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ABSTRACT BOOK

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INDEX

7	**Title: Efficient Coproduction of 5-Hydroxymethyl Furfural and Furfural from Biomass Utilizing different heterogenous Catalysts: A Sustainable Approach**
	Omvir Singh, *Department of Energy and Human Science, Rajiv Gandhi Institute for Petroleum Technology, Uttar Pradesh, India-229304*
8	**Title: Inverse design of high-entropy electrocatalysts via active graph learning**
	Jun Zhang, Great Bay University, *Dongguan 523000, China*
9	**Title: Plasma-Assisted Synthesis of Nanostructured Zeolites: Enhanced Dissolution, Crystallization and Performance for Ethanol Conversion**
	Kachaporn Saenluang, *Department of Chemical and Biomolecular Engineering Thailand*
10	**Title: Comparative study on photocatalytic degradation of low-density polyethylene: Kinetic studies, and degradation pathways as a sustainable tool for plastic waste management.**
	M.S.S.R. Tejaswini, *Vignans Foundation for Science, Technology and Research, Vadlamudi, Guntur, A. P. India*
11	**Title: Kinetic model of hydrogenation of glucose to sorbitol on Ni/Bentonite catalyst**
	Harmitkumar N Pandya, *Department of Chemical Engineering, Institute of Chemical Technology, Mumbai 400019, India*

12	**Title: Alkylation of Aniline with Benzyl Alcohol by Using Ni/O-Clay: Kinetic Studies**
	Aishwarya Poman, *Department of Chemical Engineering, Institute of Chemical Technology, Mumbai 400019, India*
13	**Title: Controlling the Atomic Layer Deposition of TiO2 on Mesoporous Al2O3 for Fischer-Tropsch Synthesis application**
	Ann Charise Cariño Delgado, *Química, Universitat de Barcelona, Barcelona, Spain*
14	**Title: Modelling and Optimization of TIG Welding as a Chemical–Metallurgical Process for In-Situ Nanoparticle Formation**
	Nabendu Ghosh, *Mechanical Engineering Department, Jadavpur University, Kolkata–700032, India*
15	**Title: Valorization of Marine Green Algae Waste Towards the Production of High-Value Product, Biosorbent, and Application in Cadmium Adsorptive Removal from Aqueous Solution**
	Amel Asselah, *University of Sciences and Technology, Faculty of Chemistry, Organic Chemistry Department, 16000 BP32 El Alia Bab Ezzouar, Algeria*
16	**Title: Enhanced Biodiesel Production via Copper-Modified MIL-100(Fe): Synergistic Catalysis and Kinetic Insights**
	Ahmed Sadeq AbouElyazed Aresha, *Chemistry Department, Faculty of Science, Menoufia University, Shebin El-Kom, Egypt*
17	**Title: Future Wonder Catalyst for Green Energy Production by Water Splitting**
	Imran Ali, *Department of Chemistry, Jamia Millia Islamia (A Central University), New Delhi -110025, India*

18 Enhanced Photocatalytic Water Splitting for Hydrogen Production Using Defect-Modified Al2CO/Al2Se3 Heterojunctions

Abdul Majid , *Department of Physics, University of Gujrat, Gujrat 50700, Pakistan*

Alejandro Santana

Johnson Matthey (JM), Cambridge, UK, CB4 0FP

Homogenous Catalysts at your fingertips

Abstract

Efficient catalytic processes are the key to reducing costs, improving selectivity, and ensuring reliable scale-up. Our catalyst collection includes homogeneous (coupling, redox, chiral), heterogeneous and biocatalysts with advanced lab equipment including high-throughput optimisation modules, benchtop pressure reactors, and jacketed reactors. Our experts work to refine every aspect of the required transformation, delivering performance and value at every stage, with a team of highly specialised chemists and chemical engineers experienced in developing and scaling up catalytic processes. CatLab provide customers with a one stop solution from catalyst identification through to supply for full-scale manufacture with a fully reconfigurable multipurpose plant and the unique capability to offer a “closed loop” solution, as JM is also on hand to support with sustainable precious metal sourcing and precious metal recovery from the waste streams.

Biography

Obtained his PhD in 2015 at University of Cádiz (Spain) working on the synthesis and characterization of bioactive natural products, and extending his experience with an internship at University of Bristol (UK) focused on asymmetric synthesis. In 2014, he joined MSD (Ireland) as Quality Assurance Specialist supporting an efficient shutdown of API manufacturing facilities. In 2016, he joined Aqdot Ltd (UK) to optimise and scale up a critical macrocycle synthetic process. In 2017, he joined Johnson Matthey (UK) escalating from Senior Chemist and Process Chemist to Lead Scientist and lately in 2022, becoming the Manufacturing Team Leader of the CatLab group in Cambridge, leading the synthesis and development of ligands and homogenous catalysts from laboratory to multi-kilogram scale with high standards in safety and quality.

Yuxi Fang

Shanghai Jiao Tong University, Shanghai, China

Biomolecule Synthesis from CO_2 via the Chiral-Induced Spin Selectivity (CISS) Effect at Inorganic Interfaces

Abstract

The origin of life's homochirality is a key question in origin-of-life research. Biomolecules show strict chirality patterns: most amino acids are L-form (with rare D-forms in deep-sea organisms), while ribose exclusively exists as D-form in life, crucial for RNA function. This study explores possible formation and chiral selection mechanisms of amino acids and ribose on early Earth.

We explored the possibility that chiral inorganic materials on the early Earth could catalyze the formation of biomolecules and induce their chirality. Using chiral zinc sulfide as catalysts, we synthesized amino acids through asymmetric photochemical reduction of CO_2 as the carbon source and ammonia as the nitrogen source via the CISS effect. Moreover, enantiomeric excess amino acids could be formed through electrochemical reduction of CO_2 and ammonia, using chiral Cu film as the catalyst. Using chiral inorganic hydroxyapatite as catalysts, ribose was enantioselectively synthetized. Considering that magnetic fields can induce the formation of chiral inorganic materials, and given the presence of light and lightning on the early Earth, it is plausible that chiral inorganic materials may have participated in the chiral selection of biomolecules, including amino acids and sugars.

Moreover, it has been found that, pyrite, which is widely present in deep-sea hydrothermal vents, can photochemically aminate α-keto acids to produce D-enantiomer-enriched amino acids, regardless of the presence of a magnetic field or other chiral factors. This may explain how pyrite on the early Earth could have interfered with the chiral selection and amplification

of L-amino acids, leading to the overrepresentation of D-amino acids in some deep-sea organisms.

Based on research into the reduction of CO_2 in the origin of life, we applied this concept to the artificial electro and photo catalytic reduction of carbon dioxide to ethanol product, discovering chiral inorganic structure significantly improve C-C coupling by CISS effect and helical lattice distortion toward high selectivity and productivity of multicarbon CO_2 reduction.

Biography

During PhD of Yuxi Fang at Tongji University and postdoc at Shanghai Jiao Tong University, he published exceed of 15 papers as first/co-corresponding author in top journals including Chem (2), J. Am. Chem. Soc. (1), Nat. Commun. (1), Angew. Chem. Int. Ed. (1), and Sci. China Chem. (1). His main research subjects are: Exploring chiral selection in the origin of life and catalytic conversion of CO2 and other small inorganic molecules based on chirality of inorganic materials.

Heesu Kim

Yonsei University, 1 Yonseidae-gil, Wonju 26493, Republic of Korea

Interfacial charge engineering in Au@Ni core–shell catalysts for low temperature oxidation

Abstract

Air pollution from carbon monoxide (CO) and volatile organic compounds (VOCs) continues to pose a major challenge to environmental sustainability and human health. Developing efficient catalysts that enable complete oxidation of these pollutants at low temperatures with long-term durability remains a critical goal in heterogeneous catalysis. In this study, we introduce a core–shell Au@Ni nanoparticle system supported on Ni-rich perovskite nanofibers, fabricated through a thermally induced restructuring process. The fibrous perovskite framework facilitates Ni migration and co-assembly with Au, leading to the formation of uniformly dispersed core–shell nanoparticles with ultrathin Au shells and intimate interfacial contact. Structural and spectroscopic characterizations confirm strong electronic metal–support interactions (EMSI) between the Au shell, Ni core, and perovskite lattice, which promote directional charge transfer toward the Au surface. This interfacial charge redistribution stabilizes anionic Au^- species, enhancing π–backdonation into the antibonding orbitals of CO and VOC molecules. Consequently, the weakened internal bonds accelerate surface oxidation kinetics through both Langmuir–Hinshelwood (L–H) and Eley–Rideal (E–R) mechanisms. The electron-enriched Au sites also enable rapid and reversible CO adsorption–desorption cycles, contributing to stable catalytic turnover. The optimized Au–Ni catalyst achieves complete CO conversion at low temperatures and exhibits superior VOC oxidation performance with remarkable structural stability under prolonged operation. Overall, the integration of a fibrous perovskite support, core–shell architecture, and interfacial electronic tuning provides a robust and generalizable strategy for designing next-generation low-temperature oxidation catalysts for air purification and environmental remediation.

Biography

Heesu Kim is a researcher specializing in the design, synthesis, and application of advanced inorganic materials for energy and environmental technologies. Her work focuses on perovskite-based compounds, metal oxides, and nanostructured catalysts, with an emphasis on tailoring structural and electronic properties to optimize performance. She has developed expertise in catalytic processes for hydrogen production and processing (including reforming and decomposition), exhaust gas purification (PM, CO, VOCs), and advanced air-quality management through UV–NTP hybrid systems. Her recent research also extends to the integration of energy and environmental technologies, aiming to create next-generation sustainable platforms that address both clean energy conversion and environmental remediation.

Enejoh Timothy Omejeh

Teesside University, Middlesbrough TS1 3BA, United Kingdom

"Tio$_2$ Catalyst Development from Jos Rutile and Ilmenite for Hydrogen Production"

Abstract

The global shift toward sustainable energy sources has intensified interest in hydrogen production through photocatalysis. Titanium dioxide (TiO_2) is a well-known photocatalyst because it is stable, safe to use, and has a strong ability to oxidise. This study explores the utilisation of locally sourced rutile and ilmenite minerals from Jos, Nigeria, as precursors for the synthesis of TiO_2 catalysts. The raw ores were subjected to beneficiation and chemical treatment to extract titanium-rich compounds, which were subsequently calcined at0°C to obtain TiO_2 in anatase and rutile phases. Structural and morphological analyses confirmed the formation of high-purity TiO_2 with nanoscale features conducive to photocatalytic activity. The synthesised TiO_2 was tested under UV-visible spectroscopy to determine the band gap, and the gap was discovered to be 2.88, which signifies the high rate of light absorption and high efficiency of hydrogen generation. Results demonstrated significant hydrogen evolution rates, indicating the potential of Jos-sourced rutile and ilmenite as cost-effective and abundant raw materials for catalyst production. This research supports the viability of local mineral resources in advancing green hydrogen technology and contributes to the development of sustainable energy solutions in Nigeria.

Biography

My name is omejeh Timothy Enejoh, PhD research student at Teesside University, i have had several conferences and journals to my name.

Kevser Temizkan Özdamar

Department of Chemical Engineering, Istanbul, Türkiye

Title: Synthesis and Supramolecular Architectures of Novel Hydrazine Derivative Homometallic Schiff Base Complexes and Their Spectroscopic and Thermal Chacterization

Abstract

In this study, a hydrazine-containing Schiff base (ScB) and its metal complexes with five different metals—Co (ScB-Co), Cu (ScB-Cu), Pb (ScB-Pb), Mn (ScB-Mn), and Zn (ScB-Zn)-were synthesized and subsequently characterized both structurally and thermally. The ScB was synthesized via an elimination reaction between vanillin and phenylhydrazine in ethanol. Hexadentate homometallic complexes (HMCs) were then obtained by reacting the ScB with five different metal salts in tetrahydrofuran. The structural architecture of the synthesized ScB and its HMCs was elucidated using Fourier Transform Infrared (FT-IR) spectroscopy, as well as proton (1H) and carbon (13C) Nuclear Magnetic Resonance (NMR) spectroscopy. Optical, thermal, and surface characterizations of the structurally confirmed ScB and HMCs were performed using UV-Visible spectroscopy (UV-Vis), thermogravimetric and differential thermogravimetric analyses (TG-DTG), and scanning electron microscopy (SEM), respectively. According to thermogravimetric analysis, the char yield of ScB was 28.2%, while the char yields of its metal complexes—ScB-Co, ScB-Cu, ScB-Pb, ScB-Zn, and ScB-Mn—were 5.4%, 27%, 16%, 19%, and 7.1%, respectively. These results indicate that the incorporation of metal ions into the structure reduced its thermal stability, as evidenced by the decreased residue amounts at 1000 °C.

Biography

Dr. Kevser Temizkan Özdamar received her PhD in Polymer Chemistry from Çanakkale Onsekiz Mart University at the age of 27. She specializes in the synthesis and characterization of functional polymers and oligomers, with a particular focus on enzyme-catalyzed reactions, polyesters, and polyazomethines. Her research integrates thermal analysis, fluorescence studies, and electrochemical profiling to develop sustainable materials with advanced properties. Currently, she serves as a faculty member in Chemical Engineering at Istanbul Health and Technology University. Dr. Özdamar has authored over 25 peer-reviewed publications in high-impact journals and has contributed to numerous national and international conferences. She is actively involved in TÜBİTAK and BAP-funded projects and holds certifications in ISO quality systems and patent education. Her interdisciplinary work bridges polymer science, coordination chemistry, and nanotechnology, positioning her as a rising figure in sustainable material design and scientific innovation.

Miaomiao Wen

Competence Center of Catalysis, Department of Chemistry and Chemical Engineering

Novel functionalized zeolite and zeotype catalysts for direct oxidation of biomethane to biomethanol

Abstract

The selective oxidation of methane to methanol under mild conditions remains a major challenge in catalysis due to the inertness of the C-H bond and the difficulty in activating molecular oxygen1. In our previous studies, we demonstrated that Brønsted acid sites (BAS) in ferrierite (FER) zeolite can promote the conversion of CH4 to methanol2. However, these acid sites alone are insufficient for activating O2. To overcome this limitation, we developed a solid–liquid ion exchange strategy to introduce Cu species into the FER framework3, stabilizing both Cu(I) and Cu(II) states. The incorporation of these copper sites is expected to facilitate O2 activation under mild conditions, thereby enabling the direct oxidation of CH4 to methanol in the presence of molecular oxygen. Our ongoing work provides insights into the synergistic roles of Brønsted acid sites and Cu redox centers in designing efficient catalysts for methane valorization.

Biography

I obtained my Ph.D. in Chemistry in France (Mines Paris-PSL), focusing on photocatalytic CO2 reduction, and I am currently a Postdoctoral Researcher at Chalmers University of Technology, Sweden. My research involves the synthesis and application of solid catalysts for sustainable transformations, with a current focus on the direct oxidation of biomethane to methanol under mild conditions using functionalized zeolites.

Omvir Singh

Department of Energy and Human Science, Rajiv Gandhi Institute for Petroleum Technology, Uttar Pradesh, India-229304

Efficient Coproduction of 5-Hydroxymethyl Furfural and Furfural from Biomass Utilizing different heterogenous Catalysts: A Sustainable Approach

Abstract

In this study we reported a preparation of Zr-loaded ZSM-5 zeolite catalysts by loading Zr species into the ZSM-5 zeolite framework. The research focused on fine-tuning zeolite modification to further enhance the catalytic activity of zeolite catalyst. The as-obtained zeolite catalyst was then applied for transformation reaction of biomass-derived sugars into furfural and 5-hydroxymethyl furfural (HMF). Biomass-derived sugar hydrolysate that achieved from enzymatic hydrolysis of corn stalk was used as feedstock for catalytic transformation to obtain furfural and HMF using Zr/ZSM-5 catalyst. The reaction parameters such as catalyst dosage, temperature and reaction time as well as content of Zr ion were investigated to find out the suitable conditions for biomass conversion. According to the results, suitable conditions leading to the highest furfural and HMF yields of 90.3±0.5% and 49.8±0.5%, respectively were established. The as-synthesized solid acid Zr/ZSM-5 zeolite catalyst showed impressive performance and can be considered as a promising catalyst for conversion of biomass to furfural and HMF for sustainability and economic viability of biorefining strategies.

Biography

Dr. Omvir Singh is currently working as an Assistant Professor of Chemistry in the Department of Sciences and Humanities at Rajiv Gandhi Institute of Petroleum Technology. he received his doctoral degree from the CSIR-Indian Institute of Petroleum (India) in 2022. He then joined in Indian institute of science (IISc) Bangalore India for postdoctoral fellow after that his next postdoctoral experience from Kyushu university Japan. His research focuses on converting unconventional feedstocks into value-added chemicals using heterogeneous catalysts for next generation of sustainable processes. Converting biomass feedstocks into drop-in chemicals is highly demanding as they can be used without any modification of existing industrial setups. He has published many scientific research articles and US patents during his research. His research at RGIPT shall be directed to the catalytic upgradation of unconventional feedstock such as Tree Borne Oil (TBO), Sugar (Cellulose), and municipal plastic wastes into drop-in chemicals which is highly demanding as they can be used without any modification of existing industrial setups. His expertise lies in synthesizing heterogeneous catalyst(s) based on porous materials like zeolite, defect-rich metal oxides, MOF and ZIF type of materials along with single-atom catalysts (SAC) for application in the development of sustainable processes. He is a recipient of various awards and fellowships, including junior/senior research fellowships and BRICS young scientist in 2022.

Jun Zhang

Great Bay University, Dongguan 523000, China

Inverse design of high-entropy electrocatalysts via active graph learning

Abstract

High-entropy alloys hold great promise for enhancing the performance of electrocatalysts. However, the rational design and screening of such catalysts are hampered by the vast compositional space and diverse local atomic arrangements involved. Traditional bottom-up deep-learning methods remain constrained by their heavy reliance on datasets generated through density functional theory (DFT), which limits the rapid screening of high-entropy catalysts. To overcome these challenges, we introduce an inverse-design strategy based on an active-learning (AL) framework that integrates conditional generative adversarial networks, atomic graph attention networks, k-nearest neighbors, and high-throughput DFT calculations. This top-down approach reduces the required training dataset size for designing high-performance high-entropy electrocatalysts (HEECs). Using the established AL workflow, we systematically explore the compositional space of HEECs composed of Ni, Co, Fe, Pd, and Pt, and identify optimized non-equiatomic compositions with exceptional hydrogen evolution performance. Furthermore, electronic structure analysis reveals that Pd and Pt serve as the active species, while Ni, Co, and Fe contribute to inducing the "cocktail effect"—a feature that distinguishes HEECs from ordered metals or alloys. Based on these insights, we propose two design principles to guide the discovery of high-performance HEECs: (i) retain Pd/Pt as essential reaction centers, and (ii) utilize Fe, Co, and Ni to enhance entropy and promote cocktail synergy. This AL-driven methodology provides a powerful platform for accelerating the discovery and design of next-generation electrocatalysts.

Biography

Jun Zhang finished his PhD at 31 years old years from City University of Hong Kong and is currently a postdoctoral researcher at Great Bay University. He has authored over 35 publications on heterogeneous catalysis and high-entropy materials.

Kachaporn Saenluang

Department of Chemical and Biomolecular Engineering Thailand, Thailand

Plasma-Assisted Synthesis of Nanostructured Zeolites: Enhanced Dissolution, Crystallization and Performance for Ethanol Conversion

Abstract

This study presents a plasma-assisted synthesis strategy for fabricating nanostructured zeolites, focusing on enhancing crystallization kinetics, structural properties, and catalytic performance for ethanol conversion to ethylene. Interestingly, Plasma can generate the radicals, which facilitate homogeneous nucleation and influence growth kinetics by modifying surface energy and depositing reactive species onto precursor particles. Furthermore, plasma exposure can induce structural defects of the Si-O-Al linkages such as silanol nests (Si-OH), which enhance dissolution and repolymerization during crystallization, further accelerating the synthesis process. Herein, plasma pretreatment of amorphous precursors was employed prior to hydrothermal crystallization, resulting in improved solubilization of silicon and aluminum species via the generation of silanol nests and hydroxyl radicals (•OH). Comparative synthesis of ZSM-5, Beta, and FAU zeolites, with and without plasma activation, revealed significant reductions in crystallization time and improved textural and acidic properties in the plasma-treated samples. The properties of the as-prepared catalysts were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), N2 adsorption-desorption technique (BET), attenuated total reflection Fourier transform Infrared spectroscopy (ATR-FTIR), and ammonia temperature-programmed desorption (NH3-TPD) and confirmed higher crystallinity, uniform Si/Al distribution, and increased mesoporosity in the plasma-assisted zeolites. Catalytic testing demonstrated that plasma-treated zeolites exhibited superior ethylene selectivity and ethanol catalytic performance. These findings highlight the potential of plasma-assisted synthesis as a green, scalable approach to accelerate zeolite fabrication and tune their nanostructural and catalytic properties.

Biography

I am currently a postdoctoral researcher at the School of Energy Science and Engineering, VISTEC, with 7 years of research experience in nanomaterials design and catalyst synthesis. My work focuses on hierarchical porous materials and their catalytic applications. Throughout my research journey, I have developed expertise in the synthesis of zeolites, layered double hydroxides (LDHs), and carbon nanotubes (CNTs) to successfully improve selectivity and conversion terms for sustainable chemical processes. I am passionate about applying my research expertise to create real business value in material characterization, oil and gas upgrading and nanotechnology-based catalyst development for energy and environmental applications.

M.S.S.R. Tejaswini

Vignans Foundation for Science, Technology and Research, Vadlamudi, Guntur, A. P. India

Comparative Study on Photocatalytic Degradation of Low-Density Polyethylene: Kinetic Studies, and Degradation Pathways as A Sustainable Tool for Plastic Waste Management

Abstract

This study demonstrates and compares the efficiency of photocatalytic degradation on low-density polyethylene (LDPE) films by employing nanomaterial catalysts viz., titanium dioxide (TiO_2), zinc oxide (ZnO) and silicon dioxide (SiO_2) in a photochemical reactor. Different parameters like source of light (ultraviolet, UV or visible, VIS), catalyst loading (%), pH, and exposure time (in hours) are studied to determine the maximum photodegradation on LDPE. The physiochemical, morphological, and molecular structural changes were significantly observed in all- nanocomposite (LDPE and catalysts) samples after 288 hours of degradation. Further, a kinetic study was performed to determine the rate of photo-degradation that follows the first-order photo-kinetics model. The maximum photodegradation was observed for LDPE-TiO_2 UV , LDPE-ZnO VIS and LDPE-SiO_2 VIS films at pH 4, 9 and 11 with a degradation rate of 9.25, 7.21 and 5.32%, respectively. Based on the results, it was concluded that the photo- degradation occurs in order of TiO_2 UV > ZnO VIS > SiO_2 VIS > TiO_2 VIS > ZnO UV > SiO_2 UV , respectively. Photocatalytic degradation of LDPE is driven by light-induced electron-hole pairs that generate highly reactive radicals capable of breaking down the polymer chains and ultimately converting them into non-toxic, environmentally friendly substances that will help in achieving sustainable development goals 11 & 12.

Biography

Finished his PhD at 25 years old years from Andhra University and postdoctoral investigations from Stanford University School of Medicine. He is the chief of XXXX, a head Bio-Soft administration association. He has Published in excess of 25 papers in rumored diaries and has been filling in as a publication board individual from notoriety.

Harmitkumar N Pandya

Department of Chemical Engineering, Institute of Chemical Technology, Mumbai 400019, India

Kinetic Model of Hydrogenation of Glucose to Sorbitol on Ni/Bentonite Catalyst

Abstract

In the present work, we studied the hydrogenation of glucose to sorbitol using nickel/bentonite catalyst. The Ni/Bentonite catalyst was prepared by the wet impregnation method and characterised by different methods to understand the catalyst surface morphology, surface area, metal content, pore size, etc. Different reaction parameters such as temperature, hydrogen pressure, metal loading, catalyst loading, and agitation speed were studied to achieve glucose conversion of 96.8% and sorbitol selectivity of 95.3%. The reusability test was performed to examine the stability of the catalyst. The kinetics models such as Eley-Rideal and Langmuir Hinshelwood-Hougen-Watson models were used to study the hydrogenation of glucose and activation energy required for the reaction.

Biography

Harmitkumar N Pandya is currently working as a Senior Research Fellow in the Department of Chemical Engineering at the Institute of Chemical Technology (ICT), Mumbai. He is currently pursuing his Ph.D. (Tech.) in Chemical Engineering, having previously completed his Bachelor's in Chemical Engineering and M.Tech in Green Technology. His research focuses on Heterogeneous catalysis, Biomass valorization, Process intensification, and Scale-up technology, with different characterization techniques and the development of sustainable chemical processes. He aims to bridge the gap between laboratory-scale innovation and industrial application through catalyst design, optimization, and pilot-scale studies. Harmitkumar has published two peer-reviewed articles. His core interests include catalysis, biomass valorization, technology transfer, and the use of continuous and batch mode reactions for chemical research and development.

Aishwarya Poman

Department of Chemical Engineering, Institute of Chemical Technology,Mumbai 400019, India

Alkylation of Aniline with Benzyl Alcohol by Using Ni/O-Clay: Kinetic Studies

Abstract

This study investigates the alkylation of aniline using benzyl alcohol over a Ni (30)/O-clay catalyst, focusing on optimizing reaction conditions and understanding the reaction kinetics. The catalyst demonstrated 70% conversion of aniline with 75% selectivity toward benzylideneaniline (BDA) at 343 K in a 6-hour reaction time. Catalyst characterization was performed using BET, NH 3 -TPD, XRD, and FE-SEM techniques, revealing a mesoporous structure with strong and medium acidic sites that enhance catalytic activity. Key parameters influencing the reaction, including temperature, molar ratio, catalyst loading, oxidants, and solvents, were systematically investigated. The Weisz-Prater cri-terion confirmed the absence of mass transfer resistance, and kinetic studies validated the Langmuir-Hinshelwood-Hougen-Watson (LHHW) mechanism. The activation energy was calculated and found to be 37 kcal/mol. The Ni (30)/O-clay catalyst exhibited excellent reusability, maintaining activity and selectivity up to four reaction cycles. This work highlights the potential of Ni-organoclay catalyst for green, cost-effective synthesis of alkylated aniline derivatives, paving the way for sustainable and efficient industrial processes. The results emphasize the importance of heterogeneous catalysts in enhancing selectivity and minimizing by-products in environmentally friendly chemical transformations.

Biography

Aishwarya S. Poman is currently working as a Senior Research Fellow in the Department of Chemical Engineering at the Institute of Chemical Technology (ICT), Mumbai. Her research focuses on heterogeneous catalysis, process intensification, and scale-up technology, with a strong emphasis on characterization techniques and the development of sustainable chemical processes. She is currently pursuing her Ph.D. (Tech) in Chemical Engineering, having previously completed her Bachelor's in Pharmacy and M.Tech in Green Technology.

Her doctoral research is sponsored by Prasol Chemicals Pvt. Ltd., and aims to bridge the gap between laboratory-scale innovation and industrial application through catalyst design, optimization, and pilot-scale studies. Aishwarya has published two peer-reviewed articles, with an additional manuscript currently under review.

Her core interests include catalysis, technology transfer, and the use of sophisticated analytical instruments and techniques to accelerate applied chemical research and development .

Ann Charise Carino Delgado

Química, Universitat de Barcelona, Barcelona, Spain

Controlling the Atomic Layer Deposition of TiO_2 on Mesoporous Al_2O_3 for Fischer-Tropsch Synthesis Application

Abstract

Atomic Layer Deposition (ALD) is a technique widely used in microelectronics and nanotechnology to deposit metal oxide layares? on a substrate in atomic scale with high uniformity. Because of its advantages, it is recently being explored for heterogeneous catalyst synthesis. However, deposition on mesoporous surfaces is still a challenge. Modifying the parameters of the ALD process, such as the number of cycles, precursor dosing time, and precursor exposure time, controls the nature and extent of the deposition on mesoporous surfaces. As an example, an increase in precursor exposure time in each cycle of deposition proves to be beneficial in the penetration of materials into the particle pores. In this research, TiO_2 was deposited on mesoporous Al_2O_3 through ALD and subsequently impregnated with 17.5 wt.% cobalt. The ALD process was optimized and the characteristics of the resulting materials was related to the conversion and selectivity of the FTS reaction. TiO_2/Al_2O_3 was characterized through N2-physisorption, TEM, and ICP, while $Co/TiO_2/Al_2O_3$ was additionaly characterized through CO DRFITS, H_2-TPR, and CO Chemisorption. Based on the results, low loadings of TiO_2(0.07-0.2% Ti) on the Co-based catalyst supported on Al2O3 exhibited similar C_{5+} selectivity and CO conversion to the reference, TiO_2- supported Co catalyst. Interestingly, the C_{5+} product distribution of catalysts synthesized using different ALD processes was also different. This behavior could be attributed to the creation of different kinds of active sites based on the locality of deposited TiO_2 on the surface of Al_2O_3. Thus, controlling the ALD process parameters consequently tunes the catalytic performance of the resulting catalyst.

Biography

Charise took up Chemical Engineering for her Bacherlor´s at Universtiy of Santo Tomas, Philippines and Master of Science in Chemical Engineering at Kongju National University, South Korea. In 2023, she was accepted to the DocFam+ Fellowship Programme, which is co-funded by the European Union under the Maria Skłodowska-Curie Actions (MSCA). She is currently doing her PhD in Material Science at the Autonomous University of Barcelona and also a predoctoral researcher at the Catalonia Instittute of Energy Research, Spain. Her past research experiences revolved on the heterogenization of organometallic catalysts on solid supports while current research focuses on the atomic layer deposition of metal oxides on mesoporous surfaces for energy application.

Nabendu Ghosh

Mechanical Engineering Department, Jadavpur University, Kolkata–700032, India

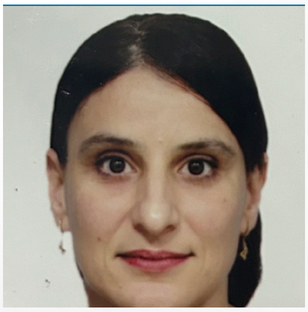
Modelling and Optimization of TIG Welding as a Chemical–Metallurgical Process for In-Situ Nanoparticle Formation

Abstract

The integration of modeling and optimization in welding research provides new perspectives for treating welding not merely as a joining technique, but as a complex chemical–metallurgical process. Tungsten Inert Gas (TIG) welding of stainless steels creates unique thermal–chemical environments that enable in-situ nanoparticle formation and catalytic strengthening of the weld zone. In this keynote, a Taguchi-based design of experiments combined with Grey–Taguchi optimization is applied to systematically study the effects of welding current, shielding gas flow rate, and travel speed. The approach highlights parameter interactions, defect minimization, and the establishment of predictive models linking process variables to mechanical and microstructural outcomes. Microstructural investigations confirm that optimized conditions lead to grain boundary refinement, nanoscale precipitate formation, and dislocation substructures, which act as strengthening agents. This keynote underscores TIG welding as a model case of process modeling and chemical optimization, where predictive frameworks and catalytic effects converge to design advanced nanostructured materials. The methodology offers transferable insights for biomedical devices, energy systems, and sustainable manufacturing applications.

Biography

Dr. Nabendu Ghosh was born on December 2, 1985, in Kolkata, West Bengal, India. He is presently serving as an Assistant Professor in the Department of Mechanical Engineering at Jadavpur University, Kolkata, West Bengal, India. Dr. Ghosh earned his Bachelor of Technology (B.Tech.) degree in Mechanical Engineering from the Birbhum Institute of Engineering and Technology in 2007. He subsequently pursued his Master of Engineering (M.E.) degree in Mechanical Engineering at Jadavpur University, which he completed in 2010. His passion for advanced research led him to further academic pursuits, and he was awarded the Doctor of Philosophy (Ph.D.) in Engineering from Jadavpur University in 2019. Before joining Jadavpur University, Dr. Ghosh accumulated over a decade of teaching and academic experience. He held faculty positions as an Assistant Professor at Techno India Banipur and at SDET–Brainware Group of Institutions, where he contributed significantly to teaching, mentoring, and academic development. His primary research interests lie in the broad domains of welding and manufacturing engineering, with a particular focus on welding techniques, materials processing, and advanced manufacturing methods. He has guided six Master of Technology (M.Tech.) students and one Doctoral (Ph.D.) scholar, reflecting his active involvement in research supervision and academic mentorship. Dr. Ghosh has also contributed to the academic community through his research publications, conference presentations, and peer-review activities. He has presented his work at numerous national and international conferences and has published articles in reputed peer-reviewed journals. In recognition of his expertise, he also serves as a member of the Editorial Board of Scientific Reports, a prestigious journal published by Springer Nature. Through his teaching, research, and editorial responsibilities, Dr. Ghosh continues to make meaningful contributions to the advancement of mechanical engineering, welding technology, and manufacturing science.



Amel Asselah

University of Sciences and Technology, Faculty of Chemistry, Organic Chemistry Department, 16000 BP32 El Alia Bab Ezzouar, Algeria

Valorization of Marine Green Algae Waste Towards the Production of High-Value Product, Biosorbent, and Application in Cadmium Adsorptive Removal from Aqueous Solution

Abstract

This paper investigates the valorization of marine green algae biomass ''Ulva Lactuca'' through its transformation into a high added value product as biosorbent to removal of cadmium from aqueous solution. The green algae, Ulva Lactuca, was collected of the Boumerdes Sea from the Algerian coast. The various parameters affecting the biosorption as initial cadmium concentration, biosorbent amount, contact time, pH, and temperature were studied in batch experiments. The adsorption mechanisms of cadmium ions onto the algal biosorbent were examined using various analytical techniques: Fourier-transform infrared spectroscopy, scanning electron microscopy coupled to energy-dispersive X -ray, and X-ray diffraction. Results indicated that at the optimum pH value of 6, about 4 g of Ulva Lactuca was enough to remove 99% of 6 mg/L of cadmium when it was exposed for 1 hour at 25 °C in the aqueous solution. The results show that these parameters influenced cadmium removal using green algae considerably. Pseudo-first-order, pseudo-second-order, intraparticle and extraparticle diffusion kinetic models were applied to explain the kinetic data, and the pseudo-second-order model achieved good agreement controlled by extraparticle, and intraparticle diffusion. The equilibrium data were well fitted with the Langmuir and Freundlich isotherms; the Langmuir model proved to be the most suitable. The monolayer adsorption capacity was 111.11 mg/g. The calculated thermodynamic parameters indicate that the cadmium biosorption onto Ulva Lactuca was spontaneous and exothermic beneath tested conditions. The tested green algae

biosorbent was regenerated using chlorhydric acid as desorption reagent and a percentage of 90 % was recovered. The promising results obtained are expected to promote the use of green algae biomass as an efficient and eco-friendly sustainable biosorbent.

Biography

Amel Asselah received her Ph.D in organic chemistry (2015) from the University of Sciences and Technology Houari Boumediene (U.S.T.H.B), Algiers, Algeria. During her doctorate, she joined the Department of Surfactant Technology, Institute of Advanced Chemistry of Catalonia-Spanich Council for Scientific Research (CSIC-IQAC), Barcelona, Spain, on an Algerian fellowship (2014). She is currently an associate professor at the Process Engineering Department, Faculty of Technology at the University of M'Hamed Bougara (U.M.B.B) of Boumerdes, Algeria. Her research interests are in surfactants, corrosion, adsorption, applications and environment. She has published 4 papers.

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Enhanced Biodiesel Production via Copper-Modified MIL-100(Fe): Synergistic Catalysis and Kinetic Insights

Abstract

A highly efficient copper-incorporated MIL-100(Fe) catalyst (30Cu/MIL-100(Fe)) is reported for sustainable biodiesel production via oleic acid esterification. By systematically tuning copper loading (10–30%), we demonstrate that 30% incorporation maximizes catalytic activity while preserving the MOF's crystalline structure (XRD) and acidic properties (NH_3-TPD). The optimized 30Cu/MIL-100(Fe) achieves 86.96% methyl oleate yield at 60 °C with a 3 wt.% catalyst loading and methanol-to-acid ratio of 47:1, outperforming pristine MIL-100(Fe) by 2.3-fold. Kinetic studies reveal a remarkably low activation energy (19.44 kJ/mol), attributable to the Cu-Fe synergy that facilitates methoxide ion attack on oleic acid-the rate-determining step. Crucially, the catalyst exhibits excellent heterogeneity (no leaching) and reusability (>5 cycles). This work provides a mechanistic blueprint for designing bimetallic MOF catalysts to bridge the gap between biomass valorization and industrial biodiesel production.

Biography

Dr. Ahmed Sadeq Abou-Elyazed Aresha is a senior scientist and team leader of catalysis at the Faculty of Science, Menoufia University, Egypt. I received a Ph.D. degree in 2023 Chemical Engineering and Technology, Harbin Institute of Technology, China, and joined postdoctoral research at the Institute of Intelligent Manufacturing Technology, Shenzhen Polytechnic University from November 2023 until now. I have extensive experience with metal-organic frameworks (MOFs) and their application in different fields such as biomass conversion biodiesel production, and photocatalysis, and I am an expert in supercapacitors, sweat sensors, and ion membrane separation-based MOFs.

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Future Wonder Catalyst for Green Energy Production by Water Splitting

Abstract

The increasing global energy demand and environmental concerns have pushed the search for sustainable and clean energy alternatives. Among various methods, hydrogen generation through water splitting has emerged as a talented solution owing to its high energy yield and eco-friendly nature. Graphene is a carbon nanomaterial with a large surface area, exceptional electrical conductivity, and mechanical and chemical stability. Consequently, graphene has gathered significant attention as a next-generation catalyst in water-splitting technologies. This lecture will highlight the potential use of graphene and its derivatives in hydrogen production by water splitting. The lecture will discuss the functionalization, and the formation of graphene-based hybrid composites to further improve catalytic activity and stability. The lecture will discuss challenges and future perspectives.

Biography

Prof. Imran Ali, Ph.D., FRSC, C Chem, London (UK), Highly Cited Researcher, Clarivate, USA and with 10 Global ranks in Analytical Chemistry (Chromatography), as per the Stanford University, USA (Global list of top 2% scientists); is a world-recognized academician and researcher. He completed his Ph.D. at the Indian Institute of Technology Roorkee, Roorkee, India. Prof. Ali is known globally due to his great contribution to pharmaceutical analysis by chromatography and capillary electrophoresis, the development of anticancer drugs, nanotechnology for water treatment, and water splitting for hydrogen green fuel generation. He has published more than 500 papers in reputed journals including papers in Nature and Chemical Reviews of more than 72 impact factors. He has also written six books published by Marcel Dekker, Inc., USA; Taylor & Francis, USA; John Wiley & Sons, USA; John Wiley & Sons, UK; Elsevier, The Netherlands, and Springer, Germany. His total citation is 46,200 with an h-index of 116 and i10-index of 393. He is a member of various scientific societies globally. He has been co-chair of a conference on the application of graphene, chaired many conference sessions, and delivered several keynote lectures. He is a widely traveled person enjoying various visiting Professor/Consultant positions in many Universities around the world.

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Enhanced Photocatalytic Water Splitting for Hydrogen Production Using Defect-Modified Al_2CO/Al_2Se_3 Heterojunctions

Abstract

Two-dimensional materials (2D) earned great importance in verity of applications because of their excellent physical and chemical properties. To further enhance the properties of the 2D materials to make them applications-friendly, the material's modifications have been found useful and can be carried out via verity of techniques including defects engineering, alloying, surface modification, composites, thickness variations, introduction of interfaces and formation of heterostructures. This work is dedicated to investigate the role of intrinsic defects in Al2CO and its heterostructure Al2CO/Al2Se3 in material's properties and photocatalysis via first-principles methodology. The structural, thermal and dynamical stability of the materials are studied before and after the formation of the defects. The enhanced electronic and charge transfer properties after the creation of vacancy validates the suitability of defects. The vacancies appeared to tailor the electronic structure and optical properties which consequent upon variation in photocatalytic character of the materials to support the visible light harvesting. The surface oxygen vacancies have enhanced the photogenerated carrier separation and offer more localized electrons to the adsorbed water molecules. The hydrogen evolution reaction and the oxygen evolution reaction both take place simultaneously over the heterojunction.

Biography

Dr. Abdul Majid is Professor and Chairperson in the Physics department at the University of Gujrat, Pakistan. His research focuses on experimental and computational studies of semiconductors for electronic, optoelectronic and magnetic devices. He has over 20 years of academic and research experience at national and international institutions. Majid completed his PhD at the Institute of Semiconductor Physics in Beijing and postdoctoral research at Osaka University studying layered semiconductors computationally. He has supervised numerous graduate theses and frequently publishes in reputable ISI indexed journals and books.