is mainly determined by the interface compatibility. In particular, the hydrophilic nature of cellulose fibers dispersed in a hydrophobic matrix requires additional surface modification as traditionally done with chemical surface grafting and hazardous solvents. Taking into account the environmental friendliness of cellulose composites, however, more sustainable routes are required to operate under aqueous environment and utilization of biopolymer substitution. Inspiration can be found in analysis and transformation of biomimetic concepts. In particular, the use of polydopamine as adhesive mediator has been explored in providing a general platform to functionalize cellulose fibers. In this presentation, different conformations for surface modifications of cellulose fibers with dopamine are illustrated for enhancing compatibility. This is done either by self-polymerization of polydopamine into a compatible surface layer and/or the self-assembly of dopamine functional groups into vesicular structures that are physically adsorbed at the cellulose surface. After a study on the surface adhesion of modified cellulose fibers, they were incorporated in PMMA matrix through solution casting. The local adhesive properties of the modified cellulose fibers were probed by atomic force microscopy and seem to contribute to higher interfacial shear strength. This was confirmed by the single-fiber pull out tests at macroscale indicating an optimum concentration of nanoparticles at the cellulose surface. The tensile strength and elongation at break of the composites were function of the degree of surface modification and superior to untreated fibers. In addition, the nanoparticles show colorimetric and fluorescent response to mechanical shear stresses providing an evaluation tool to explore the interface phenomena upon failure of the PMMA composite.

Audience Take Away Notes

- Novel design strategy for polymer composite interfaces based on natural materials
- Adhesion properties of mussel-inspired composition
- Strengthening composite interface with natural materials
- Detection and monitoring of interface failure
- Life-time extension of polymeric composite materials

Biography

Dr. Ir. Pieter Samyn received Ph.D. in Materials Science and Engineering 2007 at Ghent University and followed an academic career at University Freiburg and Hasselt University, until 2021 when he joined the collective research center Sirris as a Senior Research Engineer. He has broad experience on the synthesis, processing and characterization of bio-based materials for composite and coating applications. His research focusses on surface functionalization and he subsequently led research projects on bio-inspired adhesion mechanisms, functional coatings for paper substrates and the development of (nano)composite materials from bio-based building blocks (cellulose, biopolymers).

Hans Jurgen Federsel

Department Chemical Process and Pharmaceutical Development, RISE Research Institutes of Sweden, Stockholm, Sweden

Against all odds the development of a unique asymmetric sulfide oxidation

Syntheses for achieving stereoselective oxidations of pro-chiral sulfides to the corresponding enantiomerically defined sulfoxides have been known since the early 1960s (Andersen, 1962). The practical value of this methodology and other (Davis, 1980s and 90s) was limited, due to a lacking performance and preparative usefulness. A major game changer occurred (1984) when Henri Kagan and his group presented a titanium-based procedure building on the concomitantly developed stereoselective hydroxylation protocol by Sharpless using Ti, a homo-chiral tartaric acid ester, and a suitable oxidant. A major downside, however, was that a good to excellent enantiomeric outcome was only delivered when starting with simple sulfides such as methyl-benzylsulfide. In this lecture the need for an efficient, robust, and high-yielding sulfoxidation process for industrial application related to a novel proton-pump inhibitor (prevention of ulcers and other gastric problems) by the Swedish pharmaceutical company Astra will be described and discussed. In this project, the sulfide precursor was of substantial complexity, which rendered the Kagan method unsatisfactory offering just 5% ee at most. Instead, the enantiomers of the racemic sulfoxide omeprazole (with identical atomic arrangement as the desired compound) were separated via preparative chromatography (on kg scale) – a very tedious and low-yielding operation which could immediately be discarded as non-feasible for further scale up. Instead, all efforts were invested in finding an asymmetric synthesis that would successfully generate the desired (S)-enantiomer, esomeprazole, constituting the target molecule, which later (around the year 2000) was launched as Nexium®. The successful outcome emanated in an unprecedented process that enabled the manufacture of the product in excellent yield (>90%) and with outstanding stereochemical purity (>93%) on a large tonnage scale.

Audience Take Away Notes:

- This lecture provides an insight into an authentic case and shows the methodology used to arrive at a successful outcome.
- The contents will hopefully give the audience inspiration to not shy away from even the toughest problems.
- No doubt, if the molecular motifs under investigation are analogues to those presented in the talk.
- Inasmuch as the result of the work described was a commercial scale process delivering an important active pharmaceutical ingredient.
- It will point out a robust and highly efficient way of performing the chemical transformation in question.

Biography

Hans-Jürgen Federsel received his PhD in Organic Chemistry from the Royal Institute of Technology (KTH) in Stockholm, Sweden in 1980. He has spent most of his career in the field of chemical process R&D in the pharmaceutical industry (Astra and AstraZeneca) in Sweden and the UK assuming diverse roles. In 1990 he was appointed Associate Professor at KTH and in 2009 elected fellow of the Royal Swedish Academy of Engineering Sciences (IVA). Currently, he is a Senior Advisor at RISE Research Institutes of Sweden.

Participants List

Adib Gareyev Bashkirs State University, Russia	134
Amelia Christina Atmowidjojo Kyoto University, Japan	132
Amira Mohamed Taher Hegazy Beni-Suef University, Egypt	139
Anna Wenda-Piesik PBS Bydgoszcz University of Science and Technology, Poland	35
Anne M Gaffney University of South Carolina, United States	98
Anthony Halog The University of Queensland, Australia	30
Arkadiusz Dyjakon Wroclaw University of Environmetal and Life Sciences, Poland	48
Ashanendu Mandal University of Calcutta, India	105
Ashkan Bahadoran Chinese Academy of Sciences, China	44
Bandyopadhyay Sujoy Indrashil University, India	81
Chen-Wei Liu Industrial Technology Research Institute, Taiwan	58
Chitra CSIR- National Physical Laboratory India, India	106
Christine Hahn Texas A&M University-Kingsville, United States	26
Cristian Ravariu University Politehnica of Bucharest, Romania	126
Dai-Yeun Jeong Jeju National University, Korea	103
Dariusz Piesik PBS Bydgoszcz University of Science and Technology, Poland	39
Debashrita Mahana CSIR-National Physical Laboratory, India	53

Participants List

Debjani Nag Tata Steel Limited, India	42
Devic Gordana University of Belgrade, Serbia	108
Diana Rakhmawaty Eddy Universitas Padjadjaran, Indonesia	55
Divya Tripathy Galgotias University, India	116
Donatella Termini University of Palermo, Italy	96
Donghee Lee Saint Petersburg Mining University, Russia	46
Fabiano Andre Narciso Fernandes Federal University of Ceara, Brazil	120
Fouad El Mansouri Abdelmalek Essaadi University, Morocco	88
Fu-Der Mai Taipei Medical School, Taiwan	62
Ga yeong Kim Chungnam National University, Korea	131
Gangaraju Gedda Presidency University, India	110
Gheorghe Viorel Gas and Petroleum University, Romania	79
Grigory Korablev Izhevsk State Agricultural Academy, Russia	137
Hagsoo Kim Fine Chemical Materials Technology Research Center, Korea	34
Haibo Ge Texas Tech University, United States	78
Hans Jurgen Federsel RISE Research Institutes of Sweden, Sweden	145
Hao Dang Tsinghua University, China	59
Hasan Saygili Vocational School of Technical Sciences, Turkey	112

Participants List

Helena Belchior Rocha ISCTE-Instituto Universitário de Lisboa Portugal, Portugal	97
Helmi Hamdi Qatar University, Qatar	54
Hossam A Gabbar Ontario Tech University, Canada	29
Igor V Shevchenko Semenenko Institute of Geochemistry Mineralogy and Ore Formation, Ukraine	119
Jan Moneita Maritime University of Szczecin, Poland	111
Jeevan dontulwar Shri Mathuradas Mohota College of Science, India	84
Jinsong Wu Guilin University of Electronic Technology China, China	102
Kenji Sorimachi Dokkyo Medical University, Japan	28
Kevin Kendall Hydrogen United in Birmingham, United Kingdom	127
Kilivelu Ganesan Presidency College, India	136
Leon Burgess Technology Director CalAlSil, Australia	95
Long Yu Henan Academy of Sciences, China	52, 63
Madhusudan Hiraman Fulekar Parul University, India	99
Marta Litter University of General San Martin, Argentina	68
Mihaela Leonida Fairleigh Dickinson University, United States	142
Mohammad Amin Makarem Shiraz University, Iran	77
Mohammed M Bettahar Lorraine University, France	72
Nattaphon Hongrutai Chulalongkorn University, Thailand	43

Participants List

Ndzana Arnauld Philippe Yaounde Urban Council, Cameroon	114
Olivier Coulembier University of Mons Belgium, Belgium	50
Orlando Elguera Institute of Chemistry (IQSC), Peru	87
Osman Adiguzel Firat University, Turkey	124
Ozcan Koysuren Ankara University, Turkey	117
Pieter Samyn Ghent University, Belgium	144
Rajesh Kumar B R A Bihar University, India	75
Rohit Kumar Indian Institute of Technology (Banaras Hindu University), India	37
S R Varadhan Netaji IAS Academy, India	138
Seong Sik Shin Korea Atomic Energy Research Institute, Korea	130
Serhiy Pyshyev Department of Chemical Technology of Oil and Gas Processing Ukraine, Ukraine	91
Shahid Adeel Government College University Faisalabad, Pakistan	113
Shumaila Kiran Government College University, Pakistan	115
Shweta Vyas University of Kota, India	85
Stanislaw Dzwigaj Sorbonne University, France	66
Suresh C Ameta PAHER University, India	82
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Participants List

"We wish to meet you again at our upcoming events next year..."

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