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Abstract Book

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Hao Huang

Department of Applied Chemistry, University of Toyama 930-0887, JAPAN

Efficient self-catalytic reactors for catalytic C1 molecular conversion

Abstract

With the depletion of petroleum resources, growing environmental pollution, and increasing demand for fuels and high-value chemicals, C1 chemistry has gained significant attention. The catalytic conversion of one-carbon (C1) molecules, such as CO, CO2, and CH4, into value-added chemicals and liquid fuels is crucial for the chemical industry and aligns with green chemistry principles. However, the inertness of C-H and C-O bonds and uncontrollable C-C bond formation make selective activation and controlled conversion into high-value products challenging. Additionally, issues with reaction selectivity, energy efficiency, and emissions remain significant obstacles due to the complexity of these processes. Therefore, developing efficient C1 conversion pathways for the targeted production of liquid fuels and high-value chemicals requires innovations in catalyst design and reaction processes. Metal 3D printing has been widely applied in various industries, but its chemical properties and catalytic functions are rarely discussed. In response, we propose a self-catalytic reactor (SCR) incorporating multiple catalytic functions. By utilizing 3D printing technology, this design enhances the synergy between catalysts and reactors, reduces reactor size and cost, and improves energy efficiency. This approach enables efficient C1 molecule conversion, addressing both energy and environmental challenges, and is expected to revolutionize traditional catalysis and the chemical industry.

Biography

A PhD student from the Tsubaki Lab at the University of Toyama, Japan, supported by the JST scholarship. The main research focus is on the development of novel and efficient catalysts for carbon dioxide conversion and the new applications of 3D printing technology in the field of catalysis.

Imtiaz Ahmed

Department of Chemistry, Indian Institute of Technology Indore, Simrol Khandwa Road, 433552, India

$Co_3O_4/WO_3/C$ Nanorods with Porous Structures as High-Performance Electrocatalysts for Water Splitting

Abstract

The recent promise of the hybridization of mesoporous carbon with transition metal oxides as a desirable catalyst for the oxygen evolution reaction (OER), and its extension to the hydrogen evolution reaction (HER) to achieve the goal of overall water splitting applications, remains a major challenge. Here, a unique environmentally benign mesoporous Co3O4/WO3/C bifunctional electrocatalyst is developed from converting cellulose waste, specifically in the form of sugarcane bagasse, by pyrolysis followed by a two-step hydrothermal strategy that can catalyze electrochemically OER and HER activity in an efficient and robust manner. The electrocatalyst delivers low overpotentials of 229/295 mV and a Tafel slope of 63/77 mV/dec–1 for both alkaline and acidic media, respectively, for OER along with the overpotential of 123 mV and a Tafal slope of 36 mV/dec–1 for HER to reach a current density of 10 mA/cm2. We hypothesized that an electronic synergistic effect between the transition metals might be responsible for promoting HER and OER activity, which was confirmed by density functional theory studies. This work opens a unique pathway to develop highly efficient, but low cost, electrocatalysts for water splitting applications.

Biography

Dr. Imtiaz Ahmed received his M.Sc. and Ph.D. degrees in Chemistry from the Central University of Punjab in 2018 and 2023, respectively. He served as a Postdoctoral Research Scientist at Mahidol University in Thailand and is currently a Postdoctoral Research Associate in the Department of Chemistry at the Indian Institute of Technology Indore (IITI). His research focuses on energy conversion, particularly water electrolysis (OER and HER), supercapacitors, heterogeneous catalysis, biofuel production, and biomass conversion. He is also interested in the application of inorganic nanostructures and organic catalysis. Dr. Ahmed has published more than 35 research articles in prestigious journals, including ACS, RSC, Wiley, and Springer. Along with this hw is edotorial board member of Journal of Energy and Natural Resources. He is a recipient of the Council of Scientific & Industrial Research Junior Research Fellowship Award (2018), Senior Research Fellowship Award (2021) and Postdoctoral Research Associate Award 2024. Additionally, he qualified for the JKSET Award in 2018.

Wenjie Xiang

School of Engineering, University of Toyama, Gofuku 3190, Toyama 930-8555, Japan

Potassium-Driven Pathway Modulation in CO_2 Hydrogenation: Tuning Ethanol and Liquid fuels Synthesis over FeCuAl Catalysts

Abstract

The hydrogenation of CO_2 into value-added chemicals and fuels represents a viable strategy for carbon recycling and sustainable energy production. This study investigates the effect of potassium (K) loading on FeCuAl catalysts, specifically focusing on tuning the selectivity between ethanol and C^{5+} hydrocarbons. A series of K(x)/FeCuAl catalysts were synthesized using a co-precipitation method followed by controlled K impregnation, allowing precise modulation of catalytic properties. The results demonstrate that K loading plays a pivotal role in modifying the reaction pathway by influencing CO_2 adsorption, CO formation, and carbon chain growth via C–C coupling. At an optimal K loading of 1.6 wt%, the catalyst exhibited the highest ethanol space-time yield (STY) of 603 gAcH/kgcat h-1, whereas increasing K loading to 3.5 wt% shifted the product distribution toward C^{5+} hydrocarbons, achieving a peak STY of 632 gfuel/kgcat h-1. Comprehensive characterizations, including X-ray photoelectron spectroscopy (XPS), Mössbauer spectroscopy, and in-situ diffuse reflectance infrared Fourier transform (DRIFT) spectroscopy, revealed that K enhances surface alkalinity, stabilizes Fe carbides, and alters the electronic environment of active sites, ultimately governing product selectivity. The study provides mechanistic insights into the pathway regulation in CO_2 hydrogenation and offers a tunable catalytic strategy for optimizing the selective production of liquid fuels and oxygenates.

Biography

Dr. Wenjie Xiang is a Ph.D. candidate in Nanomaterials Science at the University of Toyama, Japan, under the supervision of Prof. Noritatsu Tsubaki. His research focuses on multifunctional catalyst development for CO2 hydrogenation and sustainable chemical synthesis. He has authored multiple high-impact publications in Applied Catalysis B and Materials Today Chemistry. Dr. Xiang has contributed to major NEDO-funded projects on CO2-based para-xylene and LPG production, collaborating with leading industrial partners. He has received prestigious awards, including the JST SPRING Fellowship. His expertise spans catalyst design, process development, and industrial-scale applications for carbon recycling technologies.

Muhammad Akram

Department of Life Sciences, School of Science, University of Management and Technology, Lahore, 54770, Pakistan

Bioengineering diverse UDP-glycosyltransferase for Glycyrrhetic acid 3-O-mono-β-d-glucuronide Production from different Substrate

Abstract

Biotransformation, the enzymatic modification of chemical compounds, plays a pivotal role in metabolism, detoxification, and drug activation. This process, facilitated by enzymes such as cytochrome P450, UDP-glucuronosyltransferases (UGTs), sulfotransferases, GUS1, GUS2, GUS3 and glutathione S-transferases, can be harnessed for in-vitro chemical modifications to enhance the bioactivity and reduce the side effects of various compounds. Glycyrrhetinic acid (GA), a pentacyclic hydrophobic aglycon with significant pharmacological potential, faces limitations due to its poor water solubility. Glycosylation offers a promising solution to this challenge. In this study, UGTs (YojK, YdhE, and UGT109A1) from Bacillus subtilis, GUS1, GUS2, GUS3 from Arabidopsis thailiana were recombinantly expressed in Escherichia coli and purified to assess their catalytic potential for GA glycosylation. GUS3, UGT109A1 and YojK demonstrated significant activity, catalyzing the formation of GA-3-O-β-D-glucoside and GA-30-O-β-D-glucoside, respectively, using UDP-glucose and UDP-glucoronic acid as a sugar donor. These glycosylated derivatives exhibit improved water solubility and enhanced bioactivity. UGT109A1 exhibited optimal activity at 50 °C and pH 10.0, while YojK showed peak performance at 35 °C and pH 8.0. Catalytic efficiency (kcat/Km) analysis confirmed the robust biocatalytic potential of both enzymes for GA glycosylation. This study highlights the utility of UGTs in the biotransformation of hydrophobic compounds like GA, offering a pathway to develop more effective and bioavailable derivatives for pharmaceutical applications. By engineering microbial strains and exploring novel enzyme activities, biotransformation can be

employed in industrial setups for the green synthesis and modification of valuable compounds.

Biography

Dr. Muhammad Akram currently working as an Assistant Professor at the UMT, Lahore, Pakistan, since February 07, 2022. He earned his Ph.D. degree from Beijing Institute of Technology, China, in 2021, in Chemical Engineering and Technology (Biochemistry) while working in the field of metabolic engineering and synthetic biology. He was awarded the "Excellent student award" for the academic year 2019-2020 during his Ph.D. studies. He published twenty-one research articles in the reputed journals. Previously, he worked in several research positions, including as a Research Assistant in an industrial biochemistry lab, a Senior Research Associate in a cancer genetics lab. He won different awards and one research funding from different organization.

Muhammad Azhar

National University of Sciences and Technology, H-12 Islamabad 44000, Pakistan

Historical Overview and Future Prospects of Photocatalysis

Abstract

Constant use of textile and fertilizer materials has substantially increased the risk of environmental pollution and energy crisis. Conventional Methods used to produce the materials are contributing to increase pollution in the environment. Photo-catalysis is an effective eco-friendly oxidation process that can safely eliminate all types of pollutants such as air and water contaminants, aromatics, and other hydrocarbons. Photocatalysis works using the sunlight thus affecting the environment positively and reducing pollution. The idea of conducting the first photochemical process for the catalysis was pioneered by Plotikow at the beginning of the 20th century. After that in 1920s first efforts were made to create analogous processes like photosynthesis by performing photoactivated reactions between carbon dioxide, water, and nitrogen compounds. The photocatalytic properties of oxides were first uncovered in the 1940s with intent of increasing the lifespan of paints, papers, and pigments. Photocatalytic procedures came out to be effective in solving environmental problems by deactivation of pathogens and degradation of air pollutants in the period of 1970s. The history of photo-catalysis can be systematized into three distinct generations by type of materials used: The first indicates the composition of inorganic semiconductors like TiO_2, the second generation is the use of doped semiconductors, and the last generation deals with the utilization of hybrid heterostructures for catalysis. Photocatalytic production of hydrogen, reduction of CO_2, and elimination of pollutants are currently the most trending research areas in photo-catalysis. Extensive progress has been accomplished in the field of photo-catalysis in recent years, and more is yet to be achieved because of the constant contribution of the scientific community. Numerous future possibilities can be accomplished in the field of photocatalysis which include more complex nanoarchitectures, introduction of novel non-oxidic materials, and hybridizing with photovoltaic modules in a single device.

Biography

I am Muhammad Azhar, a dedicated researcher from Sindh, Pakistan. I completed my bachelor's degree with a gold medal in Mechanical Engineering at the age of 20 from the National University of Sciences and Technology (NUST), where I am currently pursuing my master's degree in the same field. My research interests span thermoelectric generators, metal oxide glasses, geothermal energy, and photocatalysis. I have contributed to the academic community through three published book chapters: one on metal oxide-based glasses, another on the historical overview of geothermal energy, and a third on the historical overview and future prospects of photocatalysis. Currently, I am focused on energy management and carbon capture technologies, working to develop sustainable solutions for global energy challenges.

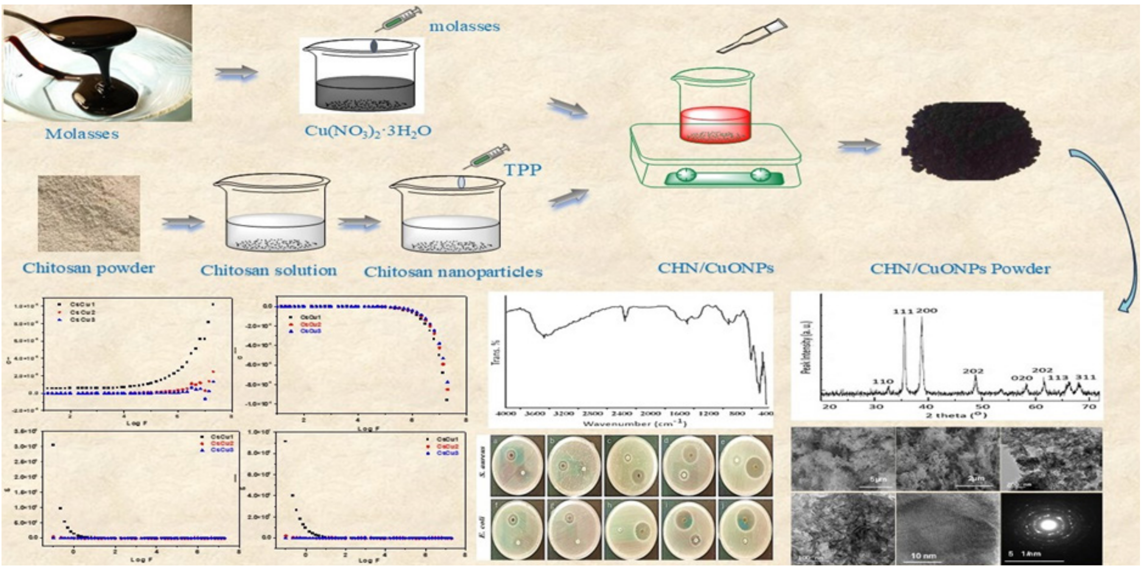
Noof Alenazi

Department of Chemistry, College of Science and Humanities in Al-Kharj, Prince Sattam bin Abdulaziz

Chitosan nanoparticles included different doses of copper oxide nanoparticles produced by molasses: Investigating electrical conductance and antibacterial attributes

Abstract

This research explores an environmentally friendly approach for synthesizing copper oxide nanoparticles (CuONPs) using molasses, which is rich in carbohydrates, polyphenols, and other beneficial compounds. This method eliminates the need for harsh processing conditions. The CuONPs were integrated into ionotropic chitosan nanoparticles (CsNPs) at varying concentrations, demonstrating effective production of small, stable CuONPs. The findings highlight the crucial role of CsNPs in maintaining CuONPs stability, preventing their aggregation into larger particles. An analysis revealed that both the dielectric constant and dielectric loss decreased with increased frequency, while a clear correlation was established between CuONPs and improved electrical conductivity. Additionally, the CsNPs-CuONPs nanocomposite exhibited antimicrobial properties against Escherichia coli (E.coli) and Staphylococcus aureus(S. aureus), showcasing its potential for biomedical applications. This technique provides a sustainable method for producing CuONPs-infused CsNPs without the use of organic solvents, costly raw materials, or complex machinery. Overall, this approach is notable for its effectiveness, simplicity, versatility, and cost-effectiveness, offering a safe and environmentally benign way to generate nanoparticles without contamination risks.


molasses
Molasses
$Cu(NO_3)_2 \cdot 3H_2O$
TPP
Chitosan powder
Chitosan solution
Chitosan nanoparticles
CHN/CuONPs
CHN/CuONPs Powder
Wavenumber (cm^{-1})
2 theta (°)
S. aureus
E. coli

Omar BOUALAM

Sidi Mohammed Ben Abdellah University, Higher School of Technology. Laboratory of Materials, Processes, Catalysis, and Environment (LMPCE)

Catalytic Oxidation of Phenol Using Iron-Supported Illite: Optimization of Parameters for Efficient Wastewater Treatment

Abstract

This study investigates the catalytic oxidation of phenol using an iron-supported natural illite clay catalyst, examining operational parameters to optimize degradation efficiency and minimize environmental impact. The effects of pH, temperature, catalyst dosage, initial phenol concentration, and H_2O_2 concentration were systematically studied. Optimal conditions were achieved at pH 3 and a temperature of 50°C, enhancing hydroxyl radical formation and reaction kinetics. Under these conditions, the catalyst achieved a 99% degradation rate for phenol and an 83% reduction in chemical oxygen demand (COD), with minimal iron leaching. Additionally, the H_2O_2 concentration was optimized at 0.5 mM to reduce excess reagent use. Analysis of intermediate by-products confirmed stepwise degradation, highlighting effective oxidation pathways. This study demonstrates the potential of iron-impregnated natural clays as sustainable, cost-effective catalysts for treating phenolic pollutants in wastewater.

Sarra Kitanou

Laboratory of Advanced Materials and Process Engineering, Faculty of Sciences, Ibn Tofail University, Kenitra - Morocco

Membrane Bioreactor (Mbr) Performance And Process Modeling

Abstract

Mathematical modeling of MBR treatment is an effective tool to predict effluent quality. Model calibration is critical to improve the accuracy of simulation. Membrane bioreactors (MBRs) consist of biological reactors combined with membrane separation processes. In this study, the parameters affecting the pollution and treatment efficiency of the MBR process were analyzed and compared in order to understand the pollution removal process sensitivity and their implications for the modeling. This work demonstrated the effective use of statistical modeling to enhance MBR process performance to obtain a sustainable and energy-efficient condition. Analysis of variance for developed quadratic models exhibits high significance and applicability. However, model is analyzed graphically for its predictive ability. The response surface methodology (RSM) was found useful statistical tool for understanding effect of HRT, TMP and AR as three operational parameters on pollution removal efficiency. Under the most optimum parameters, the HRT of 15h, and TMP of 14.9, MBR technology improved pollution removal efficiencies significantly, and the maximum pollution removal could be achieved. The most significant difference concerned the elimination of total suspended solids, which amounted to 99.7%. Regarding COD, a low concentration was obtained (15 mg/L) in the permeate. Greater differences were achieved in the case of total nutriments.

Biography

Dr. Sarra Kitanou is Professor at the National School of Chemical Engineering, Ibn Tofail University. She is a research chemist at Advanced Materials and Process Engineering Laboratory. Her research has been on Process Engineering and Environment. Her focus is wastewater treatment using membrane technologies, especially membrane bioreactor (MBR). As a researcher applying environment perspectives, she has published widely in water research journals as well as wastewater treatment and environment journals. The research findings in her studies have also been discussed in many congresses and conferences around the world. Dr. Sarra Kitanou has also been speaker and lecturer in different conferences. She conducted different studies and development projects focusing on this field, among them that of the implementation of a wastewater treatment plant at the Ibn Tofail University campus.

Eduardo A. Sánchez Ruiz

Universitat Politècnica de Catalunya | BarcelonaTech

Transforming Plastic Waste from Banana Agroindustry into Eco-friendly Construction Materials: A Circular Economy Case Study from Piura, Peru

Abstract

The global plastic waste crisis poses a growing environmental challenge, with a significant portion originating from agricultural industries. This study explores the potential of a circular economy approach to repurpose plastic waste from the banana agroindustry in Piura, Peru, into sustainable construction materials. As Peru's leading region for organic banana production and export, Piura provides an ideal case study to evaluate the technical, economic, and environmental feasibility of this model. The research assesses key factors such as job creation, cost efficiency, and waste reduction, highlighting the potential benefits for both the local economy and environmental sustainability. Findings demonstrate the viability of transforming agricultural plastic waste into durable and cost-effective construction materials, supporting a more resilient and circular agroindustrial sector. This study underscores the critical role of circular economy strategies in developing countries and offers actionable insights for policymakers and industry stakeholders seeking innovative plastic waste management solutions.

Biography

I am a Researcher, Project Manager, and Professor with a strong international background in Sustainable Engineering, Innovation, and Higher Education. With PhD studies in Sustainable Engineering and extensive academic and professional experience across Europe and Latin America, I specialize in developing technological solutions that enhance environmental efficiency, focusing on water purification, renewable energy, and circular economy models.
Expertise in:

- Sustainable Engineering & Water Purification Technologies
- Circular Economy & Renewable Energy Solutions
- Research & Innovation in Engineering
- Project Management & Higher Education

My academic journey has taken me through top European institutions, including Polytechnic University of Catalonia (Spain), Politecnico di Milano (Italy), and MIT SCALE Network (USA & Latin America). This diverse experience has allowed me to integrate global perspectives into my research and project development, fostering innovative and practical solutions for sustainable development.

Ehsan Ghazanfari

College of Engineering, University of Vermont, VT 05405, USA

Deep Geothermal Systems: Challenges and Opportunities

Abstract

Deep geothermal system operation involves passing a fluid through fractured rocks deep underground to exchange heat, followed by energy production on the surface. As the fluid passes through a network of connected fractures within reservoir, it absorbs heat, and the heated fluid is used to produce electricity at the ground surface. There are several deep geothermal sites operating around the world. However, deep geothermal systems are underutilized types of renewable energy, despite their significant potential. This is in part due to (i) the existing technological challenges for drilling in depths with high temperature and circulating water in the reservoir, (ii) reservoir production decline due to gradual closure of rock fractures, (iii) and the associated risks such as potential induced seismicity. Addressing some of these issues, particularly, reservoir production decline, can improve the success of deep geothermal system operation. Over the past two decades, there have been significant progress in overcoming technological challenges for drilling as well as reducing the risk of induced seismicity in deep geothermal operation. However, the issue of reservoir production decline remains a challenge that needs to be addressed. There is a knowledge gap in understanding of the triggered thermal, hydrological, mechanical, and chemical processes (THMC) within geothermal reservoir and their effects on gradual closure of fractures. This talk focuses on approaches addressing this specific challenge to aimprove the efficiency of deep gethermal systems and increase the share of this renewable technology around the word.

Biography

Dr. Ghazanfari received his PhD from Lehigh University and is currently an Associate Professor in the Civil and Environmental Engineering Department at the University of Vermont, with experties in subsurface energy technologies. He has extensive publication records in top-tier journals and conference proceedings.

Valeria Vergara, Rodrigo Caceres Gonzalez

School of Industrial Engineering, Diego Portales University, Av. Ejército 441, Santiago, Chile

Floating Photovoltaic Installations in Chile: A GIS-MCDA

Abstract

This study explores the best sites for floating photovoltaic (FPV) systems in Chile, integrating economic, environmental, and energy criteria through a multi-criteria analysis. Northern Chile, particularly Antofagasta, emerges as a prime candidate due to its high solar radiation and energy generation potential, with annual power output exceeding 2,000 kWh/kWp, despite low water conservation benefits. Central-southern regions (O'Higgins, Maule) balance water conservation with energy efficiency, achieving evaporation reduction rates of up to 20–30% and proximity to transmission networks, making them suitable under moderate water stress conditions. Key trade-offs between environmental and economic factors are highlighted, underscoring the need for site-specific assessments to optimize sustainability.

By addressing energy and water challenges across varying climates, this presentation demonstrates the potential of solar-driven systems to enhance energy efficiency, mitigate resource stress, and support climate-resilient infrastructure.

Biography

Industrial Civil Engineer and Master of Science in Engineering from Universidad Diego Portales. Ph.D. in Mechanical Engineering from the Georgia Institute of Technology, USA.
Rodrigo is an Assistant Professor and research coodrinator at the School of Industrial Engineering at Diego Portales Universty. His current work focus on the use and development of computational models based on thermodynamic principles that integrate geospatial information and predictive techniques, and the design analysis of microchannel heat exchangers based on entropy generation.

His research areas include the water-energy nexus, heat transfer desalination, and 4E analysis (energy, exergy, economic, and environmental) of systems that consume and produce power based on renewable energy sources.

Maha Alqarni

University of Jeddah, 21589, Saudi Arabia

Optimizing the structural, optical, dielectric, and electrical properties of polyvinyl alcohol/polyvinyl pyrrolidone/zinc manganite nanocomposites for optical and energy storage applications

Abstract

This study investigates the structural, dielectric, optical, and electrical properties of eco-friendly polyvinyl alcohol (PVA) and polyvinyl pyrrolidone (PVP) matrices embedded with zinc manganite nanoparticles (ZnMn2O4NPs). The nanocomposites films were prepared using a casting method for potential applications in flexible electrochemical devices. FTIR spectroscopy confirmed the successful incorporation of ZnMn2O4NPs into the polymeric matrix. UV–Vis absorption analysis revealed an increase in absorbance with increasing ZnMn2O4 nanoparticle content. Among the various blend nanocomposites, the lowest bandgap energy was observed for the sample containing 2.5 %ZnMn2O4 NPs. Measurements of electrical conductivity, dielectric characteristics, and complex impedance were made for all prepared films. The findings showed that as frequency and nanofiller concentration increased, so did AC conductivity and dielectric characteristics. Overall, the PVA/PVP-2.5 % ZnMn2O4 nanocomposite exhibited superior properties compared to the pure polymer blend. This sample demonstrated optimal electrical conductivity and dielectric constant. These findings suggest that by carefully adjusting the ZnMn2O4 concentration, it is possible to fine-tune the dielectric, optical, and electrical properties of these nanocomposite films. This versatility offers promising potential for applications in optoelectronic devices, energy storage devices, and nanodielectric materials.

Biography

Dr. Maha earned her Ph.D. from the University of Bath, UK, in 2022, specializing in the fabrication and high-resolution imaging of 2D materials with anisotropic properties. Her research encompasses low-temperature ultrahigh vacuum scanning tunneling microscopy, non-contact atomic force microscopy, and the exploration of atomic, electronic, and electrical properties of 2D materials, utilizing chemical vapor deposition for growth and COMSOL software for electrical behavior simulations. She obtained her Master's degree in optoelectronics from KAU, Jeddah, in 2014. Dr. Maha has actively participated in several conferences, including those at KAU, Cardiff University, and the recent London Nanoconference, as well as seminars in the physics department at the University of Bath. Her recent publications focus on studying and investigating 2D materials with potential applications in the energy industry, highlighting her commitment to advancing research in this critical field.

Abhijit Roy

Director & Global Head - Energy & Utilities

Building an AI-Driven Energy Future: A Comprehensive Guide to Transformation and Impact

Abstract

Artificial Intelligence (AI) is transforming the energy sector by optimizing infrastructure management, maintenance, and asset efficiency. This session will revolve around building a deeper understanding of how energy companies can adopt AI-driven transformations to improve asset efficiency, reliability, and overall improve fault detection.

A comprehensive guide on building an AI transformation program for energy organizations, detailing each stage from strategy to execution. This includes identifying pain points in energy operations, such as inefficiencies in asset management, equipment failures, or suboptimal maintenance. Ensuring data readiness involves assessing data availability, quality, and integration across IoT devices, sensors, and legacy systems. Developing AI infrastructure requires selecting the right technologies, including cloud computing, edge AI, and digital twins, while ensuring cybersecurity and scalability. Integrating AI into operations and maintenance and focusing on deploying predictive maintenance and real-time optimization to enhance reliability and efficiency. Finally, evaluating the tangible benefits involves measuring AI's impact on cost reduction, sustainability, asset performance, and operational resilience, ensuring continuous improvement and long-term value realization in solving critical energy challenges.

Biography

Accomplished leader with over 19+ years of global experience in complex consulting, strategy, digital roadmaps, thought leadership and fostering advisory relationship with C-suite stakeholders.

Adept at navigating the intricate landscape of utilizing digital technology and innovation to drive operational efficiency and strategic growth for our clients in the energy and utilities, manufacturing, and industrial sectors. Possessing a comprehensive understanding of industry trends, requirements and digital transformation approach leveraging digital technologies, my endeavor is to enhance our market positioning and footprint in the Energy & Utilities space.

As a thought leader, I shape significant transformation propositions using core and disruptive technologies, delivering clear business benefits. Proven track record of establishing client relationships, driving revenue growth, and leading cross-functional teams to acquire new business and manage team of business analyst and consulting professionals, fostering their growth through mentoring and career planning.

With a blend of technical expertise, business acumen, and leadership prowess, I am poised to create initiatives that redefine the future of energy and utilities through cutting-edge IT solutions and sustainable roadmap of Decarbonization, Digitization and Decentralization.

Mujammal Ahmed Hasan MUJAMMAL

University of Dr. Yahia Fares, Research Laboratory of Electrical Engineering & Automatic(LREA), Medea, Algeria

Novel Direct Power Control Based on Grid Voltage Modulated Strategy Using AI

Abstract

This paper introduces a novel control algorithm leveraging artificial intelligence to address the key defects of Direct Power Control (DPC) via Grid Voltage Modulation (GVM) strategy enhanced by Neural Network Control (NNC) for a three-phase inverter in a photovoltaic generation system. Conventional DPC-GVM techniques face major constraints due to the need for accurate tuning of gains (KP and Ki) in three PI controls, which affects the system's robustness, reliability, and stability. Besides, these conventional techniques suffer from incomplete decoupling between active and reactive powers, direct interdependence between the DC-link voltage and active power reference, elevated harmonic distortion, and suboptimal transient response. This paper introduces a progressive NNC-based algorithm, termed GVM-NNC (Grid Voltage Modulated-Neural Network Control), to overcome these issues. The proposed strategy effectively decouples the active and reactive power control, mitigates the dependence between DC-link voltage and active power reference, diminishes harmonic distortion, and improves transient response. The innovations and contributions of the GVM-NNC strategy include decoupling of active and reactive power for improved control precision, robust adaptability to sudden changes and external disturbances guaranteeing excellent dynamic response, enhanced stability and reliability by eliminating the need for precise tuning of PI controller gains, reduced harmonic distortion for cleaner power output, where the proposed algorithm reduces the THD until 0.98% compared to the THD of conventional DPC-GVM 1.20%. Numerical simulations executed in MATLAB Simulink demonstrate that the GVM-NNC method achieves superior comportment in each steady-state and transient state compared to the conventional DPC-GVM strategy.

Biography

Dr. Mujammal Ahmed Hasan MUJAMMAL is an element in Research Laboratory of Electrical Engineering & Automatic, university of Medea, Algeria. He holds a PhD specializing in advanced Direct Power Control (DPC) strategies for solar energy systems using artificial intelligence. A member of the Research Laboratory of Electrical Engineering & Automatic, his expertise spans renewable energy, AI-based control systems, and DC microgrid power management.

Dr. Mujammal has published extensively on innovative energy solutions, including hybrid MPPT strategies and smart power control techniques, and teaches various courses in control systems and renewable energy. He also collaborates on projects aimed at enhancing hybrid wind and solar energy systems, leveraging a well-equipped Smart Grid Lab).

Dr. Katherine Johnson

Johnson Consulting Group, Frederick, MD 21702

Planting Trees: A Shady Solution to Climate Change

Abstract

Trees have been described as the "lungs" of the Earth. Besides shading us on hot days, trees store carbon, create diverse habitats, and beautify our Earth. However, while carbon offsets to plant trees are growing in popularity, recent studies suggest that we don't have the right kind of trees or enough of them to meet these lofty goals.

This paper will highlight how electric utilities in the United States are using tree-planting programs as part of a broader energy efficiency strategy. Utilities, working with local and national conservation groups such as The Arbor Day Foundation, are targeting tree planting campaigns in urban areas to counteract the heat-island effect. Other effective tree planting strategies include giving away free trees to homeowners if they promise to plant the trees to create shade during hot summer months-and thus reduce electricity use associated with air conditioning.

The findings presented in this paper are drawn from multiple program evaluations of tree-planting programs. This paper will offer attendees a new way to consider developing sustainability programs that focus on trees, rather than technologies, to address climate change.

Biography

Dr. Katherine Johnson is President of Johnson Consulting Group, a woman-owned consulting firm specializing in energy efficiency near Washington, D.C. For more than 30 years, she has directed more than 150 program evaluations investigating the effectiveness of energy efficiency programs. For the past 12 years, she has led collaborative forums advising public service commissions and government agencies on energy efficiency policies and initiatives.

She has authored multiple peer-reviewed papers documenting energy-efficiency program “best practices” and has written five books and one novel. She hosts “The KJ Show” on the BoldBraveTV network every Wednesday at 11 a.m. (Eastern) discussing emerging energy trends and policies. She also wrote her best-selling book: Your Handbook for Energy Savings: Seven Easy Ways to Save Energy and Planet, which provides easy tips on energy efficiency for homeowners.

Sumaira Nazar Hussain

Institute of Advance Study, Shenzhen University 518060, China

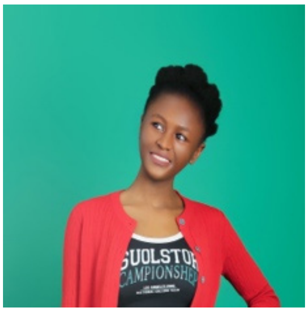
Zinc and Cobalt alloy embedded nitrogen-doped mesoporous carbon (ZnCo-NMC) composites for efficient oxygen evolution reaction

Abstract

In recent years, there has been increasing interest in developing efficient catalysts for the Oxygen Evolution Reaction (OER) by incorporating transition metals and heteroatoms into carbon-based materials. In this study, we investigate the OER in electrochemical water splitting using zinc (Zn) and cobalt (Co) embedded nitrogen-doped mesoporous carbon (ZnCo-NMC) composites. The OER activity of the (ZnCo-NMC) catalysts was evaluated using various electrochemical techniques in 0.5 M H2SO4. The results revealed that (ZnCo-NMC) composites exhibit significantly enhanced OER activity compared to pristine mesoporous carbon materials, with a lower onset potential of 148 mV at 10 mA cm-2 current density and a small Tafel slope of 34 mV dec-1, attributed to additional active sites provided by Co and Zn species. The higher electronegativity of N dopants modifies the electronic structure of the carbon matrix to promote charge transfer, enhancing the electron donor-acceptor properties and promoting stronger π-bonding. The mesoporous carbon framework imparts structural integrity in the ZnCo-embedded NMC composite, preventing agglomeration or leaching of ZnCo nanoparticles. This ensures exceptional stability during prolonged Oxygen Evolution Reaction (OER) operation, maintaining catalytic activity. The results indicate potential applications in renewable energy technologies, paving the way for the development of efficient Oxygen Evolution Reaction (OER) electrocatalysis through the incorporation of transition metals and heteroatoms in carbon-based materials.

Biography

I, Dr. Sumaira Nazar Hussain is a postdoctoral researcher at the University of São Paulo, Institute of Chemistry, São Carlos. I obtained my Ph.D. in Chemistry from Wuhan University, China, where she focused on electrocatalysis and energy conversion technologies. My research expertise includes the design and development of advanced nanomaterials for electrochemical applications, particularly in water splitting and energy conversion. Currently, I am investigating the electrooxidation of lignin and related catalytic processes. I have published several research articles in peer-reviewed journals and actively participates in international conferences. I also been involved in teaching and mentoring students in the field of materials chemistry and electrochemistry. With a strong background in surface chemistry, catalyst design, and reaction mechanisms, I aims to contribute to the advancement of sustainable energy solutions. My work integrates experimental and theoretical approaches to optimize electrocatalysts for green energy applications.



Fomekong Fomekong Rachel Merveille

Guangdong Ocean University, China

Application of SLAM and Sensor Fusion in Renewable Energy Systems: Advancing Autonomous Monitoring and Maintenance

Abstract

The usage of autonomous systems for efficient monitoring and maintenance is growing in the renewable energy industry. However, there are still challenges in ensuring reliable and accurate data collection, particularly in remote and difficult-to-reach areas. This paper explores the use of Simultaneous Localization and Mapping (SLAM) in conjunction with deep learning and sensor fusion techniques to improuve autonomous robotic systems for renewable energy applications. The suggested research aims to elaborate the improvements of wind turbines and solar farms inspection and maintenance by utilizing state-of-the-art sensors and real-time decision-making algorithms. A preliminary study shows that sensor fusion improves localization and environmental mapping accuracy, both of which are important for ensuring operational efficiency in renewable energy systems. The usage of autonomous systems for efficient monitoring and maintenance is evolving in the renewable energy industry. However, there are still challenges in ensuring reliable and accurate data collection, particularly in remote and challenging-to-reach areas. This study explores the use of SLAM integrating deep learning and sensor fusion techniques to enhance robotic systems for renewable energy applications. The suggested reseach aims to improve wind turbine and solar farm inspection and maintenance by utilizing state-of-the-art sensors and real-time decision-making algorithms. A preliminary study indicates that sensor fusion improves localization and mapping of environment accuracy, both of which are essential for ensuring operational efficiency in renewable energy systems.

Biography

FOMEKONG FOMEKONG RACHEL MERVEILLE is a Ph.D. student in the School of Naval Architecture and Maritime (Underwater Robotics) at Guangdong Ocean University, China. Her research focuses on underwater robotics, SLAM, and multi-sensor fusion, particularly integrating deep learning to improve navigation in Unmanned Underwater Vehicles (UUVs). She holds a Master's in Control Engineering from Huzhou University, where she designed an industrial robotic arm with modular end-effectors using AutoCAD, SolidWorks, and Fusion 360. She also has a Bachelor's in Physics. Merveille is skilled in programming, 3D modeling, and system integration, using tools like PyTorch, ROS, and Fusion 360. She has published peer-reviewed research and operated UUVs in diverse marine settings. A recipient of several academic honors, she also mentors students and leads collaborative research projects. Her goal is to apply advanced technology to global challenges in ocean science and robotics.

Khaled Almazam

Najran University / College of Engineering, Saudi Arabia

Energy Performance Analysis of BIPV Double-Skin Facades with Phase Change Material in a Commercial Building in a Hot-Arid Climate

Abstract

This study investigates the energy performance of a Building Integrated Photovoltaic (BIPV) double-skin facade (DSF) integrated with Phase Change Material (PCM) in a minimum standard commercial building in Riyadh, Saudi Arabia, focusing on the south facade. Riyadh's hot-arid climate, characterized by high daytime temperatures (up to 43°C) and warm nights (around 30°C), presents significant cooling demands, making effective thermal insulation critical. Four facade configurations are analyzed using simulations in eQUEST: a base case (traditional BIPV DSF without PCM) and three scenarios incorporating 1 cm thick transparent paraffin wax PCM (melting point 28°C, latent heat 200 kJ/kg) in different positions: (1) PCM laminated to the outer side of the inner window, (2) PCM between the BIPV and air gap, and (3) PCM on the outer side of the BIPV. Simulation results estimate cooling energy reductions of 15-20% for Scenario 1, 20-30% for Scenario 2, and 10-15% for Scenario 3 compared to the base case, with Scenario 2 being the most effective due to its ability to cool the BIPV panel and minimize heat transfer to the interior. Despite challenges posed by warm nights limiting PCM cycling, partial phase change still provides significant benefits. These findings underscore the potential of PCM-enhanced BIPV DSF to improve energy efficiency in hot climates, with Scenario 2 recommended for maximum performance. Further research into higher-melting-point PCMs and advanced simulation tools is suggested to optimize system design.

Biography

Khaled Almazam, an assistant professor at Najran University in Saudi Arabia, earned his Ph.D. and Master of Arts in Architecture from the University of Kansas and a Master of Science in Architecture from the University of Arizona. He specializes in energy systems and is an expert in Building-Integrated Photovoltaic (BIPV) systems and sustainability.

Hari Kumar Suberi

National consultant, Bhutan

Rooftop solar PV in Bhutan: A systemic analysis of feed-in-tariff program

Abstract

Solar photovoltaic (PV) systems are critical to the global electrification efforts, especially in the rural and remote communities of the developing countries. This study analyses the prospects of a feed-in-tariff program for solar PV systems in Bhutan. It is based on the analysis of a pilot project covering 361 households in rural areas of Bhutan. A mix of qualitative and quantitative methods is applied, which captures the multi-disciplinary variables and generates primary data from the pilot project in Bhutan. The two critical variables argued are user acceptability and financial sustainability in the long-term in the context of access to clean energy and empowerment in rural areas. From the field data assessment, it was found that the low existing energy tariff has a cybernetic effect on user acceptability and the financial sustainability of the solar PV feed-in-tariff system in Bhutan. The current tariff rate for low voltage (LV) consumers is $ 0.038/kWh whereas the solar energy generation cost ranges between $ 0.04–0.045/kWh considering the PV project life of 25 years. The findings of the study suggest that users are willing to accept the feed-in-tariff as an enabler for rural livelihood provided the tariff rate is reasonable (at least in the range $ 0.05 to 0.07/kWh) to sustain the capital investment.

Biography

Dr. Suberi complected his PhD in 2021 on the topic sustainable mobility system and human-wellbing by implementing research throgh design methodology. His works are mostly related to 100% renewable energy strategy and clean economic growth to enable sustainble society formation.

Baba Libasse Sow

WASCAL/UTG, The Gambia

The role of African universities in handling climate change

Abstract

Background: African countries are among the most vulnerable and affected by climate change. Comprehending climate change poses a major hurdle for the African population, politicians, and the African Union alike, presenting a substantial challenge for all involved. It is generally accepted that universities and other higher education institutions must play a leading role as drivers of change. Therefore, it is very important that African universities educate students about both mitigation and adaptation measures, develop the necessary initiatives to foster research in climate change-related topics and promote cooperation and alliances with key stakeholders.

Biography

I am is a seasoned researcher and educator specializing in climate change, sustainability, and education. I currently work as a researcher at the University of The Gambia, focusing on sustainability and climate change management. I have an extensive background in environmental education, having served as a lecturer in various universities, including the University of The Gambia and Hamburg University of Applied Sciences in Germany. My teaching and research have focused on sustainable practices, climate change adaptation, and social resilience in African communities. In addition to my academic work, I have consulted for projects such as the Ecogeste initiative, under Senegal's Ministry of Environment, where I promoted sustainable development and ecological transition.

Mujammal Ahmed Hasan MUJAMMAL

IRIMAS Laboratory, University of Haute Alsace, Mulhouse, France

Revolutionary Solar Solutions: AI-Powered Smart Control for Ultimate Energy Efficiency

Abstract

Discover a groundbreaking Direct Power Control (DPC) strategy that leverages cutting-edge artificial intelligence (AI) to revolutionize solar power conversion. Traditional DPC methods, reliant on grid voltage-modulated (GVM) approaches, face several significant drawbacks, including incomplete decoupling of active and reactive powers, restrictive tuning of proportional-integral (PI) controllers, and complex structural de sign. These limitations result in major ripples in grid currents, reducing the robustness and stability of the entire system. Additionally, sudden changes in irradiation and temperature further challenge system performance, diminishing overall stability and efficiency. This paper introduces an innovative smart predictive adaptive algorithm based on neural network control (NNC) to address and overcome these challenges. By replacing the GVM controller and DC link voltage controllers with advanced NNC, we achieve several advantages. Neural network control offers superior adaptability, learning capabilities, and real-time optimization, leading to enhanced control precision and system stability. It effectively mitigates the issues of incomplete decoupling and restrictive tuning, providing a more resilient and efficient control mechanism. Rigorous numerical simulations in MATLAB Simulink validate the effectiveness of our approach. Comparative results showcase remarkable improvements in both transient response and s teady-state conditions, highlighting the superior efficiency and robustness of our AI-driven strategy. The comparative Total Harmonic Distortion (THD) results prove the superior performance of the proposed algorithm, with a THD of 0.98% compared to 1.12% for the traditional algorithm. Embrace the future of solar energy with this transformative technology that promises to redefine power control and efficiency.