SOUTH ASIA FOUNDATION SPONSORED

National Conference on Green Energy Technologies for Sustainability

21st & 22nd MARCH 2024
PONDICHERRY UNIVERSITY

NCGETS 2024

Organized By
PONDICHERRY UNIVERSITY
Department Of Green Energy Technology
Madanjeet School Of Green Energy Technologies

BOOK OF ABSTRACTS & SOUVENIR

Canara Bank
A Government of India Undertaking
Together We Can

Peaceful Puducherry
Give time a break.

NCGETS 2024

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National Conference on Green Energy Technologies for Sustainability (NCGETS 2024)

BOOK OF ABSTRACTS & SOUVENIR

21st & 22nd MARCH 2024

PONDICHERRY UNIVERSITY

Organized By

Department Of Green Energy Technology

Madanjeet School Of Green Energy Technologies

PONDICHERRY UNIVERSITY

Pondicherry University
(A Central University)

புதுவை பல்கலைக்கழகம் (மத்திய பல்கலைக்கழகம்)

पांडिचेरी विश्वविद्यालय (केंद्रीय विश्वविद्यालय)

Prof. K. Tharanikkarasu

பேராசிரியர். க. தரணிக்கரசு

प्रोफ़ेसर. क।. ठरनिकरसु

Vice Chancellor(i/c)

துணைவேந்தர்(பொ)

कुलपति(प्र)

Dr.Ambedkar Administrative Building,
R.Venkataraman Nagar,
டாக்டர்.அம்பேத்கர் நிர்வாகக் கட்டிடம்,
ஆர்.வெங்கடராமன் நகர்,
डॉ.अंबेडकर प्रशासनिक भवन, आर.वेंकटरमण नगर,
Kalapet, Puducherry – 605014
காலாப்பேட், புதுச்சேரி – 605014
कालापेट, पुडुचेरी – 605014

FOREWORD
Welcome to NCGETS 2024!

It gives me great pleasure to welcome you all to the National Conference on Green Energy Technologies for Sustainability on March 21st & 22nd 2024 (NCGETS 2024), organised by the Department of Green Energy Technology, Pondicherry University with South Asia Foundation(SAF) as partner.

The conference aims to bring together experts from academic, industry, and government to discuss the latest developments in green energy technologies and their applications for sustainable development. This is an excellent active forum for the participants and experts to explore and discuss the advancements in Green Energy Technologies. I am confident that this conference will provide a platform for fruitful discussions and knowledge sharing in its best.

The conference will feature several invited speakers, technical sessions, and poster presentations covering a wide range of topics related to most of the green energy technologies, includes Solar Photovoltaic, Solar Thermal, Bio-Energy, Ocean and Wave Energy, Energy Storage, Green Buildings, Energy Conservation and Efficiency.

I encourage all the particpants to make the most of this opportunity to engage with fellow researchers and practitioners, and to share their experiences and insights. I am certain that the ideas and solutions generated at this conference will contribute to the advancement of green energy technologies and sustainable development.

I wish all those who have been associated with the conference all success in their endeavour

Prof. K. Tharanikkarasu

Madam France Marquet
Principal Trustee,
Madanjeet Singh Foundation(MSF)

I Thank Professor Tharanikkarasu, Acting Vice Chancellor of Pondicherry University; Prof Rajneesh Bhutani, Registrar; Prof. A. Subramania, Dean UMSGET; Prof. Arun Prasath, Head of Department of Green Energy Technology. Professors and sponsors for inviting me to the Two-day-National Conferences on Green Energy Technologies for Sustainability.

Not being a scientist myself, I feel deeply honored and at the same time humbled by this august gathering. I would like to quickly brief you on how this Institution was started and thanks to the vision and the funds provided by late UNESCO goodwill Ambassador Madanjeet Singh. In 1996 as personal Advisor to UNESCO Director General Federico Mayor Zaragoza, he was sent to Harare, Zimbabwe, for the inauguration of the UNESCO 1996-2005 World Solar Program. This experience had such a great impact on him that he wrote the book "*The Renewable Energy of the Sun*" and subsequently "*The Sun in myth and art*" edited and published by UNESCO. In 2020, When he decided to start the South Asia Foundation, establishing institutions on diverse subjects in countries of the SAARC region to promote regional cooperation, UMSGET was set up at the request of Vice Chancellor Prof. Jalees Tareen. and the first MoU was signed on 27 March 2010. On 16th April 2014, a couple of months after the passing away of our founder, I participated in the inauguration of the building. At that time Vice Chancellor Prof. Krishnamurthy invited me to plant a tree as a symbolic gesture. This tree has grown beautifully as the School has expanded, it is one of the most promising elite Institutions striving towards sustainable future through scientific research, it is where this conference is being conducted. The conference will bring together researchers, academics, industry, professionals and students to share their knowledge and ideas on the latest development in green energy technologies. This conference is offering a helping hand to understand and create a space for discussing alternatives and posing new ideas . I want to extend my gratitude to Pondicherry University and the entire team at Green Technology for making this possible. I take this opportunity to wish the Head of the Department and Convener of the conference Prof Arun Prasath and his colleagues who are involved, to make it a success The University Motto adorned with the sun is written in three languages: French *Vers la lumière*, Sanskrit: *प्रकाशाय* and in Tamil:*வெளிச்சத்திற்கு*. It's a living proof of your cultural richness . I wish you all a productive and enjoyable conference.

Madam France Marquet
Principal Trustee,
Madanjeet Singh Foundation(MSF)

PONDICHERRY UNIVERSITY

DEPARTMENT OF GREEN ENERGY TECHNOLOGY
MADANJEET SCHOOL OF GREEN ENERGY TECHNOLOGIES

PREFACE

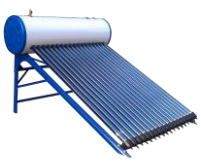
The extensive and ever-expanding use of fossil fuels for energy purposes has triggered several global issues such as climate change, global warming, environmental pollution, energy crisis, etc. Thus, the need arose to develop greener and cleaner energy technologies to have a higher potential to solve these major global issues. A quantum leap transition from carbon-based fossil fuels to non-carbon-based and carbon-neutral fuels is essential to address the urgent need to mitigate the impacts of climate change. The quantum leap transition entails for radical and massive transformation towards greener and cleaner energy technologies such as solar, wind, hydro, ocean, wave, waste-to-energy, geothermal power, hydrogen energy, and the development of new technologies like fuel cells, hydrogen, electrolyzers, electrical mobility, more efficient energy storage systems, carbon capture, utilization, and storage technologies, green building and green chemical technologies, *etc.* can help reduce carbon emissions. Thus, globally collective efforts by governments, businesses, researchers, technology developers and environmentally conscious individuals working towards the promotion/development of green and clean energy technologies to achieve a greener and cleaner environment, energy security, and sustainable development. This two-day "National Conference on Green Energy Technologies for Sustainability NCGETS 2024", organized by the Department of Green Energy Technology, Pondicherry University with the support of Madanjeet Singh's SAF brings together researchers, academics, industry professionals, and students to share their knowledge and ideas on the latest developments in green energy technologies for sustainability. I am sure that this vibrant conference will bring the required knowledge that you are looking for to progress on sustainability.

Prof. R. ARUN PRASATH

Head & Convenor

About NCGETS 2024

Two days National Conference on Green Energy Technologies for Sustainability is designed to deliberate research and technological development in various renewable energy technologies. Experts from various discipline of renewable energy shall present their research findings and thoughts on the subject matter. Young scientists and scholars will have the opportunities to interact with their peers and present their recent research findings through oral and poster presentation.



Topics

Advanced Energy Materials
Energy Storage & Conversion
Photovoltaic Technology
Solar Thermal Energy Technology
Bioenergy / Biofuels
Green Hydrogen & Fuel Cell Technology
Batteries & Supercapacitors
Wind/Ocean/Tidal Energy Technology
Computational & Simulation
Waste to Energy Technology
Machine Learning & Artificial intelligence
Carbon Capture and Storage
Energy Management Systems
Smart Grid Technology
Photo/Electro Catalytic Materials
Thermoelectric Technology

Department of Green Energy Technology

The Department of Green Energy Technology was established in 2010 under the aegis of Madanjeet School of Green Energy Technologies with a vision to promote education and research in Renewable and Green energy. DGET offers M. Tech in Green Energy Technology which is supported by South Asia Foundation and Ph.D. in the field of renewable energy & related subjects. The Ministry of New and Renewable Energy has recognized and approved the Department as a Nodal Centre in the fields of all clean Energy sources. DGET has proficient faculties to teach, offer consultancy and take up research work in several core areas of energy. The center has several MOUs with leading academic institutions and industries specializing in energy. DGET is constantly evolving and excelling in various fields of energy technologies, both in research and product development.

Madanjeet Green Energy Building

About Pondicherry University

Pondicherry University, established in 1985 is an Indian Central University is one of the most sought-after campuses amongst the students from across the nation as a destination for the Higher Education and Research. Pondicherry University has 15 Schools, 38 Departments, 11 Centres and 1 Chair offering over 144 PG, PG-Diploma/ certificate & Research programmes with a student strength of 7000 including foreign students. Currently the University has more than 130 funded research projects including SAP & FIST Projects from various agencies like UGC, DST, CSIR and DBT. The University has two-off campuses, one located in Port Blair (Andamans) with two Departments viz., Ocean Studies and Marine Biology and Coastal Disaster Management and another Post-Graduate Centre at Karaikal. Fresh green sprawling campus spread over 880 acres, features great Instrumentation & Resource facility, 100% Wi-Fi connectivity with 100% power back-up, 24x7 Library facility, 22 well-furnished hostels, Round the clock medical facility, Placement Cell, Community Radio (Puduvai Vaani) and Study India Programme.

Organising Committee

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Hon'ble Vice Chancellor(i/c),
Pondicherry University

PATRON

Prof. A. Subramania
Dean, MSGETs,
Pondicherry University

PATRON

Prof. Rajneesh Bhutani
Registrar(i/c),
Pondicherry University

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Head & Professor
DGET

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Professor

Dr. B.M. Jaffar Ali
Professor

Dr. P. Thilakan
Professor

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Professor

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Associate Professor

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Assistant Professor

Dr. Krishna Kumar Jaiswal
Assistant Professor

Dr. K. Karthik Selva Kumar
Assistant Professor

Dr. Krishna Villa Harika
DST-Inspire faculty

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Central University of Jammu

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SRMIST, KTR, Chennai

Prof. B. Neppolian
SRMIST, KTR, Chennai

WORKING COMMITTEE

WE THANK ALL THE COMMITTEE MEMBERS AND STUDENT VOLUNTEERS

Committee	Team Members
Registration	**Dr. R. Arun Prasath** Mr. G. Gururaj, Ms. A. M. Fathimathul Faseena, Ms. D. Sruthi, Mr. K. Manikandan & Ms. Agiya Fathima
Abstract & Souvenirs	**Dr. P. Thilakan, Dr. Prasanth Ravindran, Dr. A. Sreekumar** Mr. Vinoth, Ms. Soumya Jha, Ms. Mousami Barman & Mr. Aravind
Food & Refreshments	**Dr. R. Arun Prasath, Dr. Krishna Jaiswal & Dr. Karthick Selva Kumar** Ms. P. Swathi, Ms. S. Sandhiya, Mr. Guguloth Praveen, Ms. J. Jayapratha, Mr. Prem kumar, Mr. Niranjan Taid, Ms. Keerthana Dileep, Ms. Mrinal, Ms. Bhargabi Halder, Mr. Prattay Bhattacharya & Ms. Agiya Fathima
Transportation	**Dr. B.M. Jaffer Ali** Ms. Aparna Markose, Ms. Malavika Sunil, Mr. Abijith, Mr. Baranedaran & Mr. Sharafudeen
Accommodation	**Dr. P. Elumalai** Mr. Kannadasan, Mr. Ragul, Mr. Sujithkrishnan & Ms. Archana Suresh
Sponsorships	**Dr. R. Arun Prasath** Mr. Prattay Bhattacharya, Ms. Agiya Fathima & Mr. C. Surya Kumar
Cultural Events, Stage & Controls	**Dr. D.S. Sharada** Ms. D. Sruthi, Ms. Jayapratha J, Ms. Keerthana Dileep Mr. Aravind & Mr. Prem kumar, Mr. Sudhanshu Pandey, Mr. I. Vasanthmani , Mr. Gowdham Suriya, Mr. G. Gururaj
Master of Ceremony	**Dr. S Sivasankari** Ms. Archana Suresh, Ms. Malavika Sunil S, Ms. Cheryl B. Pohrmen, Ms. Litto Mary Tom & Ms. SoumyaJha
Publicity	**Dr. Villa Krishna Harika** Mr. C. Surya Kumar, Mr. Sudhanshu Pandey, Mr. Ragul & Mr. Gopi
Finance & Accounts	**Dr. R. Arun Prasath & Dr. Krishna Jaiswal** Mr. Sudhanshu Pandey, Mr. Prem kumar, Ms. Mrinal & Ms. Cheryl B. Pohrmen

SOUTH ASIA FOUNDATION SPONSORED

NATIONAL CONFERENCE ON GREEN ENERGY TECHNOLOGIES FOR SUSTAINABILITY

NCGETS 2024

21st & 22nd March, 2024

PONDICHERRY UNIVERSITY

DEPARTMENT OF GREEN ENERGY TECHNOLOGY

PROGRAM SCHEDULE

DAY – 1 : 21st March 2024 | Venue: CCC Auditorium

REGISTRATION : 8:30 AM– 9:30 AM

INAUGURAL SESSION : 9:30 AM– 10:00 AM

HIGH TEA : 10.00AM – 10.15 AM

Talk No.	Timing	Name of the Speaker	Title of the Talk
1.	10:15 – 11.00 AM	**Prof. A. K. Shukla** IISc Bengaluru, Karnataka	Towards sustainable automotive mobility
2.	11.00 – 11:45 AM	**Dr. Dwipen Boruah** GSES India Pvt. Ltd., New Delhi	Setting up of Optimum Design Parameters for Agri voltaic Power Plants in Indian Geo-Climatic Conditions
3.	11:45 – 12:30 PM	**Prof. Satish A. Patil** IISc Bengaluru, Karnataka	Emerging Renewable Energy Technologies to Enable Net-Zero
4.	12.30– 01.15 PM	**Prof. Ravi Kumar Asthana** BHU Varanasi, Uttar Pradesh	Microalgae as a Feedstock at Industrial Scale for Biofuel Production: Constraints of Biomass & Esterification of Lipids
SESSION-1 **Session Chair:** Dr. Prasanth Ravindran , Dept. of Green Energy Technology			
Lunch Break	**01.15 – 02.15 PM (Sponsored by Shri. N. Rangaswamy, Hon'ble Chief Minister of Puducherry)**		
5.	02.15 – 03. 00 PM	**Prof. I. Sreedhar** BITS Pilani, Hyderabad, Telangana	Recent Advances in CO_2 Methanation-A Clean and Green Route of CO_2 Utilization
6.	03.00 – 03:45 PM	**Er. Haritha Potluri** SOLON India Pvt. Ltd. Hyderabad	Challenges and Opportunities in Solar Photovoltaic Technology
7.	03:45 – 04.30 PM	**Dr. A. S. Prakash** CECRI, Tamil Nadu	Advancements and Challenges in Sodium-Ion Battery Technology: From Novel Cathode Materials to Full-Cell Systems
SESSION-2 **Session Chair:** Dr. D.S. Sharada, Dept. of Green Energy Technology			
Tea Break	**04:30 – 04:45 PM**		
8.	04:45 – 05.30 PM	**ORAL PRESENTATIONS FROM PARTICIPANTS** **Session Chair:** Prof. K. Karthik Selva Kumar, Dept. of Green Energy Technology	
9.	05:30 – 06:30 PM	**POSTER PRESENTATIONS FROM PARTICIPANTS**	
10.	06:30 – 07:30 PM	**CULTURAL PROGRAM**	
11.	07:30 – 08:30 PM	**GALA DINNER**	

SOUTH ASIA FOUNDATION SPONSORED

NATIONAL CONFERENCE ON GREEN ENERGY TECHNOLOGIES FOR SUSTAINABILITY

NCGETS 2024

21st & 22nd March, 2024

PONDICHERRY UNIVERSITY

DEPARTMENT OF GREEN ENERGY TECHNOLOGY

PROGRAM SCHEDULE

DAY – 2 : 22nd March 2024 | Venue: CCC Auditorium

Talk No.	Timing	Name of the Speaker	Title of the Talk
1.	09:00 – 09:45 AM	**Prof. Raghuram Chetty** IIT Madras, Chennai, Tamil Nadu	Green Electrodeposition of Platinum Catalyst for Polymer Electrolyte Membrane Fuel Cells
2.	09.45 – 10:30 AM	**Er. Satyasai Kiran Turlapati** SOLON India Pvt. Ltd. Hyderabad	Future of Battery Technologies
3.	10:30 – 11:15 AM	**Prof. Bhaskar Singh** CUJ, Jharkhand	Advancements in Biofuel Production: From Feedstocks to Applications
SESSION-3 **Session Chair:** Dr. A. Sreekumar, Dept. of Green Energy Technology			
TEA BREAK 11:15 – 11:30 AM			
4.	11:30 – 12:15 PM	**Prof. P. Sankar Ganesh** BITS Pilani, Hyderabad, Telangana	Dual role of integrated aerobic and anaerobic (IAAN®) reactor system for wastewater treatment and resource recovery
5.	12:15 – 01:00 PM	**Prof. Jitendra Sangwai** IIT Madras, Chennai, Tamil Nadu	Environmentally Sustainable Large Scale CO_2 Sequestration in Ocean for Sustainable Energy Transition
SESSION-4 **Session Chair:** Dr. S. Sivasankari, Dept. of Green Energy Technology			
LUNCH BREAK 01:00 – 2:00 PM			
7.	02:00– 02:45 PM	**Prof. P. Rajamalli** IISc Bengaluru, Karnataka	Systematic Investigation to Enable the High-Efficiency Thermally Activated Delayed Fluorescence Emitter for OLEDs
8.	02:45– 03:30 PM	**Dr. M. Mamatha Kumari** Yogi Vemana University, Andhra Pradesh	Nano-heterojunction Metal Oxide /Chalcogenide based Photocatalysts for Green Hydrogen Production
8.	03:30 – 04:15 PM	**Dr. Dwipen Boruah** GSES India Pvt. Ltd., New Delhi	Making net-zero campuses using energy efficiency and renewable energy technologies
SESSION-5 **Session Chair:** Dr. Krishna Kumar Jaiswal, Dept. of Green Energy Technology			
TEA BREAK 04:15 – 04:30 PM			
11.	04:30 – 05:30 PM	**POSTER PRESENTATIONS**	
	05:30 – 06:00 PM	**VALEDICTORY SESSION**	

Conference Statistics

Date: 21.03.2024 | 22.03.2024

- Total Registered participants – 189
- Invited speakers presented talks – 13

- Oral Presentations – 5
- Poster Presentations – 47
- Only Participation – 75
- Poster Presentations(DGET) – 25
- Only Participation(DGET) – 37

Participants from 18 Different Cities

Puducherry
Chennai
Ooty
Vellore
Coimbatore
Madurai
Villupuram
Dharmapuri

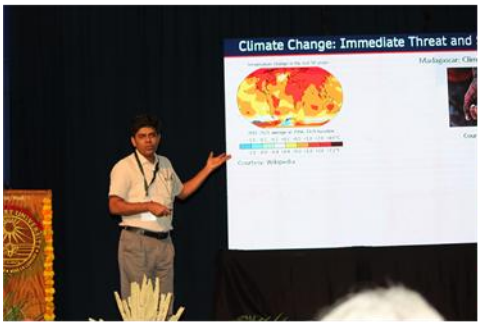
Belgavi
Manipal
Bengaluru
Mysore

Ghaziabad
Gorakhpur
Banaras/Varanasi

FRAMED MOMENTS

DAY 01









FRAMED MOMENTS

DAY 02

BEST Poster Awards

1

Ms. PAVITHRA K
Ph.D. Research Scholar
CSIR CECRI

E05 "Highly Stable Bi-Functional $MnCo_{2-x}Cu_xO_4$ Spinel Oxide Catalyst for Oxygen Reduction Reaction (ORR) and Oxygen Evolution Reaction (OER) in Li–O_2 Battery"

2

Ms. MONICA V
Ph.D. Research Scholar
JAIN UNIVERSITY

E17 "Impact of ligand modification on hydrogen evolution reaction using silver and ruthenium based N–heterocyclic carbene complexes"

3

Mr. SHAHRUKH NAWAJ ALAM
Ph.D. Research Scholar
Central University of Jharkhand

E43 "Valorization of Macroalgae Residual Biomass via Pyrolysis: Optimization and Life Cycle Analysis"

We Cordially Congratulate all the Particpants for their Valuable Presentations

NCGETS...

Follow our Website

https://tinyurl.com/4xkhtv5m

https://pib.gov.in/PressReleasePage.aspx?PRID=2016123
https://sites.google.com/pondiuni.ac.in/ncgets-2024/home
https://www.pondiuni.edu.in/department/unesco-chair-on-renewable-and-clean-energy-for-sustainable-development

Special Service and Features

Azadi Ka Amrit Mahotsav

Two-day National Conference on Green Energy Technologies for Sustainability (NCGETS-2024) at Pondicherry University Pondicherry

Posted On: 22 MAR 2024 7:05PM by PIB Chennai

The Two Day National Conference on Green Energy Technologies for Sustainability (NCGETS2024) commenced amidst great anticipation and enthusiasm at Pondicherry University. The inaugural session began with the rendition of the University Anthem, setting the tone for the day's proceedings. Professor R. Arun Prasath, the Convenor and Head of Green Energy Technology, extended a warm welcome and about the conference.

Prof. R. Arun Prasath expressed gratitude to all dignitaries and sponsors such as South Asia Foundation, India, Hon'ble CM of Puducherry Shri Rangaswamy, Govt of Puducherry, Puducherry Tourism, Canara Bank, Solon India Pvt Ltd, Ather Electric, Association for Promoting Sustainability in Campuses and Communities, M/s. The National Scientific, Laser Spectra Services India Pvt. Ltd, CHEMFAB Alkalis Limited, Global Sustainable Energy Solutions, Sisco Research Laboratories (SRL) Pvt. Ltd, Sai Scientific & Surgicals, TVS Electric, and Entuple Technologies Pvt ltd for their support in organizing the conference.

Professor R. Arun Prasath emphasized the significance of collaborative efforts in addressing the global issue such as climate change, global warming, environment pollution, energy crisis, etc. due to use of carbon based fossil fuels. The need arose to develop greener and cleaner technologies to have a higher potential to solve these major global issues. He stressed that a quantum leap transition from carbon-based fossil fuels to non-carbon-based and carbon-neutral fuels is essential to address the urgent need to mitigate the impacts of climate change. The importance of the quantum leap transition entails radical and massive transformation towards greener and cleaner energy technologies such as solar, wind, hydro, ocean, wave, waste-to- energy, geothermal power, hydrogen energy, and the development of new energy conversion and storage like fuel cells, hydrogen, electrolyzers, electrical mobility, more efficient energy storage systems, carbon capture, utilization, and storage technologies, green building and green chemical technologies, etc. can help reduce carbon emissions for cleaner environment. Prof. Arun said that the global collective efforts by governments, businesses, researchers, technology developers and environmentally conscious individuals working towards the promotion/development of green and clean energy technologies to achieve a greener and cleaner environment, energy security, and sustainable development is the need of the hour. This two-day "National Conference on Green Energy Technologies for Sustainability NCGETS 2024" will support towards achieving sustainability. In addition, Prof. R. Arun Prasath highlighted the department's commitment to fostering innovation and research in green energy technologies, underscoring the pivotal role of education and knowledge exchange in achieving sustainability goals.

The Honourable Vice-Chancellor Prof. Tharanikarasu, Guest of Honour Madame France Marquet, Trustee of MSF and UNESCO SAF representative and other dignitaries, - highlighting the conference's objectives of bridging academia and industry to foster collaborative learning and innovations for sustainable developments. This was followed by the lamp lighting ceremony marking the start of the event, symbolizing the pursuit of innovative solutions in green energy by dignitaries. In the later event, the dignitaries released the abstract book for the NCGETS Conference 2024. Prof. A. Subramania, Dean of Mandanjeet Singh School of Green Energy Technologies, delivered a felicitation address, emphasizing the transition to clean and green technologies. Presiding over the ceremony, Honourable Vice-Chancellor Prof. Tharanikarasu addressed the current challenges, citing examples like water scarcity in Bangalore, and stressed the need for sustainable processes without compromising ecosystems. He praised the research efforts of the Green Energy Department and urged them to expand nationally under the National Education Policy.

Madame France Marquet reminisced about the achievements of the late goodwill Ambassador and SAF founder Madanjeet Singh, sharing his vision of renewable energy and presenting a memorial video. Guest of honor Prof. A.K. Shukla from IISc Banglore discussed the five main changes humanity faces today and emphasized green hydrogen production as a sustainable energy solution, highlighting global initiatives in countries like the UK, US, Europe and Japan. The inaugural session concluded with Prof. P. Elumalai, Co-convenor of the conference, thanking all dignitaries followed by the national anthem.

The morning session featured a plenary lecture by Prof. A.K. Shukla from IISc Bangalore, renowned for his expertise in green energy research. This was followed by invited talks from keynote speakers, comprising two sessions, where experts shared their research findings and innovative approaches to address sustainability challenges.

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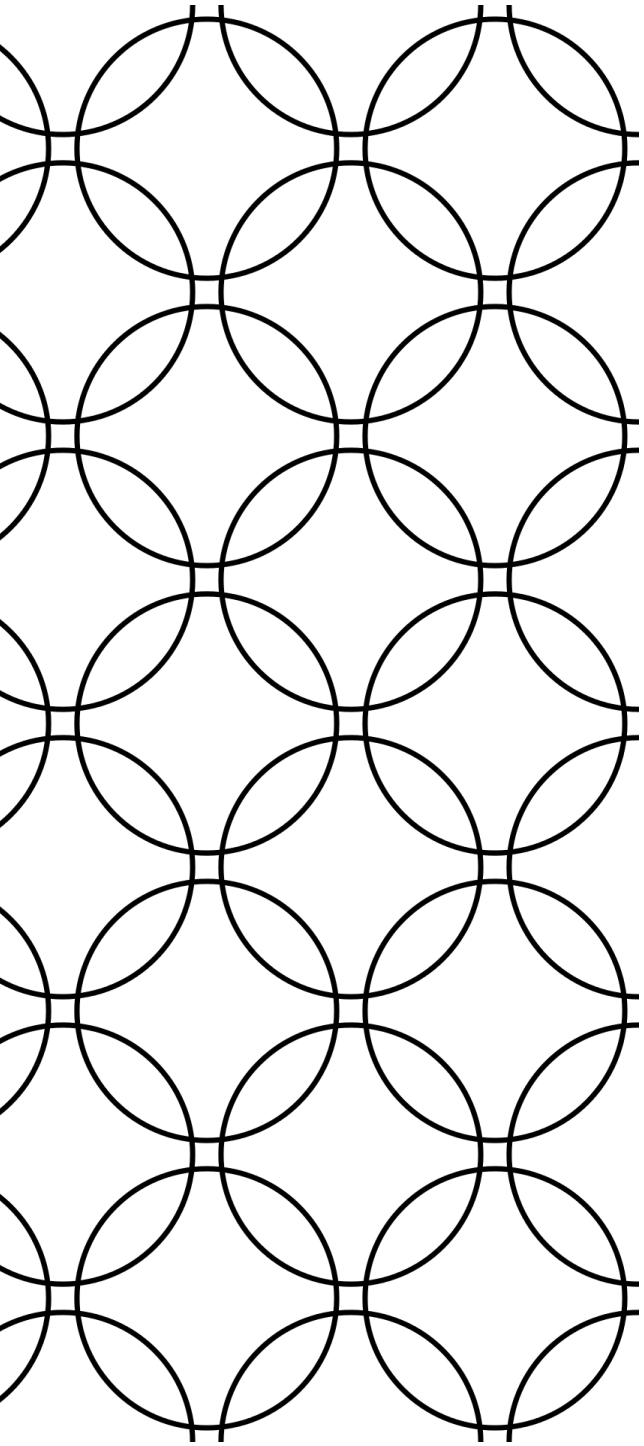
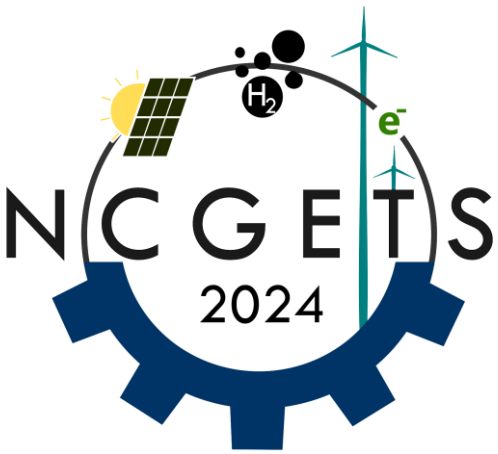
https://www.youtube.com/watch?v=xrYXJhgyugg
https://www.youtube.com/watch?v=yKqv3eJ5aCM





INVITED LECTURES

Towards sustainable automotive mobility

Prof. A.K. Shukla
PhD (IIT Kanpur), FASc, FNASc, FNAE,FNA, FECS(US)

Retired Honorary Professor
Solid State and Structural Chemistry Unit
Indian Institute of Science Bangalore – 560012, India
E-mail: akshukla2006@gmail.com

Abstract

Deteriorating urban air-quality, growing dependence on insecure energy sources and global warming are forcing a re-examination on the use of internal combustion vehicles as the basis for automotive mobility throughout the world. For alternative automotive, the performance of existing internal engine vehicles is likely to be the yardstick against which other power trains will be compared. This lecture is an appraisal of a variety of proposed electrochemical systems for sustainable automotive mobility.

Recent Advances in CO_2 Methanation-A Clean and Green Route of CO_2 Utilization

Prof. Inkollu Sreedhar*

Department of Chemical Engineering, BITS Pilani Hyderabad Campus, Hyderabad 500078, India*
Corresponding author E-mail: isreedhar@hyderabad.bits-pilani.ac.in

Abstract

Global warming stands as a pressing global issue, primarily driven by the proliferation of greenhouse gases such as CO2, which significantly elevate the Earth's average temperature. Carbon capture is found to be a potential solution to tackle this issue but has become unviable due to commercial non-viability. Hence CO2 methanation which is a means of converting greenhouse gas to methane, a clean fuel has two-fold advantages in addressing global warming and clean energy needs. Consequently, researchers have explored alternative, environmentally friendly, and cost-effective methods to repurpose CO2 into valuable products. Among these, CO2 methanation emerges as a crucial process, converting CO2 into useful fuels like methane through various catalysts. This presentation serves as an introduction to the world of CO2 methanation, highlighting studies that underscore the efficacy of catalysts like Ni, synthesized through methods such as impregnation. By leveraging promoters like Si and Ce, and supports including zeolites, ceria, and MOFs, researchers have enhanced selectivity, particularly under high pressure, low humidity, and optimal temperature conditions. The discussion in this presentation extends to different reactor designs and operating parameters, with annular fixed bed reactors emerging as the most promising option for scalability. Various proposed mechanisms for the reaction, involving intermediates such as carbenes and formates, are examined alongside challenges like low-temperature operation and the identification of suitable support and promoter materials. Thermo-kinetic modelling studies shed light on the reaction dynamics, synthesized and discussed within the studies themselves. Looking forward, this presentation outlines recent advancements and future challenges in CO2 methanation. Electrochemical reduction methods employing Cu-based compounds and perovskite oxides, bio-electrocatalytic reduction utilizing microbial catalysts, and photocatalytic reduction employing noble metals like Ni, TiO2, and graphene as support materials all hold promise for transforming carbon dioxide into methane. In summary, this presentation is aimed to underscore the multifaceted nature of CO2 methanation research, emphasizing both recent strides and persistent challenges within.

Emerging Renewable Energy Technologies to Enable Net-Zero

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Abstract

The dependence on fossil fuels to meet our energy demands has come with major environmental costs due to catastrophic climate change. The energy transition to net-zero CO2 emissions sustainably requires radical technological transformations. Adapting renewable energy sources like solar and wind poses formidable challenges due to inadequate cost-effective energy storage technologies. In this regard, novel and disruptive renewable technologies are needed to achieve net-zero emissions. I will discuss using organic materials for redox flow batteries in this talk. Organic materials have already made considerable inroads into emerging optoelectronic devices such as organic light-emitting diodes, solar cells and transistors. In my talk, I will discuss the current status of organic semiconductors for energy generation and storage devices.

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Microalgae as a Feedstock at Industrial Scale For Biofuel Production: Constraints Of Biomass and Esterification of Lipids

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Abstract

Owing to the dwindling fuel-reserves (contributing nearly 67% of the global energy market) and continuous increase in the greenhouse gases, the fossil-fuel needs to be replaced by carbon neutral, renewable and sustainable clean-green energy sources such as biodiesel, bioethanol, biomethane and biohydrogen etc. Microalgae are believed to be the most suitable candidates for alternate bioenergy sources with high photosynthetic efficiency, low nutrient requirement, higher lipid accumulating tendencies under stress and minimal space requirement compared to the contemporary fuel crops (such as Jatropha and Soybean). So far, researches on National and International levels have not been able to produce microalgal biomass and lipid content to levels that will make biodiesel production from microalgae economical. The important constraints in industrialization i.e., designing of specific photobioreactor for more than 2g/L/Day biomass production and technology for cheaper downstream processing of algal biomass are main thrust areas to tackle with. Surface modified NiFe2O4 nanoparticles for the production of biodiesel from fatty acids and microalgae lipids Dunaliella salina were demonstrated by our group involving Department of Chemistry, BHU. Multiple characterization results showed an increase in physicochemical properties compared to unmodified ones. The surface modified NiFe2O4 catalyst performed the highest conversion of 99% in the esterification of free fatty acids was remarkable. The production of biodiesel from microalga, D. salina extract was attained using surface modified catalysts. Modern knowledge of gene sequences of genomes of microalgae compounded with bioinformatics, if employed in engineering of screened strains of microalgae such as Dunaliella, Chlamydomonas and Chlorella would certainly pave the way for such efforts towards sustainable renewable energy. Thus, in this context, we intended to improve the feasibility of biodiesel production by manipulating nutrient(s) for increased biomass production vis-à-vis optimization for hyper lipid production. We have succeeded in raising the neutral lipid up to 60% in D. salina. This lipid quality was comparable to biodiesel of International standard.

Setting Up of Optimum Design Parameters For Agrivoltaic Power Plants In Indian Geo-Climatic Conditions

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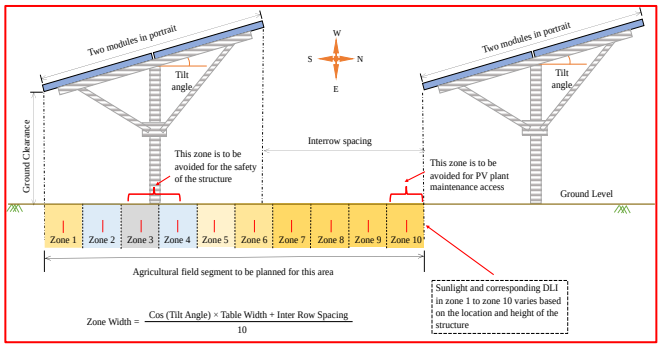
Abstract

Agrivoltaics, also known as Agro-PV, is the integration of solar photovoltaic systems and agriculture, enabling simultaneous production of food and renewable energy. This approach can improve land use efficiency, crop yields, and solar panel performance by providing a cooler microclimate. Agrivoltaics is a promising solution for addressing climate change, land scarcity, and population growth. In India, agrivoltaics has gained traction due to the country's vast agricultural land and abundant solar potential. A comprehensive study aims to establish design parameters for agrivoltaic power plants across various geo-climatic regions and soil types in India. The research explores India's major geo-climatic regions and soil types, examining crops cultivated in these regions and identifying critical plant characteristics for agrivoltaics. The study develops a methodological framework and matrix for determining suitable crops for agrivoltaic systems, and discusses the design and installation parameters of PV plants in agrivoltaic setups. The outcomes provide valuable insights and guidelines for the design, implementation, and promotion of agrivoltaic power plants in India to achieve maximum land equivalent ratio (LER).



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Challenges and Opportunities in Solar Photovoltaic Technology

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Abstract

India and most other Low- and middle-income countries (LMIC) are confronted by unique challenges related to the global emerging technological trends of solar photovoltaic (PV) modules. These challenges are not related to manufacturing of the product, but to predicting the value addition in economic and performance terms when the product is used. These challenges are further compounded in India by the low market value of energy produced and a skewed market, linked to the cost of capital. A situation contrastingly different to that of the power sector driven by good economic theories in wealthy nations. It is universally acknowledged and accepted that photovoltaic technology, be it for large scale power generation or simply electrifying simple rural household will continue and even accelerate along the growth path observed over the last decade or so. There is high probability that this growth path will continue and accelerate further at least for another decade or so as efficiencies continue to increase, prices fall, and demand expand. Near term future potential and demand for PV technology will also be enhanced as energy storage solutions evolve, prices drop and energy density increases. Even in the longer-term PV market prospects are good as measures to address global warming are enforced, green hydrogen or alternatives are adopted, each requiring a clean energy source for production. The challenges we encounter, be it for EPC or PPA types of projects are similar and centre upon incertitude in predicting levels of energy generation. Whilst long term detailed climatic data is readily available for insertion in predictive modeling of energy generation, little is known about the value addition achieved through the use of bifacial and larger solar modules where performance correlations with soil types, rooftop surfaces, incidence, latitudes, and other variables are little understood. This is a field of research with potential for great impact, important value addition to EPC/PPA projects where a precise knowledge of benefits from the current PV technology trends is critical. We at **Solon**, welcome a collaboration with the University of Pondicherry to address these critical issues which will facilitate an improved understanding of the merits and value addition of large bifacial solar modules in the Indian marketplace.

Advancements And Challenges In Sodium-Ion Battery Technology: From Novel Cathode Materials To Full-Cell Systems

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Abstract

Sodium-ion batteries (SIBs) have emerged as promising alternatives to lithium-ion batteries, offering potential advantages in resource abundance and cost-effectiveness. The pursuit of high-performance cathode and anode materials compatible with sodium-ion insertion/extraction processes has spurred innovation, showcasing notable potential in materials such as layered transition metal oxides, polyanionic compounds and hard carbons. This talk focus on the design and development of new cathode materials compositions and hard carbon production for sodium-ion battery demonstration. Further, ongoing developments in electrolytes, with a focus on enhancing sodium-ion transport and stability, coupled with novel cell configurations and sodium-ion full-cell systems, aim to overcome challenges associated with capacity and cycle life. Despite this progress, several challenges persist, including the quest for achieving high energy density, a comprehensive understanding of and effective mitigation strategies for electrode degradation mechanisms, and the optimization of large-scale manufacturing processes. This work emphasizes the ongoing efforts and potential breakthroughs in sodium-ion battery technology.

Green Electrodeposition of Platinum Catalyst For Polymer Electrolyte Membrane Fuel Cells

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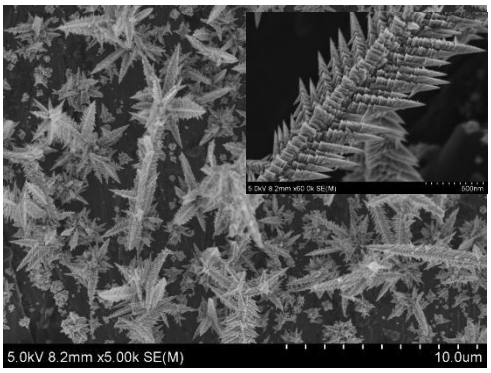
Abstract

The momentum gained by the hydrogen economy has brought Proton Exchange Membrane (PEM) fuel cells back into the public interest. Fuel cells are energy conversion devices that utilize hydrogen as fuel and oxygen as oxidant to generate electricity, with water as the byproduct. Despite their zero-emission, the high cost and durability issues associated with the commonly used Pt electrocatalyst have hindered their widespread commercialization. Efforts are directed to solve this issue by enhancing the utilization of Pt dispersed on a support material.

Several techniques are used to prepare supported Pt catalysts, such as thermal oxidation, chemical synthesis, atomic layer deposition, etc. Electrochemical deposition is one of the environmentally friendly methods because it provides several advantages, such as high purity, ambient condition operation, and use of aqueous solvents. More importantly, electrodeposition is particularly attractive for conductive support as it allows nucleation and growth of the nanoparticles on the substrate itself. In this work, the effect of electrodeposition conditions on the electrocatalytic properties of Pt nanoparticles was investigated for fuel cell applications. Pt nanoparticles were prepared by employing various electrodeposition techniques, viz. potentiostatic deposition, galvanostatic deposition, cyclic voltammetry, etc., optimizing the deposition parameters and thereby comparing the fuel cell performance between deposition techniques and achieving higher utilization of Pt.



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Future of Battery Technologies

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Abstract

Energy storage technologies play a crucial role in India's energy sector by offering solutions to enhance grid stability, facilitate the integration of renewable energy, and meet the increasing energy demand. India has been making significant progress in developing and implementing Energy Storage and Management Systems (EESS) to support its expanding power sector and transition towards a more sustainable energy future. This discussion provides an overview of energy storage technologies relevant to the Indian context, focusing on battery storage options such as sodium-ion and zinc-bromine batteries. It explores the current status, challenges, and opportunities in Na-ion and zinc-bromine battery technology for energy storage deployment in India, taking into account factors like material selection, cost, policy support, and technological advancements. Additionally, it sheds light on the research and development initiatives, partnerships, and endeavours carried out by research institutions and industries in India to drive the commercialization and utilization of advanced storage batteries across various sectors, including renewable energy integration, grid management, and rural electrification. The discussion also examines the role of government policies and regulations in promoting energy storage deployment and proposes future research directions to expedite the adoption of energy storage technologies in India's evolving energy landscape.

Advancements in Biofuel Production: From Feedstocks to Applications

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Abstract

Addressing the pressing need for sustainable energy sources amidst escalating global energy demands and environmental concerns, biofuels have emerged as a promising alternative. This talk comprehensively examines the multifaceted landscape of bioenergy, encompassing the drivers, generations, and production pathways of biofuels, along with their diverse applications and policy frameworks, with a specific focus on the Indian context. Beginning with an exploration of the various drivers propelling biofuel production, including the depletion of fossil fuel reserves and mounting concerns over greenhouse gas emissions, the address delineates the evolution of biofuels across different generations. It elucidates the concept of waste-to-energy conversion and highlights the pivotal role of biomass in bioenergy production, covering an array of feedstocks utilized in biofuel synthesis. Delving deeper into biofuel production, the address scrutinizes the processes and technologies involved in the generation of biofuels such as biobutanol, biodiesel, and bioethanol. Special attention is devoted towards our current ongoing works on the topics of innovative approaches like the transesterification of oleaginous feedstocks, utilization of waste cooking oil, and the exploitation of macroalgae for biofuel production, underscoring their potential in enhancing sustainability and resource efficiency. Furthermore, the address examines the applications of biofuels across various sectors, elucidating their role in mitigating environmental impacts and promoting energy security. It also provides insights into the Indian biofuel policy landscape, highlighting government initiatives and regulatory frameworks aimed at fostering the growth of the bioenergy sector.

Dual role of integrated aerobic and anaerobic (IAAN®) reactor system for wastewater treatment and resource recovery

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Abstract

Ammoniacal nitrogen concentration in wastewater has steadily increased in recent years, leading to environmental issues, including algal blooms in water bodies and altered biogeochemical cycles. Hence, treating ammoniacal nitrogen-rich wastewater (ANW) is imperative. Among others, the biological treatment of ammoniacal nitrogen is effective with minimum operation and maintenance costs. Anaerobic digestion is a proven technology for wastewater treatment and concomitant energy recovery as biogas. However, single-phase anaerobic digestion of ANW gets compromised, especially by altering the intracellular pH of methanogens, leading to low biogas production. Hence, a novel integrated aerobic and anaerobic (IAAN®) reactor system was developed to treat ANW. The novel IAAN® reactor system consists of simultaneous partial nitrification, anammox, and denitrification (SNAD) reactor, the aerobic step, followed by the intelligently stirred thermophilic anaerobic reactor (iSTAR®), the anaerobic step to augment ANW's treatment and produce methane-rich biogas as the final product. The final effluent from the IAAN® reactor system is of good quality and can be used in organic waste composting to adjust the moisture content in place of fresh water. The wastewater treatment plant operators can opt for a cost-effective ANW treatment technology rather than other cost-ineffective physicochemical treatment technologies requiring advanced infrastructure and trained human resources. The IAAN® reactor plays a dual role in treating ANW and recovering resources, including methane-rich biogas as bioenergy and nutrient-rich spent slurry as biofertilizer, thereby serving as a classic example of circular economy.

Environmentally Sustainable Large Scale CO2 Sequestration in Ocean for Sustainable Energy Transition

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Abstract

Energy transition will not be abrupt but slow till we find sustainable energy resources for the mankind. In view of increasing global warming and CO2 emissions, immediate actions are required to address these issues, which may involve storing large amounts of anthropogenic CO2 in geological and oceanic repositories. In terrestrial storage sites, CO2 tends to rise due to the underground temperature profile. Therefore, if the reservoir is not properly sealed, stored CO2 can escape from geological formations. On the other hand, oceanic sequestration holds great potential for long-term CO2 storage beneath the seabed, supporting the broader scientific and industrial community in achieving carbon neutrality. However, several key factors at the macroscopic level, including pressure and temperature conditions, sea depth, salinity, sediment porosity, sedimentary types, and the use of additives, are essential in realizing the full potential of subsea CO2 sequestration. A deeper understanding of the chemical interactions among CO2, hydrate-bearing sediments, additives, and marine environments is crucial for comprehending hydrate formation within subsea sediments. These dimensions offer a vast landscape for discussion, paving the way for future technological innovations. Consequently, there exists a broad scope for discourse in this field that will drive the development of novel technologies in the years to come.

Systematic Investigation to Enable the High-Efficiency Thermally Activated Delayed Fluorescence Emitter for OLEDs

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Abstract

Thermally activated delayed fluorescence (TADF) emitters have evolved as a certifying candidate in light generation technologies for producing efficient organic light-emitting diodes (OLEDs) on account of their 100% internal quantum efficiency (IQE) via reverse intersystem crossing (RISC) and toxic metal free design. Fast rate of RISC (kRISC) is the ultimate requirement of an efficient TADF emitter which can be achieved by minimizing the singlet-triplet energy gap (ΔEST). Here, four donor-acceptor type TADF emitters namely 3BPy-mDCz, 3BPy-mDTA, 3BPy-mDMAC, and 3BPy-mDPT proposed based on benzoyl pyridine (3BPy) as an unaltered acceptor and varying the donor strength ranging from carbazole to phenothiazine. The ΔEST values decreased from 0.15 to 0.09 eV upon increasing the donor strength predicting their TADF nature. The maximum external quantum efficiency (EQE) of 18.7% for 3BPy-mDCz, 22.5% for 3BPy-mDTA, 13.8% for 3BPy-mDMAC and 2.1% for 3BPy-mDPT were obtained. These drastic difference in the performances of 3BPy-mDTA and 3BPy-mDPT is due to the locally excited 3LE(T2) intermediate state between the lowest singlet (S1) and triplet (T1). Among the 3BPy-mDMAC and 3BPy-mDPT, the efficiency of 3BPy-mDMAC outperforms as compared to the 3BPy-mDPT on account of high photoluminescence quantum yield (PLQY) due to less CT character. This work paves a new direction for efficient TADF molecular design by indicating the role of intermediate triplet state (3LE) despite possessing high ΔEST values.

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Nano-heterojunction Metal Oxide/Chalcogenide based Photocatalysts for Green Hydrogen Production

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Abstract

Nanoscience and technology have opened up significant avenues in photocatalysis research, promising advancements in sustainable green energy. However, unmodified single semiconductor photocatalysts face limitations such as a restricted absorption spectrum, unproductive charge carrier recombination, and insufficient catalytic active sites. Among various strategies, semiconductor heterojunction construction has proven notably successful. This talk focuses on the rational design and development of efficient photocatalysts, emphasizing the precise suppression of charge carrier recombination to enhance redox reactions. Key aspects include morphology control, diverse heterojunction formation, synthesis methods, and optimizing reaction parameters for hydrogen production. Addressing broader challenges, the talk not only discusses the advantages and limitations of these strategies, but also offers practical insights to overcome hurdles in material synthesis and photocatalytic reactions.

ORAL PRESENTATIONS

O_01

A high-voltage Layered $NaNi_{0.5}Co_{0.1}Ti_{0.3}Sb_{0.1}O_2$ Cathode For Sodium-ion Batteries

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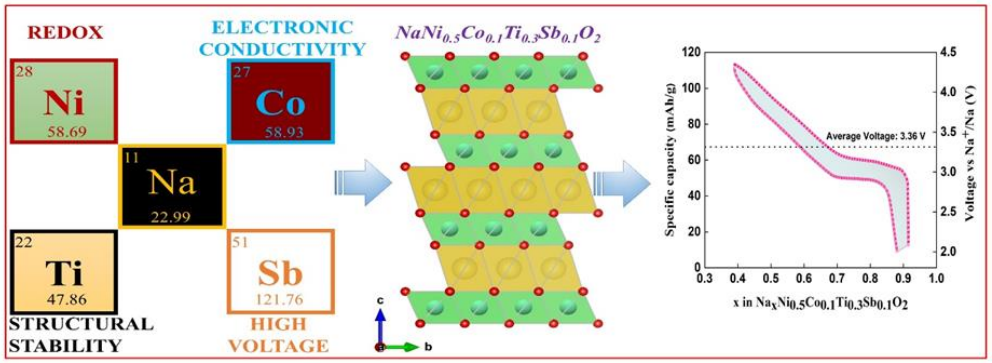
Abstract:

Developing a high voltage cathode material for sodium-ion batteries (SIB) is a great challenge. Herein, we report an O3-type layered $NaNi_{0.5}Co_{0.1}Ti_{0.3}Sb_{0.1}O_2$ cathode composition, which can operate at high voltage (4.35 V). Inclusion of different valence state transition metals like Ni, Co, and Ti and a metalloid Sb in the sodium metal oxide composition, leads to the formation of cationic disordered structure, which enhances redox, electronic conductivity, cycling stability, and working voltage. The structural characterizations reveal that the composition is free from superstructure reflections and electrochemical studies show that the composition suppresses multi-phase transitions. As a result, $NaNi_{0.5}Co_{0.1}Ti_{0.3}Sb_{0.1}O_2$, exhibits initial charge and discharge capacities as 129 and 112 mAh/g, respectively, at the current rate of 9.1mA/g for 2.0-4.35V. Thus, the high voltage, improved capacity, and retention characteristics of $NaNi_{0.5}Co_{0.1}Ti_{0.3}Sb_{0.1}O_2$, would open up the way for bulk production of Na-ion batteries.



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O_02

Boosting photofixation of nitrogen to ammonia by using oxygen-vacant visible light photocatalyst with p-n heterojunction

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Abstract:

About 2% of the energy consumed annually is used for ammonia production due to its extensive use in various sectors. Traditionally, ammonia is synthesised by the energy-intensive Haber-Bosch process, which releases carbon dioxide as an undesired byproduct. There is a paramount need to produce ammonia in ambient conditions to diminish the energy input and carbon footprint. Photocatalytic nitrogen fixation is, therefore, one of the promising strategies for synthesising ammonia in mild conditions using sunlight, water, N2 and a semiconductor photocatalyst. Tailoring a visible-light photocatalyst that adsorbs and activates the triply bonded, chemically stable N2 with high charge separation efficiency is imperative for efficient photofixation of nitrogen. Herein, a visible-light absorbing Ni-ZrO2/Bi2O3 is engineered with p-n heterojunction and oxygen vacancies to remarkably enhance the generation of ammonia to 9668.2 µmol h-1 g-1[1][2]. Furthermore, the formation of the desired photocatalyst is confirmed by systematic characterisation studies. This work presents a promising strategy to design appropriate visible light-responsive photocatalysts that efficiently reduce nitrogen.

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O_03

Understanding CO_2 Geological Sequestration In The Deccan Volcanic Province Through multiphase Flow And Reactive Transport Simulations

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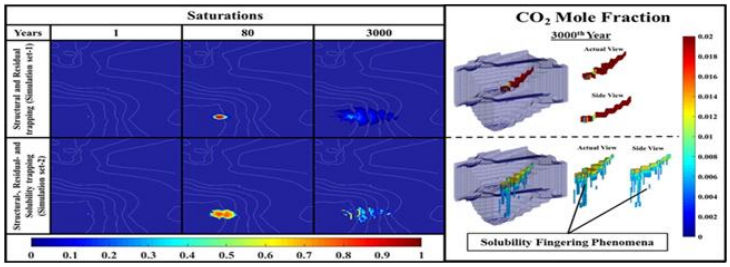
Abstract:

The current research investigates the possible implementation of CO_2 geological sequestration in the Deccan volcanic province. The numerical simulation analysis is carried out to analyse the influences of specific sequestration parameters like the injection rate and injection point; and geological parameters like top surface morphology, petrophysical properties variation, and geological features like stairsteps traps and anticline on the CO_2 plume migration in the subsurface formation domain. The effect of these sequestration and geological parameter variations is analyzed on the trapping mechanism, sweeping efficiency and structural integrity over a geological time scale for the considered subsurface synthetic domain. The multiphase, multicomponent reactive transport modeling technique is utilized to conduct this analysis. The outcome of this research has shown insight into the potential implementation of CCS and a future estimate of CO_2 migration and CO_2 entrapment [1], [2]. Further, provides the impacts of sequestration and geological parameters over a geological time scale [1]–[2]. Future studies will focus on caprock leakage analysis, leakage implications on different entrapment mechanisms, and machine learning approaches to predict the entrapment percentage, leakage, and structural integrity research for long geological time scales.



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O_04

Sonocrystallization of lead-free hybrid halide perovskite for photovoltaics

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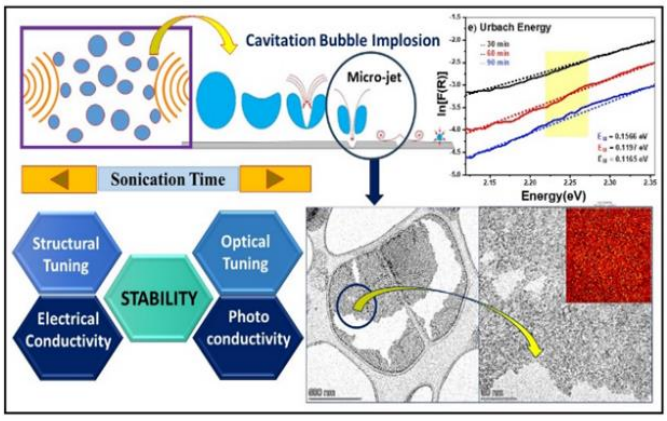
Abstract:

A paramount of interest has been paid towards toxic lead free low-dimensional hybrid organic-inorganic halide perovskites due to their better optoelectronic properties. Herein, we present optimized ultrasonic assisted wet chemical method for the synthesis of lead-free layered 2-D methylammonium copper chloride perovskites. The influence of sonication time as a simple yet effective key operating parameter to tune morphology and size thereby variation in band gap has been studied. The as-synthesized perovskites featured significant differences in optoelectronic properties and conductive nature all of which are evidenced by P-XRD, UV-VIS DRS, PL, FE-SEM, HR-TEM with EDAX, simultaneous TGA-DSC, XPS, EIS and I-V characteristics. The perovskites shown bandgap variation from 2.12 eV to 2.27 eV. An indirect approach is used to measure Urbach energy and is found to vary from 198 meV to 324 meV. Steady-state PL results show lower intensity with increase in sonication time. X-ray diffractograms revealed the crystallite size reduction along (001) basal direction with increasing sonication time with no evidence for structural change. A keen observation on FE-SEM and HR-TEM results revealed about mechanism of sonocrystallization. Simultaneous TGA/DSC was carried out which confirms the stability above 200ºC. Improved electronic properties have been verified by EIS and I-V characteristics.



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O_05

Thermohydraulic performance analysis of a Solar air heater with helicoidal fin placement on the absorber plate

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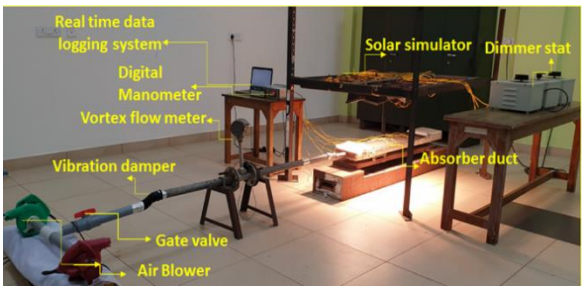
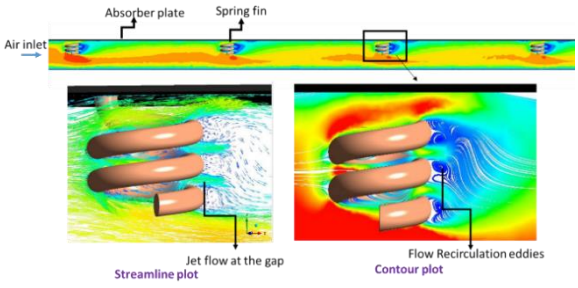
Abstract:

The study focuses on a detailed numerical analysis of a solar air heater with fins of spring shape positioned below the absorber plate. The research examines how the placement of these spring-shaped fins on the absorber plate affects the Solar air heater's thermal performance at different Reynolds number. The results show that the spring-shaped fins increase turbulence within the absorber duct but do not significantly impede the flow. The Nusselt number rises with an increase in the number of springs either by reducing longitudinal pitch or transverse pitch. However, the thermo-hydraulic enhancement factor rises up to a certain point and then drops due to higher flow resistance. The results for thermal performance in terms of Nusselt number and net effect in terms of thermo-hydraulic enhancement factor are studied. For varying longitudinal pitch ratios, the lowest pitch ratio of 0.08 gave the highest Nusselt number, and the longitudinal pitch ratio of 0.16 gave the highest THEF value with two number of springs along the width for the entire range of Reynolds numbers studied. Correlations have been established to relate spring longitudinal pitch ratios to the Nusselt number and friction factor. These correlations were derived through regression analysis of numerical data, and they exhibit a deviation of ±10 percent in terms of parity.





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O_06

Synergistic effect of noble metal modified $LaNiO_3$ perovskites for photocatalytic water splitting

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Abstract:

Efficiently meeting the increasing energy demands remains a formidable challenge in the current landscape. The need for a cleaner and more sustainable fuel to address the energy crisis is evident. Efforts are being made to utilize energy that is generated from solar, bio, and wind energy. Artificial photosynthesis harnesses solar energy to produce valuable fuels, offering a promising solution to the global energy crisis. One such vital fuel is hydrogen, achievable through the efficient evolution of water using a judiciously chosen perovskite photocatalyst. Perovskite materials, with their distinctive structural and optical properties, emerge as potential catalysts for visible light photocatalytic water splitting. Among these, $LaNiO_3$ stands out as a promising photocatalyst due to its small bandgap and well-suited band edges that enable efficient visible light absorption. Strategic modifications with noble metals further elevate the photocatalytic performance. Utilizing the solution combustion method, catalysts are synthesized and extensively characterized through techniques such as XRD, XPS, ICP-OES, SEM, BET, DRS, Photoluminescence, and time-resolved photoluminescence. Photocatalytic hydrogen evolution studies are conducted under solar simulator illumination. Notably, the addition of noble metals increased the photocatalytic activity from 1.37 mmol. g^{-1}. h^{-1} to 20.86 mmol. g^{-1} h^{-1} The catalysts demonstrate stable and consistent performance over a 12-hour duration.

O_07

Synthesis and electrochemical performance of core-shell Ni-rich oxides cathode material for rechargeable Li-ion batteries

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Abstract:

Among the rechargeable battery systems, Li-ion batteries possess a high energy density above 200 Wh kg-1 and long cycle-life; and hence dominating as the power source for portable electronic devices such as smartphones, laptops etc. These Li-ion batteries are the front-runners to power the electric vehicles. However, the driving range is limited by their energy density, which depends on the specific capacity as well as the electrochemical potential of electrode materials, especially that of cathode materials. At present, layered Ni-rich oxides ($LiNi_xMn_yCo_zO_2$, $x \geq 0.6$) are investigated as promising cathodes, because of their high specific capacities ≥ 180 mAh g-1. However, they suffer from capacity fading upon cycling due to various phase transformation during charging and micro-crack formation, leading to a decrease in the energy density. Therefore, it is essential to mitigate the structural transformation for improving the cycling performance of lithiated Ni-rich oxides. Herewith, we have synthesized a core-shell oxide material with Ni-rich oxide as the core and Li, Mn-rich oxide as the shell by a sol-gel method, which can exhibit an initial specific capacity of about 210 mAh g-1 with 89% capacity retention after 120 cycles when cycled at 20 mA g-1 in the potential range of 2.8-4.3 V vs. Li. This core-shell structure incorporates the advantage of high capacity from Ni-rich oxide and surface chemical stability of Mn-based Li-rich oxide for LIBs. The results including synthesis, structural characterization, and electrochemical performance of core-shell oxide will be presented.

POSTER PRESENTATIONS

E01

Highly efficient and magnetizable $CoFe_2O_4/ZnWO_4$ heterostructure for the enhanced sonophotocatalytic degradation of diverse antibiotics

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Abstract:

The overuse of antibiotics in the environment poses a significant risk fostering the emergence of antibiotic-resistant bacteria. To address this issue, sonophotocatalysis has emerged as a promising solution for the degradation of antibiotics in water. This process involves the use of visible light, ultrasound, and a catalyst to enhance the production of reactive oxygen species, which are highly effective against water containing antibiotics. A pioneering S-scheme heterojunction photocatalyst was fabricated, incorporating $CoFe_2O_4$ (CoF) into $ZnWO_4$ (ZnW). Results showed that on exposing visible light and ultrasound simultaneously, CoF/ZnW heterostructure exhibited exceptional degradation performance and stability for various antibiotics, including Tetracycline (93%), Chlortetracycline (89%), and Chloramphenicol (81%), respectively within 60 min. The sonophotocatalytic degradation using the CoF/ZnW heterostructure was significantly more efficient than the individual counterparts. This improvement in sonophotocatalytic activity can be attributed to the formation of S-scheme heterojunction between CoF and ZnW, which facilitates the migration of electrons and holes, leading to the generation of free radicals that effectively degrade targeted antibiotic compounds. This study offers valuable insights into the potential application of the newly developed CoF/ZnW heterojunction photocatalyst, demonstrating its effectiveness in efficiently eliminating various persistent pollutants.

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E03

Synergistically Coupled Ta Substituted LLZO and PVDF-HFP to Produce Solid Electrolyte Composite with High Ionic Conductivity and Mechanical Strength

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Abstract:

The Pinnacle of the next generation of automobile batteries will be solid-state batteries. Inorganic solid electrolytes such as garnet-based electrolytes are the best suitable for solid-state batteries due to their high ionic conductivity and high cation transport number. However, thin pellets have very poor mechanical properties and interfacial compatibility between the electrolyte and various electrodes. To overcome the above-stated issues, we designed a mixed solid electrolyte (Ta-substituted LLZO+PVDF-HFP composite) to get polymer ceramic composite electrolytes that exhibit promising high Li-ion conductivity and superior mechanical stability. In this study, the mixed solid electrolyte was characterized with XRD, EIS and Li plating/stripping methods to investigate the structural, ionic conductivity and interface stability. The structural examinations confirmed the LLZO cubic phase with composite formation. The EIS measurements of polymer composite exhibited in the order of 10-4S/cm. The stripping and plating demonstrated 400 h of interface stability.

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E05

Highly Stable Bi-Functional $MnCo_{2-x}Cu_xO_4$ Spinel Oxide Catalyst for Oxygen Reduction Reaction (ORR) and Oxygen Evolution Reaction (OER) in LiO_2 Battery

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Abstract:

High-energy-density rechargeable LiO_2 batteries (LOBs) have emerged as a promising energy storage devise. However, they face hurdles like anode dendrite/passivation and insoluble cathode discharge products. Recent research has extensively focused on addressing these concerns through the innovation of efficient electrocatalysts1-2. Aligned with this objective, our study centred on the utilization of $MnCo_{2-x}Cu_xO_4$ (X = 0,0.25, 0.5, 0.75,1) spinel as a novel bifunctional catalyst for LOBs. The inclusion of Cu in the spinel lattice was noted to exert a significant impact on the reaction kinetics and cycle stability of LOBs. A robust synergistic interaction among the redox couples Cu^{2+}/Cu^{1+}, Co^{2+}/Co^{3+}, and Mn^{3+}/Mn^{4+} within the crystalline structure showcases an exceptional catalytic activity. In the series of prepared $MnCo_{2-x}Cu_xO_4$ (X=0 to 1) spinel catalyst $MnCo_{1.7}5Cu_{0.25}O_4$ emerged as a standout performer. It demonstrated a high OER current density of 25.3 mA cm^{-2} @ E = 1.8V and exhibited stable bifunctional activity at 1.15 V vs. RHE in aqueous medium. Further, it provides outstanding stability over 225 cycles with a longer lifespan 1250 h in LOBs, at cutoff capacity of 500 mA h g^{-1}. Moreover, it showcased an exceptional discharge specific capacity of 11272 mA h g^{-1} at a current density of 175 mA g^{-1}, higher than the performance of state-of-art RuO_2.

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E07

Host-Guest Chemistry In Water Treatment: An Investigation Into The Beta-Cyclodextrin And Bromophenol Blue Interaction

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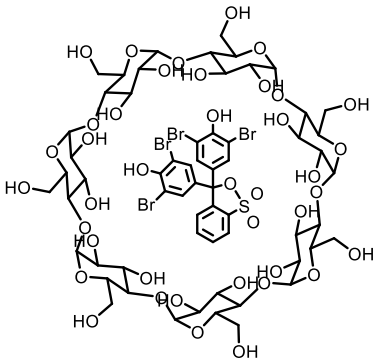
Abstract:

Environmental pollution reduction through nonchemical treatment is appealing. Pollutants can be absorbed by biologically benign hosts. β-cyclodextrin is a cost-effective, ecologically friendly host that forms complexes with organic contaminants due to its cavity structure and high hydroxyl group count. It is frequently employed for its adsorption capacity. Inclusion complexes of β-cyclodextrin with azo and anthraquinone dyes have been discovered in literature. This paper describes a powerful effluent treatment approach using β-cyclodextrin inclusion complex and bromophenol blue dye as a guest molecule. BPB is widely utilised in industries, hence its environmental impacts need its removal. Encapsulation of BPB in β-cyclodextrin cavity is validated by UV-Visible spectroscopy, revealing adsorption behaviour thermodynamics and implications for environmental pollution reduction and commercial use. The binding constant determined using Benesi-Hildebrand plot, k = 16.3639 M-1 from UV data, and the molecular mass obtained at m/z 1801.0753$[M+H]^+$ and 901.0413 $[M+2H]^{2+}$ via ESI-MS spectroscopy support the 1:1 complex. The current work reveals that inclusion complexation may remove Bromophenol blue dye from aqueous solution, making it a greener method for industrial effluent.



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E08

Selenium accumulation vis-à-vis lipid production in halotolerant green oleaginous microalga Dunaliella salina: A transcriptomic study

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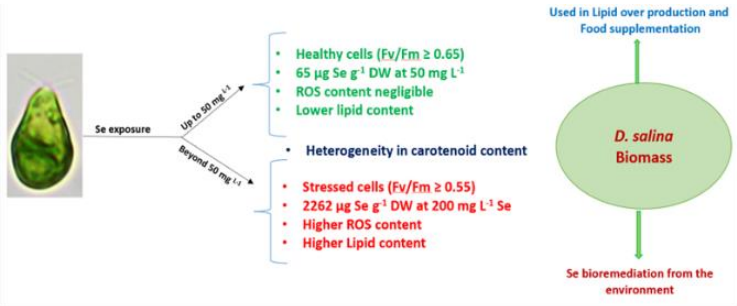
Abstract:

Microalgae incorporate selenium from its inorganic form and transform it into its organic form. It is generally known that selenoproteins modulate mammalian metabolism. The cells grown at ambient concentration of Se (50mg/L), showed photoautotrophic growth in parallel to control, and accumulated Se level as required by the human beings on per day basis and experienced stress on higher concentration of Se as evidenced by decrease in photosynthetic quantum yield, chlorophyll content with increased intracellular reactive oxygen species, proline, and lipid peroxidation accompanied by higher neutral lipid accumulation. The antioxidative enzymes, superoxide dismutase and catalase played a pivotal role in antioxidative defense. The D. salina cells at 200 mg L-1 Se, led the disorganization of organelles as reflected in transmission electron microscopy. Raman spectroscopy showed heterogeneity of carotenoid accumulation at varying Se level. D. salina growing at higher salinities are reported to have upregulated transcripts from selenium metabolism pathway. These findings collectively contribute to the broader comprehension of selenium bioaccumulation strategies in D. salina and its potential applications in lipid overproduction and food supplementation. The inherent capacity of D. salina to tolerate higher Se levels may also be used for its bioremediation purposes.



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E10

Photocatalytic degradation of methyl orange dye in aqueous solution: Improved sunlight absorption and utilization of photo-excitons at nanocavities of TiO_2 nanorods

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Abstract:

The functional characteristics of TiO_2 especially at nanoscale has revolutionised its active role in industrial products and increasing interest in photocatalytic applications. The photoactive phases of TiO_2 viz., anatase, rutile and TiO_2 (B) are known to exhibit competitive optical properties in UV-A/near-visible spectrum, electron mobility, generation of reactive oxygen species (ROS), separation of charge carriers and their surface-interface reactions. Their low photo-conversion efficiency in solar light (UV-A) and ineffective charge carrier recombination are considered as bottle-neck for wide-spread applications. Recent studies have demonstrated the superior electron transport ability of one dimensional (1-D) TiO_2 nanorods than bulk TiO_2. In this work, we postulate that fine tuning of size and density of nanocavities in TiO_2 nanorods can improve the absorption co-efficient in UV-A region, lower charge carrier recombination besides improved surface-interface reactions. Hence, in the present study we have calcined the as-synthesized $H_2Ti_3O_7$ at desired range of temperature, time duration and rate of heating as well. The nanocavities in TiO_2 nanorods were for degradation of methyl orange dye in aqueous solution under solar light irradiation. The results revealed that controlling of nanocavities size on TiO_2 nanorods enables improved UV-A light absorption, single phase anatase formation faster electron mobility towards longitudinal direction that leads to effective methyl orange dye degradation. Both catalyst processing parameters and photocatalytic reaction conditions were optimized to study the efficiency.

E11

Cobalt infusion in Tungsten composite for highly efficient hydrogen production in alkali

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Abstract:

Non precious metal/metal composites show significant electrocatalytic activity towards Hydrogen evolution reaction (HER) when exposed to alkali. Tungsten based materials (WX) is one of the predominant catalysts for electrochemical HER process, but its stability for prolonged reaction is not reliable. In this work, we report an enthralling finding of electrodeposition of Cobalt nanoparticles on Tungsten sulphide (Co@WX), a well-known HER electrocatalyst using a simple voltammetric technique. As a result, improved HER kinetics and better charge transfer were achieved, reducing the overpotential for HER to 87 mV, much better than pristine WX at 10 mA cm-2. Besides, it also showed a lower Tafel slope of 167.5 mV/dec explaining that water dissociation process on the catalyst's surface is predominant and higher ECSA in terms of Cdl, which further explains the enrichment of HER activity of the composite. The Cobalt incorporated tungsten sulphide also exhibited excellent stability upon potentiostatic electrolysis for over 40 hours, which depicts the successful and stable incorporation of cobalt in tungsten sulphide. Thus, this work opens up new avenues for studying other non-precious metal/metal composites modified with other transition metal nanoparticles in alkaline HER towards better hydrogen production.

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E12

Optimizing Biodiesel Production Potential of Chlamydomonas reinhardtii CC-125: Biomass and lipid Characterization under Varied Inorganic Carbon Regimes

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Abstract:

Algae-based biofuels are currently a little-explored renewable energy source. However, commercialization constraints like mass cultivation and economic downstream processing challenge this paradigm. Therefore, a two-stage phototrophic cultivation of C. reinhardtii was performed. In the first stage of cultivation for maximization of biomass, graded concentrations of the selected inorganic carbon sources used and various growth parameters, i.e., photo pigments estimation, protein content, biomass production, photosynthetic yield and nutrient assimilation efficiency, were assessed. The optimum carbon source concentration significantly increased the biomass (2.5 fold over the control). The carbonic anhydrase enzyme activity indicates an efficient CO2 concentration mechanism (CCM) at an optimum level of carbon concentration. After the end of the first stage of cultivation, the cultures were harvested and inoculated in a nitrogen-starved condition (4d) for hyperaccumulation of lipids. Nitrogen deprivation significantly increased the lipid content to 3.67 fold over the control. The increased neutral lipid content was also evaluated using fluorescence microscopy and flow cytometry. Fourier transform infrared (FTIR) spectroscopy was used to assess carbon allocation in the selected carbon regimes, which showed that nitrogen deprivation led to relative increases in the synthesis of lipids and carbohydrates, resulting in elevated lipid/protein (L/P) and carbohydrate/protein (C/P) ratios. The 1H-NMR spectroscopy analysis revealed an apparent increase in the concentration of neutral lipid, indicating successful transesterification under the specific bicarbonate conditions when compared to the control group. An amorphous increase, as evidenced by Powder X-ray diffraction (P-XRD), revealed cost-effective pre-treatment for biomass valorization and made a promising candidate for anaerobic digestion and fermentation perspective. Furthermore, elemental analysis was also performed to evaluate CO2 fixation/carbon partitioning and higher heating value (HHV). The higher carbon content (47.145 %), HHV (21.20 MJKg-1), low N (2.746 %) and S (0.00 %) in C. reinhardtii, this mode of cultivation can be suitably used for the production of biofuel vis-à-vis compounded with CO2 reduction.

E13

A strategy to use phytohormones on biomass vis-a-vis lipid production in Dunaliella salina under nitrogen starvation and characterization of biomass/ lipids.

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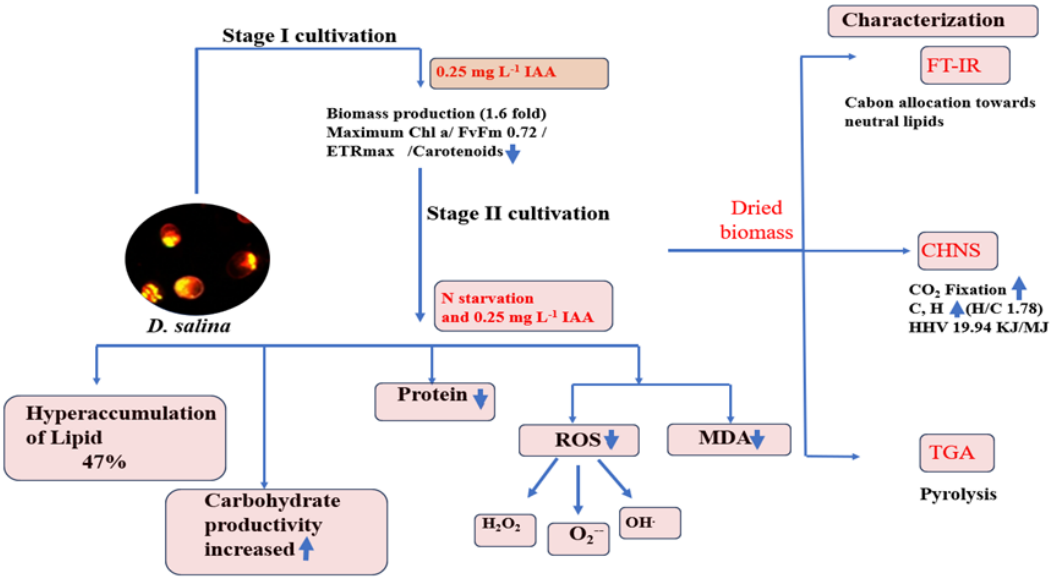
Abstract:

Microalgae, as a possible source, shows great potential in producing biofuel because of its ability to reduce CO_2 emissions, thus helping to combat global warming. D. salina, isolated from Sambhar Lake, Rajasthan, is a single-celled, halotolerant organism belonging to green algae. Phytohormones were used as a stimulant at various concentrations to determine the optimal level of specific hormones, either alone or in combinations. Several growth parameters, such as turbidity, photosynthetic parameters, pH, and photopigments analysis of dry cell weight (DCW), were monitored. Simultaneously, Rubisco enzymes activity as well as lipid biosynthesis related key enzyme ACCase and GPAT were assessed. LCMS/MS based metabolomics study was performed in optimized phytohormone regimes. A 2.4-fold lipid content was recorded compared to the control which channelized carbon towards the neutral lipid (TAG) accumulation as evidenced by Nile red fluorescence microscopy as well as flow cytometry analysis and 1H- NMR spectroscopy. The CHNS characterization of the biomass showed higher heating value. This study suggests phytohormone mediated biomass vis-a-vis lipid production could be viable at a large-scale industrialization.



E14

Overproduction of lipids and β-carotene from Dunaliella salina: A realization of biorefinery approach for economical biofuel production

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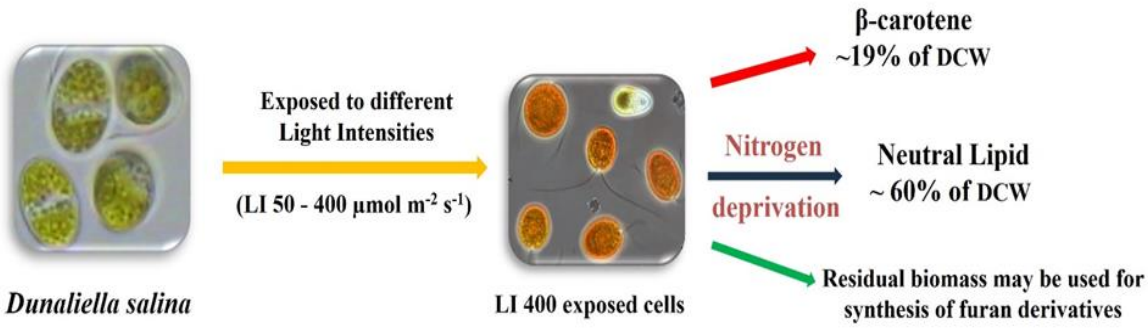
Abstract:

Microalgae represent a promising source of biomass feedstock for fuels and chemicals, as many species possess the ability to grow rapidly and synthesize large amounts of storage neutral lipids in a form of triacylglycerol (TAG). Dunaliella salina, a wall-less, halophilic, green microalga is a single cell factory for the production of lipids, carotenoids and other value-added products. D. salina can accumulate β-carotene up to 10% of its dry weight under normal growth conditions. An attempt of overproduction of neutral lipid and carotenoids was demonstrated using varying light intensity. There was an increase in the β-carotene content up to 19% of the dry cell weight (DCW) along with neutral lipid production reaching about 60% of DCW with the increase in light intensity. Microalgae are promising feedstocks for carbon-neutral biofuels and their commercialization depends on strain improvement by the overexpression of desired gene(s) to increase lipid content. In this regard, transcriptomics data has shed some light on the identification of candidate genes for lipid overproduction. Some carotenoid biosynthesizing genes have also been identified using the transcriptomics data that will increase the yield of β-carotene from this microalga. The concomitant production of lipids and carotenoids from microalgal biomass and the use of residual biomass for synthesis of furan-derivatives will certainly make the concept of biorefinery feasible in the long run.



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E16

Exalting cyclability and energy storage capacity of sodium-ion batteries using DMSO delaminated Titanium carbide MXene

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Abstract:

The increasing demand for sodium storage solutions that are both efficient and reliable has prompted the necessity for advanced electrodes that exhibit outstanding rate performance and cycling stability[1]. The 2D Titanium carbide MXene, which has been recently developed, offers a highly promising solution in this context. The delamination process of MXene in dimethyl sulfoxide (DMSO) has led to an augmentation in the interlayer spacing, thereby promoting the mobility of sodium ions. This enhanced mobility can be attributed to the low energy barrier present on the surface of MXene. The Ti_3C_2Tx MXene, which has been delaminated using DMSO, demonstrates a notable increase in capacity for sodium-ion batteries. Specifically, it exhibits a capacity of 274 mAh g^{-1}, which is 52% higher compared to its original capacity of 95 mAh g^{-1}. Furthermore, this MXene also demonstrates an impressive capacitance retention rate of 86.21% after undergoing 1000 cycles. The remarkable electrochemical performance of DMSO delaminated $Ti_3C_2T_x$ MXene can be ascribed to its twodimensional (2D) structure, self-improved kinetics, and the combined effects of intercalation pseudocapacitance and surface-controlled pseudocapacitance in its hybrid energy storage mechanisms[2].

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E17

Impact of ligand modification on hydrogen evolution reaction using silver and ruthenium based N–heterocyclic carbene complexes

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Abstract:

The demand for the energy has increased globally, consumption of vast proportions of fossil fuels have also increased. An alternate source for these fuels is highly essential and hydrogen gas is one such substituent. Hydrogen is considered to be a clean, renewable and carbon–free substituent energy. Production of hydrogen by non–electrochemical steam reforming of natural gas leads to CO2 emission. Hence, electrocatalytic/photoelectrocatalytic water splitting is the alternative route for hydrogen production without the emission of CO2. Pt is considered as the benchmark catalyst for hydrogen evolution reaction (HER), however it is expensive, rare and thus makes industrial scaling difficult. Hence considerable effort has been made to develop potentially cheaper but efficient electrocatalysts. The development of complexes functionalized by NHCs possess key properties that enables them to be stable, tunable, efficient and possess high metal atom economy. Our aim is focussed on developing metal–NHC complexes from NHC precursors and their characterization by various analytical and spectrochemical techniques. These metal–NHC complexes are further investigated for their HER activity in acidic media

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E19

Investigation into the Role of Central Metal Atom on Metal N-heterocyclic Carbene Complexes based Free-Standing Electrodes for Overall Water Splitting

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Abstract:

Metal N-heterocyclic carbene (NHC) complexes have emerged as promising candidates for electrocatalysis due to their unique catalytic properties. This study investigates the role of the central metal atom i.e., Au, Ag, Co, Ni and Pd in an aryl-substituted 1,2,4–triazole with pyridine functionalization as metal NHC complexes for overall water splitting. The effect of the varying central metal substitution on the coordination and geometry of the metal NHC complexes is also investigated. The investigation encompasses thorough characterization of the metal NHC complexes by spectral and analytical techniques such as single crystal X-ray diffraction, NMR, IR and FE-SEM. The developed metal NHC complexes are investigated for their electrocatalytic hydrogen and oxygen evolution reactions by dip-coating them onto carbon cloth to fabricate free standing electrodes. The developed free-standing electrodes are employed as bifunctional electrocatalysts for water splitting applications in alkaline media. The activity of the electrodes was compared using polarisation curves, Tafel slopes values and electrochemical impedance spectroscopy. The long-term stability of the electrodes was also investigated by chronoamperometry for up to 40 hours, with the electrodes displaying minimal decline in efficiency. The post-stability analysis of the electrodes was determined by FE-SEM and FT-IR indicating the robustness and stability of the electrodes for long term operational stability. A symmetric full cell electrolyser was assembled from the model electrode and compared with commercial electrocatalysts for overall water splitting. These findings shed light on the design principles for optimizing metal NHC complexes-based electrodes for efficient overall water splitting, paving the way for the development of sustainable energy conversion technologies.

E20

Ionic Conduction in $NaxCoO_2$-δ - $Sm_{0.2}Ce_{0.8}O_{2-\delta}$ Semiconductor Ionic Heterostructures for Low-Temperature Solid Oxide Fuel Cell

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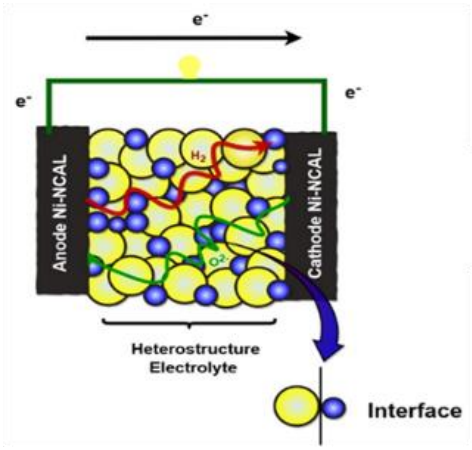
Abstract:

In recent times, the development of heterostructure electrolytes has emerged as a promising strategy for enhancing the ionic conductivity of low-temperature solid oxide fuel cells (LT-SOFCs). In this study, we report a semiconductor NaxCoO2-δ (x = 0, 0.9, 0.7, 0.5, 0.3, and 0.1) and ionic Sm0.2Ce0.8O2-δ heterostructure as a functional membrane, where the modulation of Na ions is achieved through a surface-doping mechanism. This mechanism leads to appropriate lattice distortion with a balanced amount of Co3+/Co4+ and the creation of oxygen vacancies in NaxCoO2, thereby influencing the conductivity enhancement at the optimal sodium concentration. Furthermore, we investigated the correlation between the structural properties of the heterostructure material and its electrical measurement. Electrochemical impedance spectroscopy studies reveal that Na0.7CoO2-δ-Sm0.2Ce0.8O2-δ exhibits remarkable performance with an ionic conductivity of 0.132 S/cm at 550°C under a 3% H2O humidified 4% H2 + 96% nitrogen atmosphere condition. The electrical measurements demonstrated the highest conductivity for Na0.7CoO2-δ-Sm0.2Ce0.8O2-δ, emphasizing the significance of the optimal lattice distortion, generation of oxygen vacancies, and surface band bending near the interface, which is crucial for the efficient transport of charge carriers. These findings underscore the potential of NaxCO-SDC as an electrolyte for LT-SOFC.



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E21

Various methods of green hydrogen production: Short Analysis

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Abstract:

Hydrogen has demonstrated its superiority as a substitute for fossil fuels, being both environmentally friendly and produced from renewable sources. It is commonly referred to as 'Green hydrogen gas (GHG)' due to these qualities. As a result, hydrogen energy is a zero-carbon emission energy system that is renewable. Additionally, its non-volatile nature makes hydrogen a promising alternative fuel for widespread use. Greenhouse gases (GHG) can be generated by various technical methods and raw materials, both renewable and non-renewable.Greenhouse gases (GHG) can be generated by several processes using abundant elements such as water, power, and easily accessible resources. This study provides a concise review of different techniques for hydrogen production, focusing on commonly utilised technologies such as biomass, water electrolysis, solar energy, wind, and solar-photovoltaic energy. Hydrogen production from biomass can be achieved by many methods such as combustion and pyrolysis. The processes include liquefaction, gasification, direct bio-photolysis, biological water-gas shift reaction, photo-fermentation, and dark fermentation. Water splitting, when performed in the presence of solar energy, is referred to as photoelectrochemical water splitting and results in the creation of hydrogen. Electricity produced by large-scale resources, such as wind turbines and photovoltaic energy systems, can be utilised to generate hydrogen gas through the process of electrolysis. The solar photovoltaic cell harnesses solar energy and transforms it into electrical energy, which can also be utilised to generate greenhouse gases. Therefore, it can be inferred that the greenhouse gas (GHG) is being generated through various means, resulting in the production of environmentally friendly fuel for a future with zero carbon emissions.

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E22

Physico-chemical Pretreatment of Grass Clippings for Improved Co-Biomethanation with Food Waste

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Abstract:

Biomethanation offers a sustainable solution for waste management by generating renewable energy from organic matter. However, biomethanation of food waste alone suffers from rapid acidification. Co-digestion with garden waste, notably grass clippings, presents an attractive alternative. However, the high lignin content and the recalcitrant nature of the grass clippings limit their effectiveness as co-substrates. This study investigates the potential of pre-treating grass clippings to overcome recalcitrance and use it as a co-substrate to enhance food waste biomethanation. The physical pretreatments include thermal, microwave and size reduction techniques, whereas the chemical pretreatment involves acid, alkali, wet oxidation, etc. The temperature for thermal treatment implemented by various studies has varied from 50 to 100°C for 30 to 60 minutes, based on the requirement. Different size reduction techniques include ball milling, grinding, extrusion, etc. The acid treatment employing dilute acids is more suitable for the pretreatment of grass clippings to break the lignin and hemicellulose and make the grass clippings easily hydrolysable to ensure increased methane production during biomethanation. Applying ammonia for alkali pretreatment helps selectively target the lignin without affecting the hydrolysable contents, which are beneficial for methane production. This study aims to overcome the grass clippings' stubborn lignin barrier and unleash their full potential as co-substrates by identifying the most efficient physical and chemical pretreatment methods. Incorporation of pretreatment of the grass clippings before co-digestion with food waste will increase methane production and divert food waste from landfills, promoting a circular economy approach.

E23

Experimental Analysis Of Single Slope Single Basin Solar Still In Different Glass Cover Thickness

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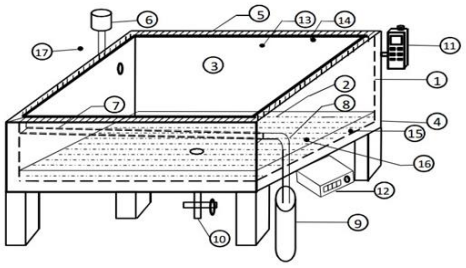
Abstract:

Solar Stills are the simplest desalination devices which uses the solar energy for the desalination process to purify the saline water. In this experiment we are using different glass covers of varying thickness to conduct the experiment without changing the other parameters like insulation and basin water depth. From the experiments we can analyse which thickness of the glass cover is efficient with respect to the input parameters taken.

The main objective of the experiment is to find out the optimal value of each parameter like glass covers, insulations, basin water depth and area of the basin. After analysing each parameter we can build a solar still with each parameters we obtained as the optimal results.

In our experiment we are using three glass cover thicknesses like 3mm, 4mm and 5mm. The 1 and 2mm glass covers are not chosen since they are very fragile to handle and can't be mounted on the still for the experiment to be conducted.

From the experiments it if found that the 4mm glass cover is efficient than others and yet the experiment can be carried out with changing other parameters till we optimise each aspect of the setup to get better efficiency rate.



1. Basin, 2. Saline water, 3. Glass cover, 4. Wooden Box, 5. Thermocol Insulation,

6. Saline Water Inlet pipe, 7. Collecting Trough, 8. Desalinated Water outlet pipe,

9. Collection Flask, 10. Drain Valve, 11. Solarimeter, 12. Temperature Indicator,

13,14,15,16 and 17 are Thermocouples.

E24

Enhancing aerobic biological wastewater treatment using carbotrophic-oxygenic organisms

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Abstract:

Efficient wastewater treatment is crucial for environmental sustainability and public health. This study introduces a novel approach for enhancing aerobic biological wastewater treatment efficiency using a microbial consortium with synergistic interactions between carbotrophic and oxygenic organisms. The consortium provides a sustainable and cost-effective approach to wastewater treatment by utilizing their metabolic interactions. Carbotrophic microorganisms metabolize organic compounds, producing carbon dioxide as a byproduct. Oxygenic photosynthetic organisms utilize this carbon dioxide, generating oxygen through photosynthesis. This symbiotic partnership enhances the aerobic treatment processes by creating an oxygen-rich environment conducive to microbial growth. The significance of extracellular polymeric substances in promoting microbial aggregation and biofilm formation within the consortium is highlighted. After their life cycle, when the consortia are washed out of the aerobic treatment system, they are used as co-substrates in anaerobic digestion, further enhancing resource recovery. This innovative strategy presents a significant step towards achieving long-term environmental sustainability and addressing the need for efficient biological wastewater treatment solutions.

E25

Facile Hydrothermal method for the synthesis of V doped ZnO for complete degradation of MB dye under direct Sunlight irradiation.

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Abstract:

The importance of raising global awareness about how light-based technologies promote sustainable development and provide solutions to global challenges has been recognized. Light can play a vital role, because its combination with semiconducting materials provides a great power for photocatalysis. Conventional inorganic semiconductors generally have a large band gap and cannot effectively use visible light for photocatalytic degradation of organic pollutants. Here we showed optimized V Doped ZnO material for photocatalysis synthesized by Hydrothermal method. Effect of concentration of doping metal influences the band gap and morphological properties of material. As synthesised material shows the significance difference in the conducting and photocatalytic properties, this can be justified by XRD, UV-DRS, PL, BET, FE-SEM, HR-TEM among different concentration of dopant (1, 3, 5 mMol) 5 mMol V Doped ZnO shows the highest photo catalytical activity. The phase purity of as synthesised compounds is confirmed by P-XRD. There is slight decrees in band gap from 3 eV to 2.92 eV as doping concentration increased in the material. PL spectra shows the low recombination rate for 5 mMol V Doped ZnO which is favourable for photo catalytical activity. To support this there is increase in surface area of doped material analysed by BET, which enhance the photo-catalytical activity. The Degradation studies of MB done under direct sunlight using 5 mg/50 ml catalyst dose of 5 mMol V Doped ZnO shows complete degradation of dye within 3h at natural pH.

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E28

Exploring Biomass-Derived Charcoal as an Eco-Friendly Alternative to Coal and Coke in Industrial Processes

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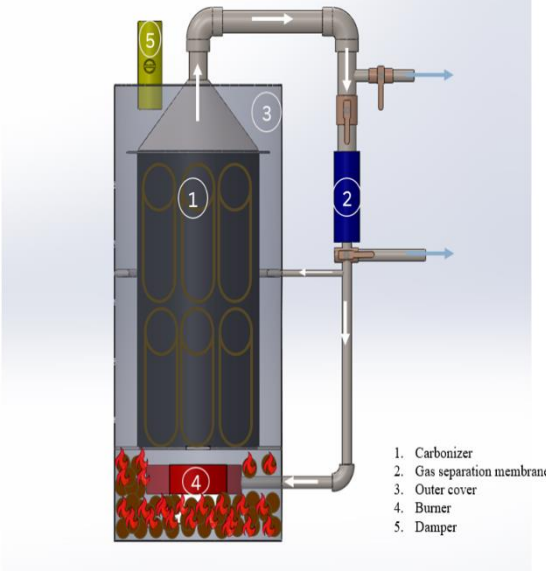
Abstract:

This study studies biomass-derived charcoal as a sustainable steel production substitute for coal and coke to reduce CO2 emissions and environmental effect. The work develops a new pyrolysis setup to create high-quality charcoal, optimises experimental settings using physical tests and CFD simulations, and investigates heat regeneration using presumed volatile materials. A thorough literature analysis examines biomass pyrolysis techniques and their use in steel manufacturing, focusing on temperature, heating rate, holding duration, and biomass type. The biomass Casuarina equisetifolia was thermally analysed using TGA and DSC, which provided useful insights for theoretical analysis. The potential feasibility of using presumed volatile materials for heat regeneration with heat recovery efficiency > 70% was shown. The theoretical calorific value of biomass-derived charcoal was 27.26–33.7 MJ/kg. Detailed experimental setup configurations, including carbonizer, outer cover, and log arrangement design calculations, and gas separation membrane discussions are provided. To properly investigate sustainable charcoal production parameters, Centre Composite Design (CCD) and Taguchi designs are suggested.



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E30

Fabrication of Self-Powered Supercapacitor Devices and Their Real-time Applications

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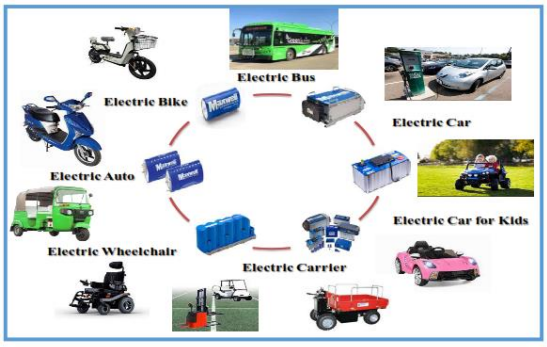
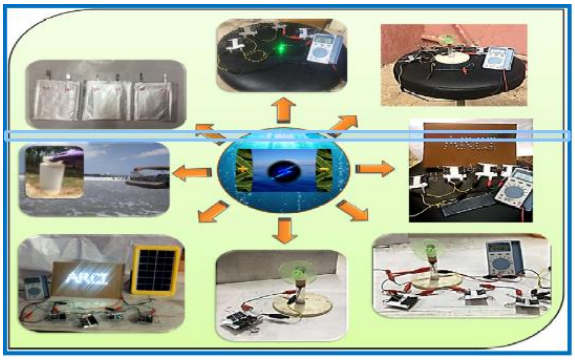
Abstract:

Supercapacitor is a promising electrochemical energy storage device which possessing very high power density, rapid charge and discharge rates with a very long lifecycle. Supercapacitors hold high energy density as compared to common electrolytic capacitors and hence supercapacitors are extensively utilized not only for powering several portable electronic devices but also plug-in hybrid electric vehicles. Supercapacitor can deliver a huge power within a very short time and hence it has the potential to contribute toward the rapid growth of power electronics such as portable and wearable electronic devices. In this context, the present chapter describes on the design and fabrication of various supercapacitor cells and their potential applications in several sectors like flexible and portable electronics, automobiles and transport, implantable healthcare, biomedical sensor, etc. Besides, the design and development of a bidirectional DC-DC converter by using a battery-supercapacitor hybrid system for electric vehicle applications and hybrid energy management system are briefly explained and highlighted.





E32

Impact of Microplastic on Anaerobic Digestion of Domestic Sewage Sludge

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Abstract:

Polymers smaller than 5 mm, known as microplastic (MP) pollutants, are ubiquitous in the environment and are now gaining growing attention. Though their effects on the environment are slowly coming to light, their entire scope of consequences is yet unknown despite their pervasiveness. The size of MPs varies greatly, and their predominance in domestic sewage sludge is primarily due to synthetic fibers from textiles and apparel, as well as personal care items like toiletries and cosmetics. Domestic sewage sludge (DSS) contains a high percentage of organic matter, is rich in biomass, and contains various inorganic chemicals. These factors make it difficult to extract and identify microplastics from DSS. Characterization of microplastics is the first step for their efficient removal. Due to the production of biogas from organic-rich sewage sludge, anaerobic digestion (AD) is considered one of the most effective treatment methods. AD can eliminate pathogens and odor, reduce the sludge volume, and generate renewable energy. Many studies revealed that MPs show positive and negative impacts on AD, but their effects are still unclear. While numerous techniques exist for removing MPs from diverse environmental matrices, a reliable, standardized approach for removing MPs from domestic sewage sludge must be needed. To separate microplastics from organic-rich domestic sewage sludge, this study presents a novel method with high digestion efficiency that uses Fenton's reagent. Results demonstrate a recovery rate of 90.78% for MPs from sewage sludge, with no significant changes observed in the physical properties of different polymer types of MPs. The suggested technique effectively breaks down domestic sewage sludge and extracts MPs with more excellent recovery rates, fewer steps needed in between, and less damage, providing a practical and affordable way to find MPs in domestic sewage sludge.

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E34

A study on the role of electrolyte on supercapacitor behavior of carbon nitride

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Abstract:

The search for novel electrode is driven by the demands of energy storage application. Here we have studied the electrochemical performance of a modified carbon nitride sheets. The electrochemical behavior and capacitance of the prepared material shall vary with respect to the employed electrolytes. Even-though the carbon-based electrode provides better capacitance, the cyclic stability is enhanced by nitrogen doping on carbon-based electrodes[1,2]. However, carbon nitride possesses a low capacitive behavior compared to carbon-based electrodes. To improve the capacitance of conventional carbon nitride-based electrode, doping of carbon nitride has been carried out. Here we have doped lithium interstitially in carbon nitride structures. A solid-state synthesis is followed by sintering at 550 Deg.C at N_2 atmosphere shall yield the expected lithium doped carbon nitride. XRD and Raman analysis confirms the structural characteristics. SEM analysis confirms the nano structural features of the prepared C_3N_4. The prepared doped carbon nitride electrochemical performance has been analyzed with the different electrolytes to understand the electrode and electrolyte interfacial behavior. It is found that simple carbon-based organic electrolytes support the mobility of ions compared to complex carbon chain-based electrolytes, within and between the electrolyte and electrode[3–5]. Further analysis to understand the role of electrolyte with respect to electrode surface features and edge sharing nitrogen atoms in carbon nitride are being conducted.

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E36

Strain Modulation in thermochromic nanoparticle through structural engineering for energy-efficient smart windows

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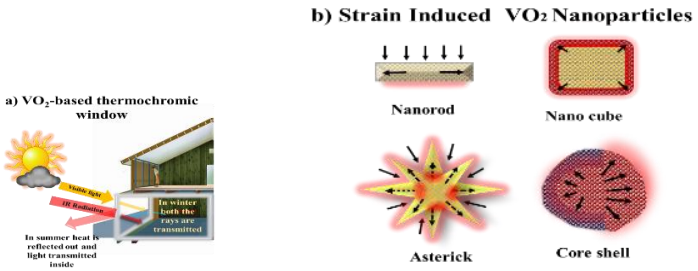
Abstract:

As reported around 40% of energy is consumed by heating, ventilation, (HVAC) systems of buildings which significantly contributes in emitting 30% of greenhouse gas. Vanadium dioxide (VO2)-based thermochromic smart windows provide a solution to this issue by offering temperature-dependant modulation in the near-infrared (NIR) spectrum through their unique reversible metal-insulator transition (MIT) phenomenon. But its broader application is hindered by high transition temperature (Tc) i.e. 68°C. This challenge can be tackled by conventional chemical doping techniques. that will successfully reduce TC to near room temperature but compromise solar modulation efficiency. To address this limitation, our unique approach involves inducing atomic strain through the structural engineering of VO2 nanoparticles (NPs), thereby influencing their optical properties and achieving a near-room-temperature phase transition. Through precise control of both the magnitude and orientation of induced strain in VO2 nanoparticles via tailored morphologies and interfaces, it is possible to mitigate the impact of strain-induced alterations on Tc and solar modulation efficiency(□Tsol). This process requires a comprehensive understanding of how strain influences the electronic band structure and optical absorption characteristics of VO2, followed by optimization of the strain parameters accordingly. Additionally, Nanostructuring enhances light trapping and absorption properties, thereby improving performance. To address this unique approach involves inducing atomic strain through the structural engineering of VO2 nanoparticles (NPs), thereby influencing their optical properties and achieving a near-room-temperature phase transition. Subsequently, as-synthesized VO2 NPs are embedded into the polymer and cast on a glass substrate to assess the real-time thermal and optical efficiency of thermochromic smart windows.



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E37

Electrification of Billenahosalli and Lakshmanapura Tribal Hamlet's, Using Green Energy based Micro Grid

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Abstract:

Decentralized energy solutions such as Microgrids allow for reliable, equitable, and sustainable access to energy in the remotest, rural, and hard-to-reach regions of India, including the potential to interface with clean energy/renewable energy solutions. These Microgrids are necessary in locations where grid supply is either notaffordable, unpredictable or unavailable and most importantly allow for improvisation and innovation of cleantech solutions. It is to usher us into a new age of energy access and address the different socio-economic adjecencies. Microgrids are a more comprehensive solution that can be community-owned empowering communities to diversify livelihood options, improve income-generating options, and contribute to furthering health, education, and mobility within communities.Micro-grids that generally run on clean fuels including Biodiesel, Biogas, and solar are gaining importance as an alternative to the centralized grid. Microgrids are finding application in offgrid, rural, and remote areas and in cases where alternative fuels, net zero, and renewable energy are prioritized. These systems are appropriate for remote electrification, villages at high altitudes, hamlets, green buildings, and commercial applications. The Paper depicts the project, Solar/Biodiesel based microgrid designed, established at Billenahosalli and Lasksmanapura tribal Hamlet, Mysuru District, India by NIE-CREST (Center for Renewable Energy and Sustainable Technologies), The National Institute of Engineering, Mysuru and funded by Ashraya Hastha Trust, Bangalore. Totally 73 houses are electrified in this project using a Biodiesel and solar powered Microgrid. A 7.5kva Biodiesel generator and 8.7kWp Solar PV are currently running from 17th January 2024. Biofuel for the engine is obtained from non-edible seeds available in the tribal hamlets. The Microgrid provides power for all the houses and 5 street lights 24hrs, 365 days. Further in phase-2 of the project two Pulverizer's for grinding pulses, ragi, masala power, cooking food and hot water for anganawadi children, E-bicycles for the mobility of girl students will be provided. The System is IOT-based. The Microgrid is not only providing much-needed electricity but also meeting the national targets of biofuels, solar energy missions, net zero policy, and sustainable development goals.

E38

Investigation of Guar gum/PVA based Nanocomposite polymer Electrolyte with Enhanced Electrochemical properties for solid state Li - Ion batteries

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Abstract:

An interesting way of technological advancement involves innovative adaptation of technology for revolution in energy storage systems. In recent years, natural biopolymers have acquired greater importance than conventional polymers because of their eco-friendly, ease of fabrication and great bio-degradable properties. Guar-gum (GG) is one of such biopolymers characterized by its high molecular weight, non-ionic nature, and branched structure, consisting of mannose and galactose. The development of GG-based nanocomposite polymer electrolyte (NCPE) membranes essentially involves commonly employed solution casting technique. During the present study NCPEs were prepared using biopolymer guar gum as the host polymer suitably blended with PVA in order to enhance its mechanical properties, along with LiClO4 salt, followed by dispersing of nanofiller TiO2 in common solvent namely water at room temperature. Specimens of NCPEs thus obtained were further characterized by various techniques such as X- ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Differential scanning calorimetry (DSC), Electrochemical complex impedance analysis, Linear sweep voltammetry (LSV) and Scanning electron microscopy (SEM) techniques. Interestingly, FTIR investigation has confirmed the complex formation between polymers, salt and nanofiller. On the other hand, the phase transformation into an amorphous nature is confirmed from the present XRD studies. The occurrence of an increase in the melting temperature and decrease in degree of crystallinity for various ratios of nanofiller incorporated NCPEs was determined by DSC results. Electrochemical impedance measurement showed the maximum ionic conductivity of 3.12 × 10-2 S/cm for loading of 5 wt% TiO2 into the chosen blended polymer electrolyte system at room temperature. The observed LSV results revealed an electrochemical stability window of these highly ion conducting NCPEs up to 3.5V. Using SEM investigations, relevant surface morphological characteristics of freshly prepared NCPEs were also evaluated. These results have revealed that Guar-gum based NCPEs may be a potential candidate as a suitable for Li rechargeable battery applications.

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E40

Application of Compliant mechanism in Architecture: A Sustainable and Resilient solution

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Abstract:

The paper examines the importance of compliant mechanisms in modern architecture and the many obstacles of planning and building compliant buildings. Architectural compliance means a building or structure can adapt, comply, and respond to environmental, user, and regulatory changes. This paper examines compliance mechanisms and their role in sustainable, adaptable, and resilient architecture.A detailed literature analysis of historical and contemporary compliance architecture illuminates its progress and integration into modern design. The study lays the groundwork for architectural compliance concepts and methods by analysing case studies and frameworks.This study also examines the many technologies and materials available for compliant mechanisms, emphasising their potential to change architectural design. Compliant architecture can improve energy efficiency, resource conservation, and sustainability, according to the study. Finally, compliance architecture potential and obstacles are discussed. It provides architects, engineers, and politicians with design principles, best practices, and recommendations to create a more adaptable built environment. This paper provides a complete overview of architectural compliance's theoretical foundations, practical applications, and implications for sustainable, adaptable, and resilient architectural design, contributing to the expanding conversation. It shows how compliance mechanisms can change architecture and the built environment.

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E41

Social and Cultural Aspects of Sustainable Architecture: Community Engagement and Behavioral Change for Energy Conservation

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Abstract:

Sustainable integrated townships address 21st-century urbanisation, environmental degradation, and social inequality. Sustainable integrated township planning and implementation's idea, benefits, difficulties, and key concerns are covered in this abstract.Sustainable integrated townships are well-planned urban regions that incorporate residential, commercial, industrial, recreational, and institutional uses. Compact urban form, mixed land-use development, pedestrian-friendly infrastructure, green building technologies, renewable energy integration, efficient waste management systems, and affordable housing aim to balance human activities and the natural environment based on environmental sustainability, resource efficiency, and social equity.It creates vibrant, integrated communities that promote social inclusion, economic prosperity, and quality of life through inclusive government, participatory planning, and diverse social amenities and public spaces.They provide equal housing, healthcare, education, and recreation to promote social cohesiveness, cultural diversity, and communal well-being. Smart land use and infrastructure development enhance local employment, investment, and production. These townships limit urban sprawl, carbon emissions, natural resource depletion, and climate change resilience via energy-efficient buildings, renewable energy, and smart grid technologies. Photovoltaic, concentrated solar power, evacuated tube collectors, waste-to-energy, and geothermal energy storage in design and building generate resilient communities. Institutional barriers, legal constraints, financial viability concerns, technical complexity, and social resistance exist. Sustainable urban development collaboration and consensus require innovative policy interventions, capacity-building, public-private partnerships, and knowledge-sharing platforms.

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E42

An Investigative Analysis of Adaptive Green Energy Technologies for Sustainable Rural Habitat Architecture

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Abstract:

Promotion of green building and sustainability initiatives has been widespread for major developments such as commercial complexes, residential buildings, industrial units, and transportation hubs, all of which consume significant energy. These initiatives often employ a uniform conceptual framework, with little variation. However, rural habitats present a different scenario altogether. They vary greatly in terms of culture, region, lifestyle, distribution, and other factors, necessitating a unique approach to architecture. Unlike urban areas, rural habitats typically lack sustainable green concepts, relying instead on traditional methods that overlook renewable energy sources, appropriate building materials, and suitable technologies or architectural features. This study aimed to explore and understand the factors influencing rural habitats, analyzing their qualitative impacts. Five major factors were identified: sustainable green concepts, building materials, appropriate technology, architectural features, and non-renewable energy sources. To address the sustainability challenges in rural areas, a comprehensive approach is needed. This includes incorporating sustainable practices such as zero-emission buildings, utilizing sustainable materials, adopting appropriate technologies, and considering architectural features that optimize natural resources like daylight, temperature, and air quality. Additionally, renewable energy technologies such as solar and wind power must be integrated into the architectural design. Unfortunately, basic utilities like power, water, and waste disposal often remain out of reach for underdeveloped rural areas, posing significant challenges to modern sustainability efforts. This research delves into how these challenges were investigated and analyzed, ultimately proposing a feasible framework for sustainable architecture in rural settings. By integrating the principles of sustainable green concepts, suitable building materials, appropriate technology, architectural features, and renewable energy sources, this framework aligns with the United Nations' Sustainable Development Goals, aiming to enhance the sustainability of rural habitats. Although one will find challenges like institutional barriers, regulatory constraints, financial viability concerns, technical complexities, and sociocultural resistance. It requires innovative policy interventions, capacity-building initiatives, public-private partnerships, and knowledge-sharing platforms to facilitate effective collaboration and consensus-building towards sustainable urban development goals.

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E43

Valorization of Macroalgae Residual Biomass via Pyrolysis: Optimization and Life Cycle Analysis

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Abstract:

The pressing challenges posed by current climate change dynamics, including escalating global energy demands, dwindling fossil fuel reservoirs, and escalating greenhouse gas emissions, mandate the pursuit of sustainable alternatives to conventional energy sources. Bio refineries have emerged as a promising avenue for sustainable fuel production, harnessing various conversion technologies to transform biomass into biofuels and ancillary products. Among these, aquatic biomass, particularly macroalgae, presents a compelling solution due to its abundance, renewability, and compatibility with diverse ecosystems.

This study delves into the efficient conversion of macroalgae biomass via biorefinery processes, focusing on lipid extraction for biodiesel production, alongside the generation of biochar and bio-oil through biomass pyrolysis. Employing Response Surface Methodology (RSM) via a Box-Behnken design, the investigation systematically explores the impact of temperature (350–550 °C), reaction time (30-60 min.), and catalyst concentration (0-5%) on bio-oil and biochar yields, with the aim of optimizing production efficiency. CaO emerges as the most effective catalyst following comprehensive screening.

Integration of Life Cycle Assessment (LCA) facilitates comprehensive evaluation of carbon emissions, environmental burdens, and potential optimization avenues such as resource efficiency, waste management, and energy utilization. LCA findings pinpoint environmental hotspots and inform strategies for enhancing the overall sustainability of biofuel production processes. Notably, the study identifies the solvent in transesterification, as a significant contributor to greenhouse gas emissions and climate change impact, underscoring the imperative to explore safer solvent alternatives.

E44

Carbon coated Tin Oxide Nanocomposites as an efficient anode for Sodium-Ion Batteries

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Abstract:

Sodium-ion batteries are recognized as an alternative to lithium ion batteries due to the abundance of sodium and potentially low cost of the whole battery system. The major barrier in the Sodium Ion Batteries (SBIs) is the lack of suitable anodes. In Li-ion batteries, graphite has been used as an anode, but for sodium ion batteries graphite cannot be used. The insertion of sodium ion is very challenging due to its large ionic size. By a simple method Carbon coated Tin Carbon Composite has been prepared affording an efficient anode material for Sodium Ion Batteries. Tin Carbon composites (Sn/C) can be used as the high sodium storage capacity for future sodium ion batteries and practical implementation for storage applications. Furthermore, the SnO_2 based anodes due to its large volume expansion while charging and discharging process impedes its practical applications. This volume expansion leads to pulverization and loss of electrical contact between Tin oxide and carbon. To overcome this difficulty it is been introduced an amorphous carbon coated Tin carbon composite, resulting in the high storage of Na ions and also make it as a good electronic conductor. The preliminary XRD studies confirm the presence of Tin oxide, and Raman spectroscopic analysis confirms the presence of carbon coated on a tin oxide nanoparticle. FE-SEM and HR-TEM micrographs clearly showed the particle type, size and surface morphology. The sodium ion cell in fact operates at an average voltage of 2.7V, with a specific capacity of 119.2 $mAhg^{-1}$ with 0.2C rate.

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E45

Towards Sustainable Mobility: Integrating Carbon Capture Unit and Biomaterials in Automotive Design

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Abstract:

In response to the imperative for environmentally friendly transportation solutions, this research explores the synergistic benefits of utilizing bio materials in automobile manufacturing and implementing carbon capture technologies at the exhaust level to mitigate greenhouse gas emissions. With a global shift towards green fuels, such as bio CNG and bio diesel, the comparable CO2 emissions of 2.5kg per litre to traditional fossil fuels underscore the potential of bio-based alternatives in reducing carbon footprints. This paper investigates various carbon capture techniques applicable to automobiles capable of efficiently capturing and reusing CO2 and suggests innovative technology for further design and adaptation. Also best lightweight, retrofitable unit from sustainable materials for automobiles.

The study delves into the utilization of biomaterials for automotive components, particularly focusing on India's abundant agricultural residues as a resource for producing bio plastics for automobile interiors. The conversion of agricultural by-products into sustainable materials not only addresses environmental concerns but also contributes to rural economic development. By integrating bio materials and carbon capture technologies into automobile design and manufacturing processes, this research aims to pave the way for a more sustainable and bio circular material in mobility.

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E46

Ruthenium Halide Double Perovskites and their Application in Solar Water Oxidation

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Abstract:

Hydrogen is intended as the “holy grail” for the energy community. Solar-water splitting is one of the most promising strategies for producing hydrogen. The abundance of water and solar energy enables the potential of scaling up this new technology if suitable photo-electrocatalysts and solar cells are developed. The aqueous stability photo absorbers are essential for developing successful photoelectrochemical (PEC) solar fuel devices. The fascinating optoelectronic properties and chemical tunability of halide perovskites have drawn considerable curiosity. However, their stability in aqueous electrolyte media is poor. The vacancy-ordered double perovskite Cs2RuX6 (X = Cl, Br) described here exhibits wizard stability in ambient and aqueous media at extreme pH values (pH 1 to 11). These materials exhibit magnificent absorption properties covering most of the visible spectrum. These ultra-stable materials allow the tuning of optical properties across mixed halide sites. The electrochemical properties of these materials are investigated, showing solar water oxidation on an unprotected photoanode with a photocurrent density of >0.2 mA cm-2 at 1.23 V (vs. RHE) under simulated AM1.5G sunlight. These materials show PEC stability for hours without compromising performance in constant voltage measurements.

E47

Transforming Wet Waste into Bio-CNG and Carbon Capture: A Pilot Project at NIE CREST

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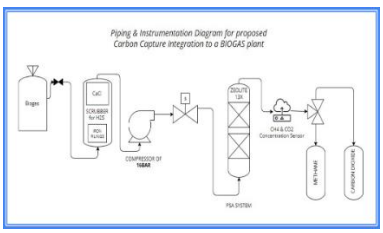
Abstract:

Biogas from organic waste produces green energy but also generates carbon dioxide at source leading to carbonization of the atmosphere. India has installed over 5 million Biogas plants of various sizes. To achieve clean energy goals, the Indian government has launched the 'SATAT' scheme to create large-scale Bio Compressed Natural Gas (BIO CNG) plants across the country by 2030. At the same time, it has a crucial task of achieving net-zero by 2070. By using decarbonisation technologies in the Bio Gas sector, India can achieve both its clean energy targets and environmental goals. To decrease the carbon footprint and achieve the net zero targets, capturing the carbon dioxide (CO_2) at the source is imperative. The separation of CO_2 from the BIO-GAS not only increases the calorific value of Biogas but aids Carbon capture. A prototype is designed and developed at NIE-CREST, Centre for Renewable Energy & Sustainable Technologies at the National Institute of Engineering, Mysuru, India, where in a pilot plant, kitchen waste is converted into BioGas by anaerobic digestion by the Bio Gas plant, and later the Bio Gas generated is scrubbed to remove impurities resulting in BIO CNG and CO_2 captured. The technology involves BIOGAS is passed through the scrubbers. The H_2S is removed using iron filings and moisture is removed by $CaCl_2$. The gas is compressed and then passed through the adsorption column containing adsorbent activated charcoal in a PSA (Pressure Swing Adsorption) unit. Switching operation of valves is done to capture methane (CH_4) and CO_2 separately through automation and IoT. The captured CH_4 and CO_2 in the respective cylinders are ready to be used for various applications. The activated charcoal to be used in the PSA scrubber is eco-friendly, produced from waste coconut shells; this not only reduces the need for importing adsorbent materials but also promotes indigenous materials, as coconut shells are abundantly available in India. In the pilot plant at NIE currently 50 kilograms of organic waste is fed to yield on an average of 3 m^3 of Biogas per day which is equivalent to approximately 25 kWh (90,000 kJ) of energy per day. This amounts to a total of 9,125 kWh of green energy per year.The system not only generates green energy but additionally captures CO_2 at source. The capture of around 30% of CO_2 through the sustainable carbon capture system results in 328.5 m^3 of carbon capture per year.



E48

Microwave-assisted sol-gel synthesis of mesoporous NiO-decorated silica nanostructures utilizing biogenic silica source for supercapacitor applications

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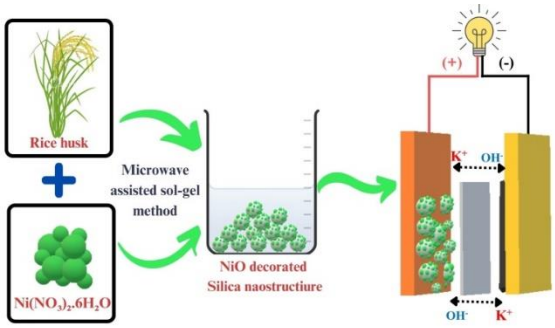
Abstract:

Developing efficient and sustainable energy storage materials is essential for supercapacitor technology. This study presents a microwave-assisted sol-gel synthesis of nickel oxide-decorated SiO2 nanostructures employing rice husk as a silica source for supercapacitor application. Rice husk, an abundant agricultural waste, was utilized as a cost-effective and environmentally friendly precursor for silica synthesis. Sol-gel synthesis assisted by microwaves allowed rapid and controlled formation of the silica nanostructure via alkaline extraction with NaOH, acidification with acetic acid, and capping with PEG. Likewise, nickel precursor with an appropriate concentration was introduced during the formation of silica nanostructures, leading to NiO-decorated silica nanostructures. XRD, FTIR, BET, FESEM, EDS, and HRTEM analysis demonstrated that NiO was decorated on the silica nanostructure distinctly depending on the concentration of nickel precursor. The electrochemical studies using 2M KOH electrolyte revealed that the maximum specific capacitance of RH-SiO2, NiO@RH-SiO2-1, and NiO@RH-SiO2-2 was found to be 102 F/g, 405 F/g, and 506 F/g at a current density of 0.5 A/g with superior energy density and power density. It is also found that the electrode exhibits high-capacitance retention and good cycle stability after 5000 cycles. The obtained result revealed that when the nickel precursor concentration was increased, the specific capacitance was also increased because high nickel precursor concentration leads to the formation of NiO species which can serve as reactive surfaces for carrier transport. Moreover, the ASC was fabricated using NiO@RH-SiO2-2 and it provides an excellent energy density of 31.25 Wh kg−1 at a power density of 745 W kg−1 with long-term cyclic stability (96.4% specific capacitance retention after 10000 cycles). Based on these results, NiO-decorated silica nanostructures can be a promising electrode material for supercapacitor applications.



E49

Acid- and Base-Stable $Cs_2Pt(Cl,Br)_6$ Vacancy-Ordered Double Perovskites and Their Core–Shell Heterostructures for Solar Water Oxidation

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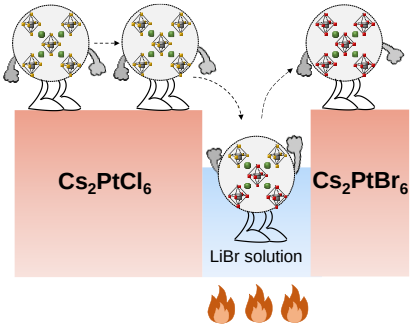
Abstract:

Lead- free vacancy ordered halide double perovskites (VOP) can be considered as an alternative to conventional lead- based halide perovskite (ABX_3) due to its excellent stability, high absorption coefficient, panchromatic absorption and compositional tunability which makes it suitable for photovoltaic applications such as solar cells and photo-electrochemical studies. Halide perovskites have attracted great attention in solar energy conversion in the last decade due to its opportunity to tune desired optoelectronic properties and exhibit very high photovoltaic power conversion efficiency; however, their stability remained a pitching issue which essentially restricted these materials from being employed. It requires different layers of encapsulation to protect the perovskite material from the electrolyte medium during water splitting.

Here the most stable vacancy ordered double perovskites Cs_2PtCl_6 and Cs_2PtBr_6, which remain intact in a wide range of pH values between 1 and 13 is reported. These materials also possess excellent absorption properties covering a significant portion of the visible spectrum. Like conventional ABX_3 materials, these ultra-stable materials offer tunability in optical properties via mixed halide sites. Through anion exchange, the conversion of Cs_2PtCl_6 to Cs_2PtBr_6 through core–shell conversion mechanism is explained. The latter led to the formation of type-II heterostructures. The electrochemical properties of these materials are investigated in detail and their ability to carry out solar water oxidation on an unprotected photoanode, with photocurrent density of > 0.2 mA cm^{-2} at 1.23 V (vs. RHE) is demonstrated. Studies on how anion exchange affects the performance of the device is studied. Since VOP is lead free and stable in water, it can be used as an unprotected photo-electrode for water splitting. This reduces major charge transfer losses at the interface of encapsulation and perovskite which is a major advantage making it suitable for solar water splitting.



E50

Real-time Visualization of Photo-brightening in Lead Halide Perovskites using Confocal Laser Scanning Microscopy

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Abstract:

One of the key issues with halide perovskites is the light induced structural changes and its associated instability which affects its optoelectronic properties. To understand and unravel the role of light on the properties of these materials, we systematically investigated the effect of light as a function of wavelength, time and intensity of illumination. Also, all these earlier mentioned light effects are carried out on various chemical compositions (varying A-site and X-site) and the effect on bulk/surface of perovskites is visualized with respect to the real-time changes using confocal laser scanning microscopy. The technique to study the light induced variations is inspired from bio imaging method – Fluorescence Recovery After Photobleaching (FRAP). A modified version of FRAP is applied to perovskites in-order to understand the variations due to light. This is one of the first detailed real-time microscopic investigations of halide perovskites that provides evidence for stability/instability via the observations on photoluminescence brightening and bleaching. In this work, the APbX3(A= CH_3NH^{3+}, $(NH_2)CH(NH_2)^+$, Cs^+; X = Br^-, I^- or their mix) was subjected to variety of light conditions (excitation wavelength, time of illumination, intensity of illumination) and their photoluminescence changes were imaged via confocal microscope and correlated with PL spectra. The study was separately conducted in these materials at three different illuminations wavelengths (488 nm, 561 nm & 633 nm) until PL saturates. Different wavelength of light induces different changes to the perovskite materials with green photons enhancing the photoluminescence more than blue or red photons, which is termed as photobrightening (PLB). The PLB saturates after certain illumination time, and intense photon illumination, tend to degrade the material. With careful confocal imaging, we could clearly identify that most of the changes that are happening reside on the surface/grain boundary and less to do with bulk. The similar enhancement in PL spectrums at various wavelengths are observed in the steady state PL. One other interesting aspect is that all these changes are very much specific to CH3NH3PbI3 and the introduction of formamidinium or cesium cations in the A site or the presence of mixed halide or bromide in the B site suppresses the photobrightening or bleaching. The structural properties under various testing conditions were investigated using quasi in-situ FT-far-IR studies. The relaxation of organic A site cation is found to be responsible for the observed changes in PL. In addition, the conductivity measured in dark conditions before and after shining lights showed an enhancement in conductivity by electrochemical impedance spectroscopy. The J-V measurements also displayed that the J_{sc} and V_{oc} of the film are enhanced due to photoshining at specific wavelength. However, at high laser intensity, quenching of PL and photobleaching was observed due to the degradation of material with respect to laser intensity. Hence, the light induced photobrightening and photobleaching phenomena plays a key role and it is significant to understand its photo-physical effect on the optoelectronic and photovoltaic device performances of the material.

E51

A detailed study using gellan gum – zinc trifluoromethanesuflonate based biopolymer electrolyte/separator for zinc ion battery

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Abstract:

Zinc ion conducting biopolymer electrolytes have been prepared using Gellan gum (bio-polymer) and different wt% of zinc trifluoromethanesulfonate with distilled water as a solvent by simple solution casting technique. The prepared thin solid polymer electrolytes (SPE) were subjected to different characterization techniques such as XRD, FTIR, DSC and impedance analysis. The semi-crystalline nature of the prepared biopolymers was studied by using XRD studies. FTIR study has revealed the formation of complexes between the Gellan gum and Zinc trifluoromethanesulfonate. Glass transition temperatures for the biopolymer electrolytes were found using a differential scanning calorimetry. The ionic conductivity of the prepared thin films have been analyzed by AC impedance analysis technique. The electrochemical stability of the optimized composition of prepared SPE was studied by the linear sweep voltammetry. It is inferred that ionic conductivity can be further improved and optimized by incorporation of nano-fillers in different wt %, which would emerge as a potential electrolyte/separator candidate in the fabrication of Zinc ion batteries.

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E54

g-C_3N_4/CdS@ reduced graphene oxide nanocomposite for hydrogen evolution reaction through electrocatalytic water splitting

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Abstract:

Electrocatalytic water splitting is a very promising method for producing clean hydrogen through the splitting of water. A nanocomposite of g-C3N4/CdS@ reduced graphene oxide (rGO) was selectively synthesized using a simple hydrothermal method. The resultant g-C3N4/CdS@rGO nanocomposite was subjected to various analytical methods to confirm its structural, morphological, and electrochemical properties. As-prepared nanocomposite used in a three-electrode electrochemical cell as the working electrode (WE). Experimental measurements confirmed that the g-C3N4/ZnS heterojunction was uniformly embedded on the reduced graphene oxide (rGO), which enhanced the synergetic effect of the heterojunction and promoted the charge carriers. The g-C3N4/CdS@rGO nanocomposite demonstrated strong electrocatalytic performance, with an observed hydrogen evolution reaction (HER) overpotential of about 371 mV at a current density of 10 mA cm−2. The g-C3N4/CdS@rGO nanocomposite exhibited outstanding electrochemical stability and significantly enhanced performance compared to the g-C3N4 and g-C3N4/CdS composite. Therefore, the results suggest that this material is more stable at the electrode-electrolyte interface to produce hydrogen by water splitting.

E55

Synthesis and fabrication of WS_2/Ag_3PO_4 heterojunction composite electrocatalyst for electrochemical hydrogen evolution reaction

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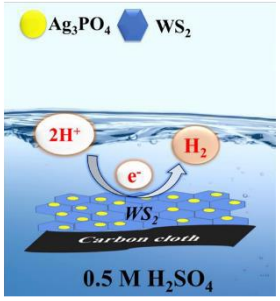
Abstract:

The increasing energy demand has led to the massive consumption of fossil fuels creates environmental concern. In recent years a rapid attention gained on 2D transition metal dichalcogenides especially in the electrochemical hydrogen evolution reaction. Catalyst exhibiting hydrogen evolution reaction (HER) activity are vital for sustainable energy technology. WS2 is an efficient and moderately earth abundant electrocatalyst for HER due to similar structural and electronic properties as that of MoS2. The choice of Ag3PO4 as a co-catalyst for WS2 is underpinned by its significant HER activity and its strategic compatibility with the properties of WS2. Ag3PO4 has demonstrated remarkable HER activity making it an ideal partner for WS2 towards enhanced efficiency. This paper focused on simple hydrothermal synthesis of 2D WS2/Ag3PO4 by varying the weight percentages of WS2 on Ag3PO4 is explored for hydrogen evolution reaction. This reaction relays on three important factors: low overpotential value, less Tafel slope and high electrochemical surface area. The 3%WS2/Ag3PO4 worked well as a potential candidate under acidic condition and shows minimum overpotential of 206 mV and less Tafel slope of 176 mV/dec this high electrochemical performance of optimal catalyst could be worthful to explore more to meet the properties of noble metal-based electrodes for HER activity.



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E57

Promoting Sustainable Livelihood Through the Revival of Gharats/Traditional Watermills

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Abstract:

Gharat, or a traditional watermill, is one of the earliest mechanical devices that utilize the kinetic energy of flowing water from perennial rivers, streams, rivulets, etc., and converts it to mechanical energy to rotate two grinding stones to grind flour and pulses. These traditional watermills can be found throughout the Himalayan region and are known by different names in different regions. They are known as Rantak in Ladakh, Chuskor in Arunachal Pradesh, and most commonly as Gharat in the Himalayan regions of Uttarakhand and Himachal Pradesh. The gharats were generally used for grinding purposes, but the scope of utilizing Gharat is becoming broadened with respect to applying mechanical energy obtained from gharats for different purposes. Gharat provides clean and cheap energy. The kinetic energy of the water coming from the natural reservoirs is directed through a man-made channel to fall upon a turbine to rotate it. This rotation of turbine can be utilized for multifarious uses. The turbine's mechanical energy can be used for electricity generation, oil extraction to obtain natural cold-pressed oils, rice husking, etc. The energy obtained through gharats is more sustainable as compared to hydropower plants, fossil fuels, etc. The existence of hydropower plants leads to changes in the natural course of rivers and streams. Also, these powerplant project are not suitable for the environment of fragile Himalayas. Fossil fuels, such as coal, petroleum, etc., are non-renewable. On the other side, traditional watermills are constructed through natural resources available in the Himalayas, such as mud, clay, wood, stones, etc., and utilize the kinetic energy of flowing water without causing any harm to the environment as there are no harmful emissions or by-products. The multipurpose use of traditional watermills has the potential to bring a revolution in the livelihood generation of the locals, which would prevent migration of the locals and will prove to be a great aid in the conservation of the Himalayas.

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E58

An insight into the mechanism of electrochemical CO2 reduction on silver surfaces

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Abstract:

The electrochemical reduction of carbon dioxide to value-added chemicals and fuels provides a possible platform to utilise CO2. Metals are the most employed electrocatalytic materials for the electrochemical CO2 reduction, and among them, gold and silver are more active and selective electrocatalysts for the production of CO. In the present work, the electrochemical CO2 reduction using silver in aqueous electrolyte is studied with more emphasis on its reaction mechanism. The key benefit of this process is that the major reduction products CO and H2 can be readily separated from the electrolyte and the resulting mixture, known as synthesis gas, can be converted to fuels such as methanol, dimethyl ether, or a mixture of hydrocarbons. CO is produced on the silver electrode surfaces via a few adsorbed species; one of the plausible mechanistic pathways include a proton coupled electron transfer at every reaction step. The *COOH intermediate species is assumed to be formed in the first activation step, takes another electron and proton to form a CO and H2O molecule. The experiment involves the chronoamperometric studies using a three-electrode setup, with Pt mesh as a counter electrode and Ag/AgCl (3.5M KCl) as a reference electrode. 0.1M KHCO3 is used as the electrolyte. The gaseous products are quantified using a gas chromatograph and faradic efficiencies at different potentials are evaluated. The resulting data are used to get insights into the reaction pathway, the competition between CO2 Reduction and Hydrogen Evolution Reaction, and mass transport effects.

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E61

Electrochemical properties of mixed metal silver molybdate for supercapacitor application

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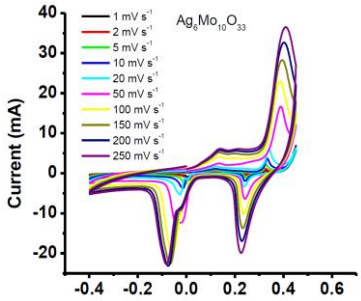
Abstract:

Recently, the mixed electronic and ionic conductors are showing promising electrochemical energy storage applications [1,2]. Here the electrochemical properties of mixed electronic and ionic conductors Ag6Mo10O33 were investigated by means of cyclic voltammetry (CV), galvanostatic charge/discharge (GCD) cycling, and impedance spectroscopy in a three-electrode configuration. The Ag6Mo10O33 was coated on Ni foil as a working electrode and their charge storage mechanisms were analyzed in 3M KOH solution. The Ag/AgCl and Pt wire are used as reference and counter electrode respectively. The CV reveals the coexistence of surface and intercalation redox mechanism as shown in figure. The scan rate dependent specific capacity of the electrode is found to be decreases with sweep rate of CV. To find the practical specific capacity of the electrode, the charging/discharging at different current density were measured with galvanostatic charging/discharging method. The specific capacity is decreasing with current density. A good stability is very important for real energy storage application. Hence the continuous GCD tests of the working electrode were carried out for 5000 cycles at 3 A g-1. After, 5000 cycles the electrode shows more than 97% of their initial specific capacity.



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E63

Energy Optimization in Renewable Energy Infrastructure by Internet of Drones

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Abstract:

The field of Unmanned Aerial Vehicles (UAVs), or drones, is encountering quick development in the areas of air transportation and computerization. The European Union's comprehensive Green Deal strategy envisions net-zero emissions of greenhouse gases by 2050, aiming to separate economic growth from resource use. Drones, with their multifaceted applications, occupy a significant place within the Sustainability and Mobility Strategy, offering substantial potential for advancing the green transition and reducing greenhouse gas emissions. Drones hold the potential to revolutionize sustainability and mobility, playing a crucial role in the green transition and mitigating greenhouse gas emissions. The key contribution of this research paper endeavors to undertake a comparative analysis of power supply technologies for drones and machine vision applications to identify and forecast future trends in the UAV technology sphere.

Different types of UAVs are used for different applications, and there is a suitable power source for each application. Some options include fuel cells, combustion engines, batteries of various technologies, and more. These power sources are crucial for the operation of UAVs and must meet certain requirements such as size, weight, cost, and power density.

Energy Source	UAV	Applications
Battery powered	DJI Phantom 4 Pro	Photography- Videography
Fuel powered	Aeryon Skyranger	Aerial inspection
Solar Powered	Airbus Solar UAV	Agriculture

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E64

Approaches to Design Reducing Power Consumption in Emerging Digital Processing Models Using Green Computing Technologies

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Abstract:

Presently, the whole world's is dependency on it for global connectivity, information sharing and digital computation in such a way that it's both hardware devices and software sectors contribute to great extant in global warming. Very little work has being done in these sectors by researchers, mainly focus is on enhancing their performance level without concerning for power consume factor. Since area of Artificial Intelligence (AI) & Machine Learning (ML), Data Science, Cloud Computing and Internet Communication model that have dramatically enhance accuracy in area of their concern fields like natural language processing, image processing and speech processing but also being tremendously applied to various houses transformations the trends for newly evolving technologies. However, utilizing large-scale digital computational based models demand substantial electric power consumption in algorithm training and application phases. Large amount of power needs for storage at servers and transmission through network for cornered data and computational needed for those models. Trends shows that power consumption and CO emission caused by current digital models are highly expected to rising day by day in incoming future, and it is imperative that efforts be made to reduce energy consumption.

In this paper we first comparatively study about the contribution of cyber space in global warming global and environment pollution. And further analysis to design for reducing power consumption in exploring AI & ML based models with approaches to achieve objective. This save considerable amount of energy resources at every sector of digital processing model fragmentations.

E65

Consequence of water infusion in nitrogen gliding arc plasma on ammonia fixation in water medium

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Abstract:

Ammonia is the second-most significant chemical synthesis globally, serving various applications including plant growth fertilization, hydrogen transportation, energy storage, cleaning agents, etc [1,2]. This study explores the effect of water addition in nitrogen gliding arc plasma on the formation of ammonia in a water medium with the presence of a porous copper metal foam. For this purpose, three-dimensional open-cell porous copper metal foam (40 PPI) was positioned between the plasma and water as a solid interface. The experiment was performed using deionized water (30 ml) at a fixed nitrogen gas flow rate (10 slpm), interaction time (10 minutes), and discharge power (44 Watts). Deionized water was added to the nitrogen gas flow at three distinct flow rates (0.5, 1.0, and 1.5 mL/min.) and their effect on ammonia formation in a water medium was studied by the Indophenol blue method. The result showed that the ammonia concentration increased by 56.7 % when 1 ml/min of water was added to the nitrogen gliding arc plasma. The optical emission spectroscopy studies identified the presence of N2*, N2+, N atoms, Hα, O, and O2+ species in water-infused nitrogen gliding arc plasma which are crucial for the fixation of ammonia in water medium. Experimental results proved the water-infused nitrogen gliding arc plasma produced a high concentration of ammonia compared to the nitrogen gliding arc plasma discharge alone.

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E66

Retrograding Grey Hydrogen - Biomass Energy Nexus for Sustainable Green Energy Networking

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Abstract:

Biohydrogen is a renewable biofuel and persistent energy source for reducing fossil-fuel-related emissions. Hydrogen fuel, is clean, versatile, and energy-efficient. Hydrogen is a critical resource for a variety of industries throughout the world, particularly the iron and steel industry, which is reliant on low-cost, emission-free fuel. Bio hydrogen is our startup product derived through process utilising multiple feed materials such as Bio waste and agro waste materials. Hydrogen fuel can be synthesized from many other methods which results in quite expensive way, hereby we give solution for cost effective way of producing Bio Hydrogen, free from greenhouse gas emission and reduce the mounting up of organic and municipal wastes. Grey hydrogen will be generated utilizing bio waste products to reduce greenhouse gas emissions and increase the pace of biohydrogen generation.

Out of the nine types of hydrogen configuring to purity of hundred percent, efforts were being focussed on the process configuration to reduce the interference and residue that eventually improves the overall quality. Dark fermentation is usually seen in nature as part of a wider process known as anaerobic digestion. Organic matter is digested in an anaerobic environment during this process, however, physico-chemical changes attributes to increase in biohydrogen percentage. In our work, simultaneous production biomethane and bio hydrogen was carried out in a sequential manner, and subsequently purified through the requirements of Industrial quality. Biomethane can be converted to Bio Hydrogen through steam refining process, if required it can also be used as a gaseous fuel as an energy requirement of steel plant. Biohydrogen process can also be used to tailor made from feed sources like agro waste, algal mass and azolla from agricultural land in and around.

E67

Rapid and Stable Energy Storage Using MoN/Mo2N Composite Electrodes

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Abstract:

Molybdenum nitride-based composites, specifically the two-dimensional MoN/Mo2N variants, emerge as promising electrode materials for next-generation energy storage devices. This research presents a facile synthesis approach involving a mechanochemical method followed by heat treatment at 900◌° C in a nitrogen atmosphere to produce the MoN/Mo2N composite material. Crystallographic analysis using X-ray diffraction (XRD) and morphological characterization via high-resolution scanning electron microscopy (HRSEM) were conducted. Electrochemical evaluation demonstrated remarkable supercapacitor performance, with a specific capacitance of 306.7 F/g at 1 A/g, highlighting exceptional charge storage capacity. Even at a higher current density of 2 A/g, the composite maintained substantial reversible capacity (198.6 F/g), coupled with capacitance retention (95.7%) and Columbic efficiency (86.2%) over 6000 cycles, showcasing robust stability. At a challenging current density of 10 A/g, the specific capacitance remained high at 85.4 F/g. Detailed charge storage mechanism analysis, employing the Dunn method, revealed a complex interplay of capacitive and diffusive processes. Particularly noteworthy was the predominance of capacitive behavior, constituting 78.4% at an accelerated scan rate of 100 mV/s. This observation underscores the material's advantageous propensity for a higher proportion of capacitive behavior in the charge storage mechanism at elevated scan rates, making it well-suited for applications requiring rapid energy storage and release.

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E69

SYNTHESIS, CHARACTERIZATION AND ELECTROCHEMICAL STUDIES OF NANOSTRUCTURED MgFe2O4 FOR SUPERCAPATTERY

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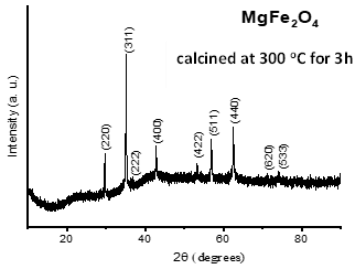
Abstract:

We present the synthesis of MgFe2O4 nanostructured materials by using ammonium bicarbonate-assisted simple solvothermal route. The structural properties were investigated by means of X-ray diffraction (XRD), Raman, Fourier transformation infrared (FTIR) and X-ray photoelectron spectroscopic (XPS) techniques. The XRD pattern reveals the spinel-type cubic structure with lattice parameter of 8.4667 Å as shown in figure. The average crystallite size of the sample is estimated to be 27 nm with Debye Scherr formula. Furthermore, the formation and purity of the sample was confirmed with Raman and XPS analysis. The electrochemical properties of sample were investigated by means of cyclic voltammetry, galvanostatic charging/discharging (GCD) and impedance spectroscopic method with three electrode configurations in 3 M KOH solution. The calomel electrode and Pt wire are used as a reference and working electrode respectively. The working electrode of the sample is fabricated on Ni foil by coating the mixture of active material (80%), activated carbon (10%) and PVDF (10%). The specific capacity of the sample found to decreases with scan rate. The good cyclic ability of the sample is very essential for practical application [1,2]. Hence the GCD measurements were carried out for 10,000 cycles at current density of 2 A g-1. It reveals the cyclic retention of its initial values more than 95%.

Graphical Abstract



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E70

Enhanced photocatalytic hydrogen production from metal nanoparticle decorated gC3N4/MoS2 heterojunction

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Abstract:

Limitations of pristine carbon nitride (gC3N4) reduce its effectiveness in photocatalytic hydrogen generation. Here, we overcame the constraints of pristine gC3N4 by creating an efficient heterojunction with molybdenum sulfide (MoS2) by a simple co-calcination and hydrothermal procedure to boost its charge transfer efficiency. Additional metal nanoparticles were incorporated into gC3N4/MoS2 to improve the hydrogen production. Characterization studies to analyse crystalline structure and morphology were done using X-ray diffraction (XRD), high-resolution TEM (HRTEM), and scanning electron microscopy (SEM). Using the photoluminescence (PL) spectrum and ultraviolet-visible diffusion reflection (UV-vis), the optical properties of the as-prepared nanocomposites were investigated on composite materials to understand the charge transfer mechanism. Photocatalysis and photoelectrochemical studies on composite materials demonstrated superior performance compared to bare materials.

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E71

Enhancing Food Waste Biomethanation Through Co-Digestion with Poultry Waste and Sewage Sludge

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Abstract:

Biomethanation is an established technology for food waste treatment and concomitant energy recovery as biomethane. The generated biogas can be utilized as energy, and the unspent slurry can be bioprocessed to produce biofertilizer. Despite the evident advantages of food waste biomethanation, various challenges persist throughout the process. Notably, volatile fatty acid (VFA) accumulation and low pH levels significantly contribute to process instability and hinder methane production efficiency. To overcome these challenges, co-digestion is a promising strategy to optimize biomethanation efficacy. Through co-digestion, precise control of the carbon-to-nitrogen (C/N) ratio is achievable, thereby promoting process stability. Furthermore, co-biomethanation fosters enhanced syntrophic interactions among microorganisms by enriching micro and macronutrient availability. This investigation explored the enhancement of food waste biomethanation through co-digestion with various organic-rich substrates, including poultry waste (PW) and sewage sludge (SS), in five distinct ratios (100:0, 75:25, 50:50, 25:75, 0:100) for each substrate combinations. In this experiment, 15 serum bottles with a capacity of 134 mL were utilized. The feed-to-inoculum ratio was maintained at 2:1. Physicochemical characterization was estimated to comprehend the biochemical properties during the process, and biogas production was monitored daily. Relative to the digestion of 100% food waste (FW), significant improvements were observed in methane yield, with a 3.16-fold increase noted in the 50FW:50SS ratio and a 1.9-fold increase in the 50FW:50PW ratio. Additionally, the 75:25 ratio resulted in a 1.7-fold increase in sewage sludge and a 1.31-fold increase in poultry waste. Concomitantly, enhanced biomethanation results in high organic matter removal, reduced pH variability, and nutrient-rich digestate, which are achieved from the co-digestion of FW with SS and PW. A significant amount of biogas increment was observed in this co-biomethanation process, which is a cost-effective energy approach and a sustainable waste management strategy.

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E72

Computational studies on Ru-OctaethylPorphyrin and it's derivatives for energy harvesting and photocatalysis

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Abstract:

Ruthenation of Porphyrin is an important reaction debated for years and finally achieved. After the formation of ruthenaporphyrin its applications are started evolving most importantly in energy harvesting and in photodynamic therapy. The natural macrocycle porphyrin possesses diverse applications. Ruthenium porphyrin complexes are found applications in energy harvesting and in photo catalysis. The new hybrid ruthenium complex and the octaethyl Porphyrin together can have more applications. Here we have studied the electronic and geometric structural features and spectroscopic properties of the different ruthenium octaethylporphyrins of the type [Ru(OEP)X2] where P = porphyrin; X = NPh_2 (1), NH_3 (2), PH_3 (3), AsH_3 (4) were optimized using the DFT method at BP86/TZVP level to get more insight into the electronic, geometrical structure, bonding and reactivities of these important compounds.

The DFT optimized geometries confirm that the resulting structures are minima in the potential energy surface and confirm their stable nature. Molecular orbital analysis performed on these compounds provide more insight into the reactivities of these compounds. The interaction of these molecules with biomolecules are in progress. The important preliminary results obtained will be presented.

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E73

Structural and electrochemical properties of silver oxide embedded MWCNT for Bio-sensing application

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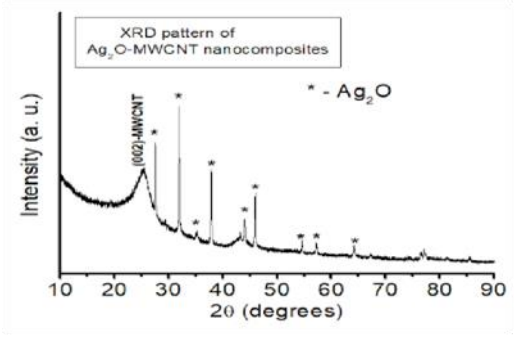
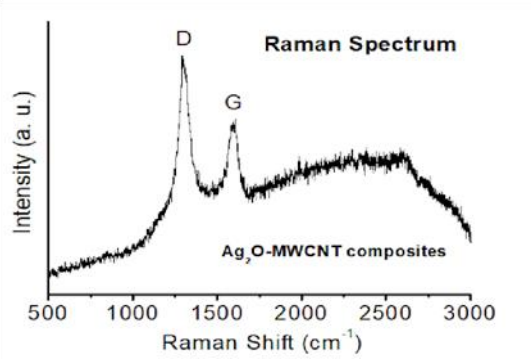
Abstract:

Recent advancement in studying various applications of multiwalled carbon nanotubes (MWCNT) shows impressive electrochemical properties and biosensing applications [1,2]. Our study focuses on the synthesis of silver oxide embedded MWCNT nanocomposites through simple, straightforward, and economic approach. Structural properties of the nanocomposites were studied with X-ray diffraction, Fourier transformation infrared spectroscopy, Raman and X-ray photoelectron spectroscopic methods. The XRD pattern reveals the formation silver oxide nanoparticles with MWCNT as nanocomposites as shown in figures. The mean crystallite size of the silver oxide found to be 78 nm. The electrochemical properties of the nanocomposites were investigated by means of cyclic voltammetry and impedance spectroscopy method with three electrode configurations in 0.1M KOH solution. The working electrode was fabricated on Ni foil by coating the mixture of nanocomposites and PVDF (85:15wt%). The CV curves of working electrode reveals non faradic processes. The electrochemical response current of silver oxide embedded MWCNT against glucose were investigated. It shows good responses against glucose from 1 to 10 mM concentration in 0.1 M KOH solution. The MWCNT based nanocomposite is potential candidate for glucose sensing application.





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E74

Pondicherry University Towards Carbon Neutral Campus by 2050

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Abstract:

Carbon footprint refers to the generation of greenhouse gases (GHG) due to anthropogenic actions in the atmosphere. The calculation of carbon footprint and preventive measures in higher educational institutes plays a major role in fostering awareness among young minds. This study presents the carbon footprint data using GHG_emissions_calculator_ver02.6 of the United Nations Framework Convention on Climate Change and mitigation strategy to make the carbon-neutral campus of the main campus of Pondicherry University, located in Kalapet, Puducherry, India. The study encompasses three Scopes: Scope I (direct emissions), Scope II (indirect emissions), and Scope III (indirect emissions) in assessing the University's carbon footprint over ten years. The results reveal that the University exhibits an average carbon footprint calculated around 71254 tonnes of CO_2e, correlating to the average population of the campus of 6500. The ten-year average per capita emission was observed as 1.9 tonnes of CO_2e with 1.49%, 77.3%, and 21.15% of Scope I, Scope II, and Scope III. The 2.4 MW solar power plant installed in the University mitigates an average of 1683 tonnes of CO_2e, ~ 30.5% of scope II. The carbon-neutral campus goal can be achieved before 2050 by adopting better economic policies, installing additional solar (on-grid/off-grid) power systems, promoting EVs mobility, using biofuels for genset power, energy conservation measures, zero-waste policy and installation of offsite renewable energy generation plants with the on-grid connection.

E75

Hydrazine -Functionalized Perylene Diimide Integrated Ti^{3+} Self-Doped TiO_2 Heterostructure for Visible Light-Driven Photocatalytic H_2 Evolution

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Abstract:

Developing heterostructure catalysts for photocatalytic hydrogen production with an intrinsic step scheme mechanism has attracted significant interest. TiO2 is a widely used photocatalytic material for water splitting, but its broad bandgap limits its ability to absorb photons in the visible spectrum. To overcome this limitation, oxygen vacancies were created in TiO2 to introduce trap states. Additionally, Ti3+ was incorporated into oxygen-vacant TiO2 using a solvent mixing method, taking advantage of the π-π stacking structure and broad visible light absorbance of perylene diimide. XPS and Mott-Schottky spectra confirmed the formation of oxygen vacancies in Ti3+ and the heterojunction between PDI and Ti3+. The resulting PDI-incorporated Ti3+-TiO2 photocatalyst demonstrated a successful formation of the Step scheme mechanism and exhibited superior hydrogen production efficiency of 1390 μmol/g, which is four times higher than bare TiO2.

E76

Size dependent structural morophological, optical, and electrical studies of hydrothermally synthesized TiO2 nanocoral for DSSC application

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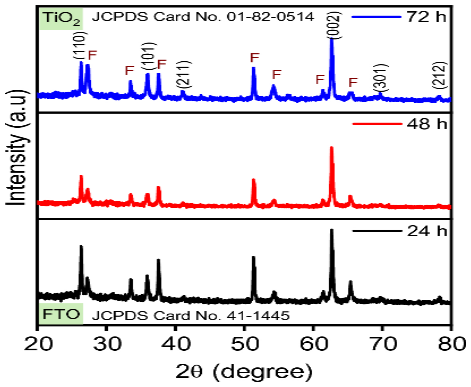
Abstract:

In this work, we report the titanium dioxide (TiO_2) nanocoral synthesized by hydrothermal method with different reaction times of (24, 42, and 72h) at 160°C. The structural analyses reveal that existence of sharp, intense peaks, showing that the well crystalline nature in all prepared TiO2 nanocoral film, as confirmed by powder x- ray diffraction. In optical bandgap analyses synthesis, all the sample calculated which was found to be 3.23, 3.31, and 3.42eV by using taue plot with straight line slope method. However, HR-SEM images shows the formation of TiO_2 nano coral due to the effect of increasing reaction time. In addition EDS spectrum confirm the chemical compounds. The surface nature of the sample analyses of the atomic and molecular level using AFM microscopy. EIS reveal the charge transfer process of dye sensitized solar cell.The power conversion efficiency of (TiO_2-N719-dye) to increase reaction time of 24, 42, 72h surface morophology affected and also particle size decreases due to the effect of dye molecules absorbed the fast charge collection and superior light scattering ability to increase the dye sensitized solar cell. The best power conversion efficiency of 72h sample 5.85% has been achieved on a TiO_2 nanocoral film.



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I01

Green transition metal organic framework catalysts for transesterification of microalgal lipids to produce biofuels

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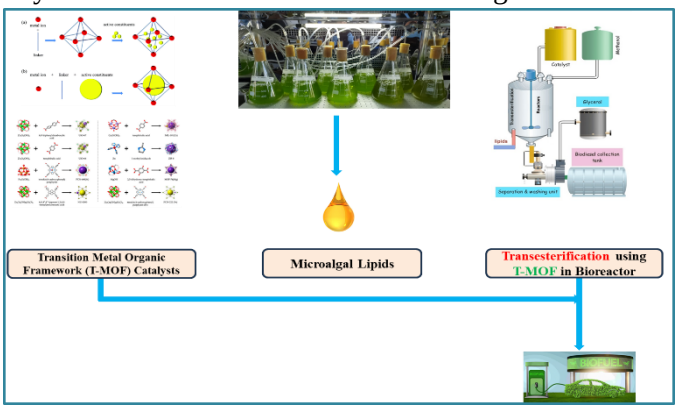
Abstract

The depletion of global fossil-energy reserves and GHGs emissions incite amplified research into alternative and renewable carbon-neutral biofuels. Recently, biofuels, particularly those made from microalgae, are considered viable. Microalgal biodiesel is one of the sustainable and renewable biofuels, but high-quality oil feedstocks require efficient catalysts for transesterification in its industrial production. In this work, green transition metal-organic frameworks (T-MOFs) have been pondered for microalgal biodiesel synthesis [1]. The critical factor such as surface area, pore size, volume, and active site concentration are empirical for catalytic competence. Metal nodes and organic linkers form metal organic frameworks have various uses, including in catalysis. Moreover, approaches have been particularized for the synthesis of T-MOF structures based on green transition metals. The integrity and regeneration of green catalysts has also been conferred. The characteristic properties of catalysts and their role in the catalytic mechanism have been deliberated particularly in the case of transesterification of microalgal lipids. The T-MOF green catalysts approach has demonstrated the potential prospects to produce higher quality FAME, easier to isolate and requires less expensive refining processes for clean energy uses and a safer environment [2].



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I02

Green catalytic nanomaterials and nanocatalysts supports for transesterification of microalgal lipids to produce biofuels

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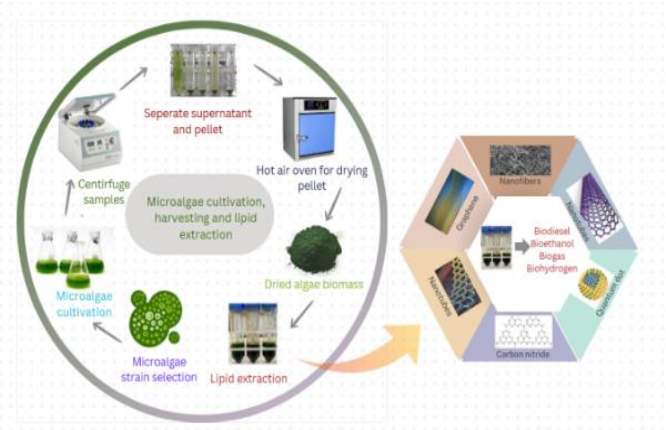
Abstract

Exponential growth population and increasing demand for fossil fuels is an environmental concern causing the degradation of natural resources and human health. Biofuels derived from biomass, such as microalgae, are the potential alternative and clean energy sources that substitute the harmful impacts of fossil fuels. The microalgal feedstocks have been recognized for high lipid productivity in a shorter cultivation time to ensure efficient biofuel generation. However, several critical problems and challenges need to be addressed for the technological interventions in the case of microalgal biofuels production systems. This review work has deliberated the recent advances in the application of green nanomaterials as catalysts and supports for microalgal biofuel production [1]. Nanomaterial catalysts including green synthesized nanometals, nanocomposites, carbon nanomaterials, graphene and its composites have been significantly addressed in the process of microalgal biofuel production. The recent research has explored to use nanocatalysts as lipids immobilizers to act as catalysts in the transesterification reaction in the process to improve the biofuels properties and production efficiency [2]. Moreover, the technical and economic aspects of green and/or bio-based nanocatalysts are also conferred. The positive environmental implications of green nanocatalysts as well as the substantial improvement in biofuel production endorse the sustainability and applicability of microalgal biofuels and biorefineries.



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I03

CdS-deposited Copper-doped Titanium dioxide nanotube heterostructure for Hydrogen Production

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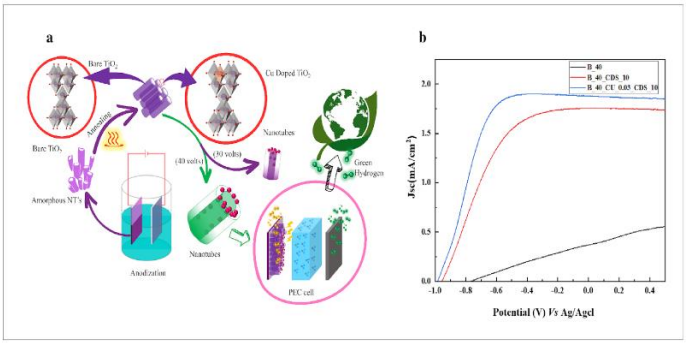
Abstract:

Extensive material research is required to accomplish Sustainable Development Goal 7, which focuses on affordable and clean energy. TiO2 is a potential candidate with a large bandgap that finds extensive use in industries related to green energy. Titanium dioxide (TiO2) is plentiful, cost-effective, chemically and thermally stable, and non-hazardous. However, it has low conductivity and undesirable band alignments. However, we can modify the structural and electronic properties through doping, morphological modifications, and heterojunction formation1. A hybrid photoanode named CdS/Cu-TNT is created by depositing Cadmium Sulfide (CdS) onto Copper (Cu) doped Titanium dioxide nanotubes (TNT) using electrochemical deposition. The fabrication pathway and concept are displayed in Fig.1. This structure effectively modified the electrode's morphological and structural characteristics. Doping titanium dioxide nanotubes with copper notably decreases the surface area, leading to the coagulation of cadmium sulfide and decreased current and hydrogen production. This paper discusses a strategy to counteract the drop in surface area by expanding the diameter of TNT tubes. Herein, we report a hybrid photoelectrode of CdS/Cu-TNT with 1.46 mmol g-1 hr-1 hydrogen production which is 4.1 times that of the bare TNT electrode. Fig.1(a) compares different electrode photocurrent densities drawn using linear sweep voltammetry.



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I04

Characterization of Carbonized TiO_2 Nanotubes for Improved Supercapacitance

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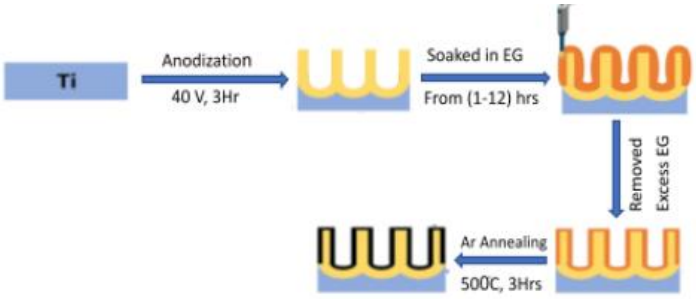
Abstract:

The usage of energy storage devices to meet the demand for energy consumption has been increasing daily. Supercapacitors have drawn attention and have become one of the leading research topics in energy storage devices for their potential to have high energy and power density. Areal capacitance plays a significant role in designing supercapacitors as a power source for an electronic device. TiO2 is a promising anode material for supercapacitor application as it is naturally abundant, non-toxic, and environmentally friendly [1]. TiO2 nanotubes (TNT) offer the advantage of unidirectional electron transport, high surface area, and porosity, which are essential for good supercapacitor anode material. However, some setbacks in such metal oxide anode materials must be addressed, such as inherently suffering from inferior rate performance and poor cyclability due to low ion conductivity and slow ion diffusion [2]. Various strategies are being employed to address these issues; doping is one such method. Introducing impurity to the pure structure is believed to develop defects often exhibiting prominent effects that could lead to substantial advancement. Therefore, TNT with a defective structure could enhance electric conductivity owing to the plentiful oxygen vacancies. Combining carbon in TiO2 enhances the capacitance of the material [3]. It can improve electronic conductivity, reduce oxygen deficiency, and increase the contact area with electrolytes, promising features for a superior electrode. This study prepared the electrodes by single-step anodizing titanium foils in Ammonium fluoride-based electrolytes at 40 volts, followed by carbonization. The carbonized TNT is characterized for supercapacitor applications. We observed an areal capacitance of 8.67mF/cm2 when the weight percentage of carbon is 10.



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I05

Enzymatic Conversion of Paddy Straw to Fermentable Sugars

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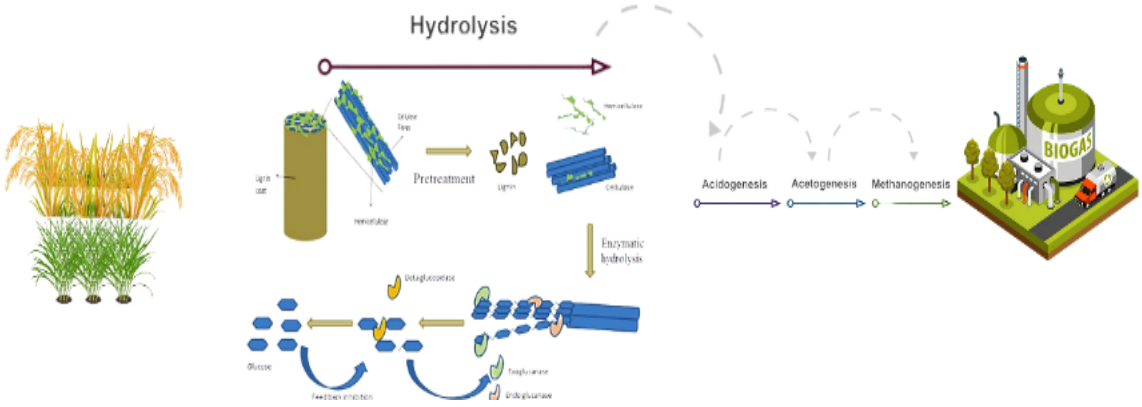
Abstract:

The present research work deals with the development of a culture/enzyme-based hydrolysis process for the production of fermentable sugars (xylose, glucose) from paddy straw for biogas production. The hydrolytic enzyme from the fungal cultures Aspergillus sp. MAFI-1 and Aspergillus sp. MAFI-2 produced by solid-state fermentation (SSF) used as a crude enzyme to reduce the cost of direct enzyme application. The optimization of the conditions required for the specific substrate paddy straw and been proceeded for efficient biomass conversion into sugars. The local native fungal isolates effectively produced the hydrolytic enzymes in SSF from the pre-processed water hyacinth biomass under optimized conditions near to ambient temperature. However, the enzyme production has intended to use an energy management system with culture fermentation. The hydrolytic enzymes were used effectively in enzyme hydrolysis of pre-treated paddy straw and resulted in 18-20% of the fermentable sugar production. The present invention provides a simple and cost-effective way to produce sugars from selective biomass; it results in sustainable biogas production with a reduced amount of energy utilization.



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I06

Valorization of Syntrichia sp. for biodiesel and value-added products

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Abstract:

This study explores the potential valorization of Syntrichia sp., a widely distributed moss species, for the production of biodiesel and other value-added products. With increasing concerns about energy security and environmental sustainability, there has been a growing interest in exploring alternative sources of biofuels. Mosses have emerged as promising candidates due to their rapid growth rates, high lipid content, and minimal input requirements. This study focused on the optimization of lipid extraction and transesterification. Furthermore, it aimed to achieve high yields of biodiesel precursors. Characterization of the extracted lipids reveals their suitability for biodiesel production, with favourable fatty acid profiles and low levels of impurities. The optimized transesterification processes lead in biodiesel conversion from bio-oil, ensured high yield and quality standard. Beyond biodiesel production, the study explores the potential of utilizing residual biomass and by-products for the synthesis of value-added compounds such as antioxidants, pigments, and bioactive molecules. The economic feasibility and environmental impact of the proposed valorization process are assessed through techno-economic analysis and life cycle assessment, providing insights into the sustainability and viability of utilizing Syntrichia sp. as a renewable resource for bio-energy and bio-products. Overall, this study contributes to the development of sustainable pathways for biomass utilization, addressing both energy and environmental challenges while exploring novel opportunities for bio-refinery applications.

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I09

RuO_2 Embedded $CuFe_2O_4$ as Cathode Catalyst for Rechargeable Li-Air and Li-CO_2 Batteries

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Abstract:

Lithium-Air batteries are promising next-generation energy storage devices due to their ultrahigh theoretical specific energy. Similarly, Li-CO_2 batteries have a higher energy density along with its attractive carbon neutral cycle in the charge-discharge storage mechanism. Utilizing sustainable CO_2 as a cathode in Li-CO_2 batteries makes them highly attractive in the current era focused on reducing the carbon footprint in the energy sector. The bifunctional catalyst at the heart of Li-Air and Li-CO2 batteries facilitates both the discharge and decomposition processes during charging. Here, the performance of oxygen reduction reaction (ORR), oxygen evolution reaction (OER) and CO2 reduction reaction (CO_2RR) of $CuFe_2O_4$

has been gradually enhanced with help of tuned RuO_2 doping. The electrocatalyst synthesized is characterized using X-ray diffraction, Raman spectroscopy, Fourier-transformed infrared spectroscopy, X-ray photospectroscopy, scanning electron magnification and BET analysis. The better performing catalyst has been taken as catalyst for the Li-Air and Li-CO_2 batteries and their performance has been studied in various atmospheres of O_2, CO_2 and Ar using cyclic voltammetry, galvanostatic charge-discharge. The battery fabricated is tested for stable open circuit voltage maintenance and for commercial application. Li-CO_2 battery charge discharge mechanism is unveiled with the help of X-ray diffraction and Raman spectroscopy.

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I10

Carbon based Carbon Capture Technologies – A Sustainable Solution To CO_2 Sequestration

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Abstract:

One of the main reasons for global warming and climate change is anthropogenic CO_2 emissions from burning fossil fuels and industrial operations. To mitigate this imminent disaster, the goal of global CO_2 reduction policies are focused on attaining net-zero emissions target. Carbon capture, storage, and utilization (CCUS) has been considered as one of the essential methods to be pursued to attain the CO_2 emissions reduction target and carbon neutrality. There exist many technological solutions to the CO_2 capture problem, namely, post-combustion, pre-combustion, oxy-fuel combustion, direct air capture, and the technologies for CO_2 separation, including membrane, cryogenic, biological, and adsorption. The captured CO_2 can be resorted in many ways. CO_2 can be directly used as a precursor to synthesize other value-added products including methanol, ethanol or formic acid or can be sequestered in different ways like deep ocean storage and geological storage. For the capture of CO_2 from flue gas, solid adsorbents represent an effective material. Among the viable solid adsorbents, Activated Carbon (AC) constitutes a promising material due to sustainable and high-throughput CO_2 capture ability. In this work, using a custom-built high-pressure gas chamber, CO_2 adsorption and desorption at 25 ^{0}C under 1bar pressure was quantified for activated carbon material (Fig.1). The results show CO_2 adsorption of 97mg.g^{-1} achieved and a similar amount is released during desorption cycle. However, efforts to further enhance the adsorption by nitrogen doping with melamine precursor in 1:1 ratio with activated carbon, resulted in lower adsorption of 51.95 mg.g^{-1} at similar condition. Further efforts are on to optimize the doping process while retaining the activated state of carbon. It is observed that for a large-scale CO_2 capture, huge amount of adsorbent material is required. Use of carbon based adsorbent represent a sustainable approach for CO_2 sequestration.

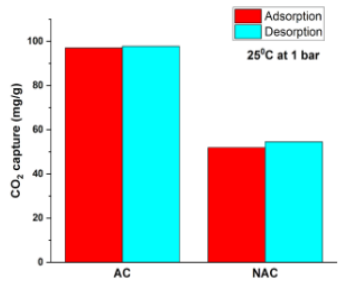

Fig.1: CO_2 adsorption/desorption profile of activated and nitrogen-doped carbon

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I11

Enhanced photocatalytic H_2 production by plasmonic modification of heteroatom co-doped g-C_3N_4

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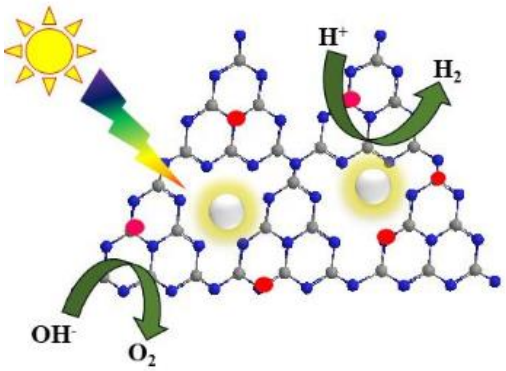
Abstract:

Photocatalytic water splitting using sunlight has emerged as a favorable approach for green hydrogen production. Among the various semiconductor photocatalysts, graphitic carbon nitride (g-C_3N_4), a metal-free polymeric semiconductor, has garnered significant attention. This is attributed to its well-suited band gap, appropriate band edge positions, and satisfactory photocatalytic activity for hydrogen production. However, its practical application is severely affected by high charge carrier recombination rate and inefficient visible light absorption.

In this work, we report the design, synthesis, and optimization of hybrid photocatalytic materials containing Ag-plasmonic metal and non-metal heteroatom B/P co-doped g-C_3N_4. Further, the structural, morphological, and optical properties of photocatalysts were studied through PXRD, FTIR, XPS, HR-SEM, UV-Vis, and PL spectroscopic techniques. SPR and heteroatom co-doping synergistic effects exhibit superior photocatalytic hydrogen production compared to pristine, B or P individual-doped, and B/P co-doped g- g-C_3N_4 samples. The optimized 1Ag/PBCN photocatalyst has demonstrated the highest photocatalytic hydrogen production rate of 1825 $\mu molh^{-1}g^{-1}$, 18.3 times greater than g-C_3N_4. The modified hybrid material has a higher surface area, enhanced charge separation, and improved visible light response. The design and synthesis of plasmon-enhanced hybrid photocatalysts and photocatalytic hydrogen production will be presented in detail.



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I12

CO_2 sequestration in construction materials: Study on the mechanical properties of Cement-M-sand blocks under CO_2 curing under pressure.

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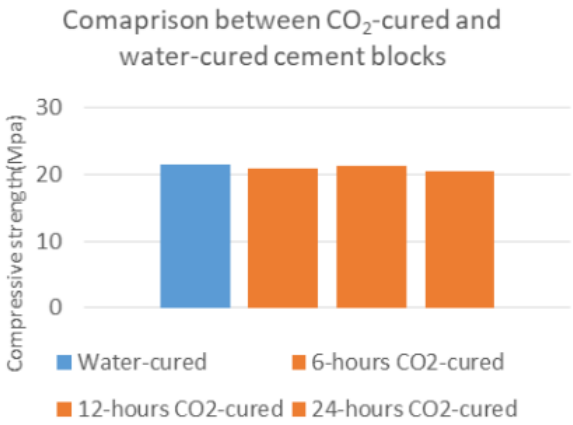
Abstract:

Due to massive greenhouse gas emissions, our planet is experiencing climate issues, with CO_2 being the primary culprit. It is well known that construction materials give rise to a significant CO_2 footprint. To mitigate this, there has been a greater focus on the carbonation of these materials to fix back some of the released carbon. Research shows construction materials have a CO_2 uptake potential of 10-30% by weight. One of the carbonation techniques is CO_2 curing which uses the reaction that occurs between CO_2 and cement materials to create carbonate that is denser as well as thermally stable. In this research, we investigate the potential of cement blocks as a carbon sink through CO_2 absorption during curing, promoting long-term CO_2 sequestration. ASTM standard cement blocks of 70mm cube were prepared using Ordinary Portland Cement (43 grade) and M-sand with a 1:2.75 ratio, and a water-cement ratio of 0.485, and cured with CO_2 for 6h, 12h, and 24h duration, seeking to achieve various levels of carbonation. The control and CO_2-cured samples were subjected to compressive strength analysis. Results show that cement block strength is not diminished by CO_2 curing, as seen by the almost equal compressive strengths of water- and CO_2-cured blocks. Though researchers have reported little enhanced compressive strength under CO_2 curing, it was not observed in our study. However, the focus was sequestration of CO_2 as much as possible. Further investigations are on to quantitatively establish the extent of carbonation of the materials.



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I13

Density Functional Theory Study on Biodiesel Production from Oleic Acid Catalyzed by Pyridinium Ionic Liquid

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Abstract:

In recent years, we have become more interested in finding alternative fuels that can replace conventional fossil fuels. Biodiesel is produced from oils or fat through a transesterification reaction that converts glycerides into fatty acid methyl esters (FAME), with the use of a low molecular weight alcohol, in varied reaction conditions and with different types of catalysts. Feedstock and catalyst choice are two of the essential elements that determine the cost of biodiesel production. The development of cost-effective and high-efficiency heterogeneous catalysts for the catalytic transesterification of triglycerides to biodiesel has seen numerous breakthroughs in recent years. The pyridinium-based ionic liquid is a novel and efficient catalyst for biodiesel production. However, the catalytic mechanism of how pyridinium-based ionic liquid works in the reaction is still unclear. Here, we attempted to investigate such study in an esterification reaction using the density functional theory (DFT) approach. Reaction pathways containing three intermediates and two transition states were proposed for biodiesel production. The DFT calculations were done using the B3LYP functional with a 6-31+G(d,p) basis set for optimizing the intermediates and transition states. From the Gibbs free energy profile, the mechanism for converting the oleic acid into biodiesel was elucidated. The catalytic mechanism validated in this study provides a new idea for subsequent optimization of pyridinium-based ionic liquid structure to improve their catalytic efficiency in biodiesel production from oleic acid.

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I14

Simulation And Performance Analysis Of Bifacial Solar Module With Varied albedo

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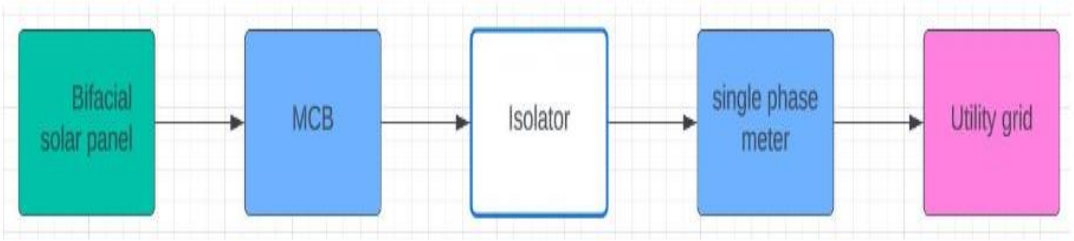
Abstract:

This study presents a simulation and performance analysis of bifacial solar modules considering variations in albedo and tilt angles, specifically tailored for Pondicherry, India. The investigation aims to elucidate the influence of these parameters on energy production potential, with a focus on identifying optimal configurations for maximizing efficiency. Using PV syst software, a rigorous simulation framework is employed to evaluate the energy generation capabilities of bifacial solar modules under varying albedo conditions of 0.3, 0.5, and 0.8, along with tilt angles set at 12°, 45°, and 90°. The study utilizes localized meteorological data and site-specific parameters to ensure accuracy and relevance to the Pondicherry region. Results of the analysis reveal distinct trends in energy output corresponding to different combinations of albedo and tilt angles. Notably, simulations indicate that a tilt angle of 12° consistently yields superior energy production compared to 45° and 90° angles, attributed to optimal sunlight capture and incidence angles for the geographical location of Pondicherry. Additionally, variations in albedo exhibit discernible effects on energy generation, with higher surface reflectivity contributing to increased output under certain conditions.



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3.

I15

Preparation and experimental investigations on the thermal performance of binary eutectic phase change material for thermal energy storage applications

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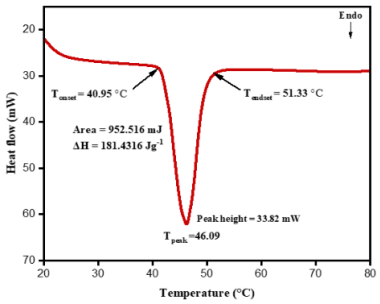
Abstract:

Phase change materials (PCMs) as a core technology of latent heat thermal energy storage has gained great attention across the world since it possesses the potential to store and release a significant amount of thermal energy in response to a slight variation in temperature, as well as its large energy storage capacity. In this work, a binary eutectic PCM was synthesized from glutaric acid and lauric acid (GA/LA) by heat-blending method. Using the schroder-van laar equation, the solid–liquid phase diagram of GA/LA was obtained, through which the eutectic composition of GA/LA binary PCM as 20:80 was determined. The DSC results exhibit that the phase transition temperature and latent heat of fusion of the eutectic mixture is 46.09 °C and 181.43 Jg-1. The thermogravimetric analysis and relative percentage difference (RPD%) from 500 thermal cycles test demonstrated that the eutectic mixture exhibited effective thermal stability till 183.11 °C and good thermal reliability. The chemical stability of the mixture is confirmed by FTIR analysis, as there is no chemical interaction occurred between the components of the mixture. XRD results further indicates that the mixture contained no additional phases. Thereby, XRD and FTIR results confirms that the interactions of GA and LA were intermolecular hydrogen bonds only (physical mixture). Furthermore, the compatibility of the developed PCM was determined through corrosion analysis in various metal samples (stainless steel, copper, and aluminium), whereas stainless steel shows less corrosion rate. The experimental results revealed that the developed GA-LA mixture is a promising material for applications involving energy storage at moderate temperatures.



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I16

Development and investigation on the performance of an organic eutectic phase change material for solar drying application

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Abstract:

Drying wet samples with solar dryers has tremendous potential, particularly for agricultural food products. In order to improve performance and shorten the amount of time or uncertainty associated with supply and demand processes, thermal energy storage systems are utilized in thermal systems. This study developed a phase change material (PCM) using a binary eutectic mixture of palmitic and sebacic acids (PA-SA). 80 wt. % of palmitic acid and 20 wt. % of sebacic acid combined to generate the eutectic composition of PA-SA. Using a differential scanning calorimeter, the melting temperature and latent heat of fusion were found to be 61.10 °C and 161.14 J g-1, respectively. Fourier transform infrared spectroscopy results demonstrate that there are no chemical reactions between the components and that they are all uniformly stable. Thermic cycles (1000), thermo-gravimetric analysis and thermal conductivity test show the developed PA-SA PCM has excellent thermal reliability, stability and competency. Based on the corrosion studies, stainless steel was well suited for the compatibility for the fabricating of the macro encapsulation cylindrical container, which meets the application. Additionally, thorough experimental studies were conducted to compare the effectiveness of a natural convection solar dryer with and without PA-SA eutectic PCM. The experiment with PA-SA PCM provided better results by extending its drying time after the sun falls. Thus, it is likely inferred that the developed eutectic material is suitable for energy storage applications in solar dryers.

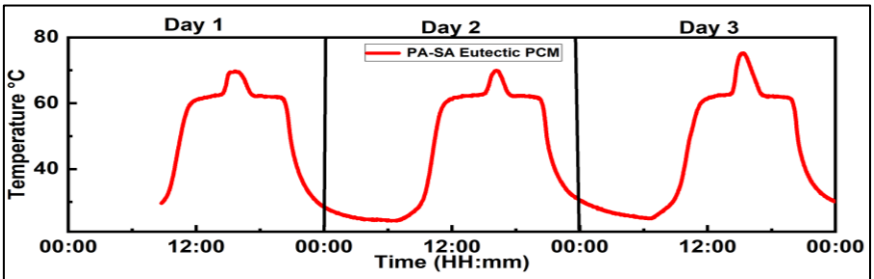

Figure: Charging and discharging graph of a PA-SA eutectic PCM

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I17

Development of a Solar-Assisted Thermal Energy Storage System Integrated with Shell and Tube Heat Exchanger- A Real-time Performance Analysis and Discharge characteristics

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Abstract:

The consumption of energy in all forms has been steadily rising all over the country. It is essential to tackle the energy crisis through judicious utilization of abundant renewable energy sources like solar energy. Thermal energy storage can facilitate a solar thermally driven system's dispatchability by storing heat during off-peak hours and discharging it during peak demand hours. The present study would give utmost importance to this aspect. This study discusses about the thermal energy from the Parabolic Trough Collector (PTC) which is utilized by a PCM integrated shell and tube heat exchanger. The transfer of thermal energy is done by heat transfer fluid from the PTC to the shell and tube heat exchanger. Sebacic acid with a melting temperature of 134.5 °C and with a latent heat of 285.1 kJ/kg is used as a PCM in the shell and tube heat exchanger. A real-time experimental study of the designed system is carried out with an automated sun tracking setup and compared the results with the manual mode of operating the parabolic trough collector. The overall variation of exergy efficiency of the collector with an automatic tracking system is more than 30% than normal manual mode which achieved optimum solar flux absorption. The present study also involves the charging-discharging characteristics, when the PCM receives energy from the HTF and transitions from a solid to a liquid state, at a temperature of 134.5 °C latent heat is stored. It is concluded that the high range of energy and exergy stored in the system is achieved by the automated sun tracking system coupled with a conventional heating coil setup arrangement. It has been envisaged that the development of the aforementioned Parabolic trough collector assisted PCM integrated shell and tube heat exchanger arrangement can significantly reduce the electric cost and will elevate energy efficiency and better utilization of various thermal energy storage applications.

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I18

Metal Oxide embedded Composite Polymer Electrolyte for Solid-State Lithium-ion Battery

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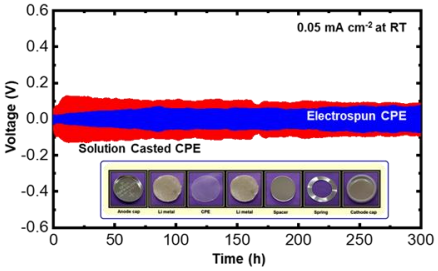
Abstract:

Solid-state electrolytes (SSEs) are promising alternatives to traditional liquid electrolytes because of their safety issues. However, polymer SSEs have low ionic conductivity and weak mechanical strength, and inorganic SSEs are very brittle and unstable to lithium metal and atmospheric moisture, which restricts their practical applications. To avoid these disadvantages, it is essential to develop polymer–inorganic composite SSEs. In this work, we explore SiO2 prepared from beach sands as filler in PVDF-HFP polymer matrix. Two distinct methods of preparation of composite polymer electrolytes (CPEs) were studied namely, solution casting (SC) and electrospinning (ES). The 2.5 wt.% filler concentrated SC and ES electrolytes exhibited the highest ionic conductivity of 1.3 × 10-4 and 3.6 × 10-4 S cm-1 at room temperature (RT) and the transference number was calculated to be 0.7 and 0.8, respectively. The CPEs were subjected to lithium stripping-plating studies for cycling stability which showed high stability of the electrolytes against lithium metal with negligible polarization voltage up to 300 h. Further, the as-assembled solid-state batteries show superior electrochemical performance comprising of both kinds of CPEs. Thus, such performance originates from the introduction of SiO2 particles as filler to enhance the ionic conductivity, mechanical strength and lithium metal compatibility of the CPE



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I19

Solvent Engineered ZIF-67-derived Cobalt-embedded Carbon Polyhedrons as Polysulfide Trapping Cathode for Li-S Battery

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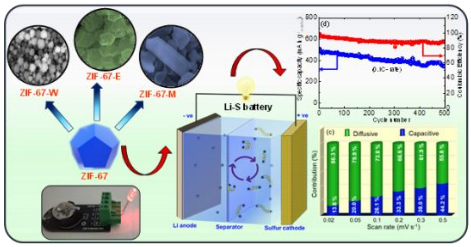
Abstract:

Lithium-Sulfur (Li-S) batteries are one of the significant candidates in post lithium era owing to high energy density, low cost and non-toxicity. However, barriers like low conductivity of elemental sulfur, shuttle effect of lithium polysulfides and large volume expansion require remediation for commercially viable Li-S batteries. A metal organic framework (MOF)-derived cobalt embedded-nitrogen doped carbon/sulfur composites (Co-NCS) using ZIF-67 as a template was synthesized and explored as a cathode for the lithium-sulfur (Li-S) battery. Solvent engineered tunable morphology of the ZIF-67 and its influence on the electrochemical lithium storage of the Li-S battery were examined. The dodecahedron shaped Co-NCS composite synthesized using water solvent (Co-NCS-W) showed a superior performance with high discharge capacity of 1000 mAh g-1 at 0.02C-rate and exceptional cycling stability over 500 charge-discharge cycles. The good electrochemical performance of the cathode was ascribed to the structural stability obtained through MOF synthesis route and the presence of carbon matrix that served as a conducting network for charge transport as well as offering enough space for the sulfur cathode. The enhanced polysulfide trapping facilitated by the presence of the Co-N sites in the Co-NCS-W composite led to an excellent cycling stability. There is a significant capacitive storage in addition to diffusive Li+ storage in all cathode hosts generated that has resulted in high-rate capability. The derived cathode composite showed a high specific capacity, outstanding rate capability and excellent cyclic stability rendering it a promising candidate for high-performance Li-S battery.



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I20

In-Situ UV Cross-linked Comb Polymer incorporated with Nasicon Composite Electrolyte with Improved stability for Lithium Metal Batteries

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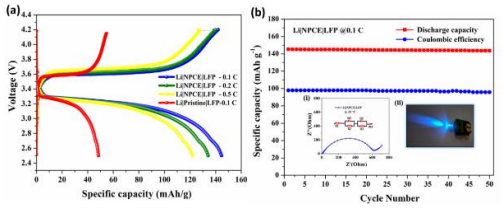
Abstract:

Next-generation electric vehicles rely on safe, high-energy lithium metal batteries. Solid polymer electrolytes are safe, flexible, and mechanically stable. However, practical uses of solid-state electrolytes are limited by their weak ionic conductivity and inadequate interfacial compatibility with the electrodes. In this study, we devised a unique in situ cross-linked (thio-acrylate polymerization) reaction between comb polymer (CP) and polyethylene glycol methyl ether (PEGME) connected itaconic anhydride (ITA) to form a fibrous PVDF integrated Nasicon (Li1.5Al0.5Ti1.5(PO4)3, LATP) composite electrolyte. At 25 ºC, the developed NaSICon polymer composite electrolyte (NPCE) has a broad electrochemical stability of up to 4.8 V and ionic conductivity of 2.3×10-4 S/cm. With stable cycling lasting up to 600 hours, the Li|NPCE|Li symmetric cell exhibits a polarization voltage of 500 mV at a current density of 0.1 mA/cm-2. Furthermore, the Li|NPCE|LFP complete cell that was built had a 97% coulombic efficiency and a discharge capacity of 144 mAh g-1 at 0.1 C. The fibrous PVDF-LATP membrane and numerous functionally aligned C-O-C comb polymer improve lithium metal stability. For all-solid-state lithium metal batteries, our study offers a simple and economical method for creating a new comb polymer with excellent interface stability and good lithium-ion conductivity.



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I21

Cu-MOF/g-C3N4-based Composite Polymer Electrolyte for All Solid-state Lithium-ion Battery

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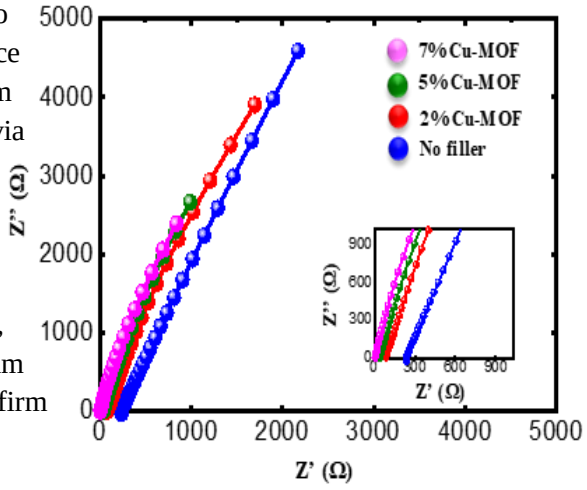
Abstract:

Current lithium-ion batteries, which rely on a liquid electrolyte, are widely used in portable electronics like laptops, smartphones, and electric vehicles. However, they carry drawbacks such as the inherent dangers of fire and leaks. To address these issues, all-solid-state batteries are employed among which composite polymer electrolytes (CPEs) are considered as one of the most promising candidates due to their excellent features of lower interfacial resistance and flexibility. In this work, Cu-MOF filler was synthesized using the hydrothermal method. Further, material characterization like XRD was done to confirm the crystal phase of the material. It was then incorporated in various weight percentages (2, 5, 7%) of the PVDF-HFP polymer host to make a CPE. The ionic conductivity tests were performed using the prepared CPEs in the form of coin cells. The 7 wt.% CPE showed the highest ionic conductivity of 0.84 × 10-3 S cm-1. Further, to make a hybrid filler of Cu-MOF and graphitic carbon nitride (g-CN) to enhance the ionic conductivity via surface interaction of 2D g-CN with the dispersed lithium salts, the preparation of g-CN was carried out via thermal exfoliation of thiourea. As the 7 wt.% CPE of pristine Cu-MOF showed high ionic conductivity, a hybrid CPE was prepared using both Cu-MOF and g-C3N4. Electrochemical characterization like chronoamperometry studies, linear sweep voltammetry, and lithium stripping/plating studies were conducted to confirm the practicability of the CPEs



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I22

NiP anchord rGO as Bifunctional Electrocatalyst for High-capacity Rechargeable Lithium-Air Battery

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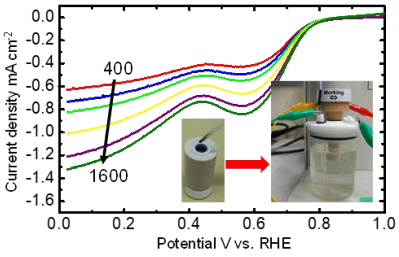
Abstract:

To enable the commercialization of metal-air batteries, the an efficient bifunctional electrocatalyst is imperative. In this context, transition metal oxides, sulphides and phosphides are being investigated as promising electrocatalyst for metal-air battery applications. Among them, the metal Phosphides often demonstrate a good catalytic activity for both ORR and OER, making them an efficient catalysts. In this work, nanostructured NiP@rGO (Nickel Phosphide on reduced Graphene Oxide) was generated through a sequence of processes involving the Hummer's method, hydrothermal synthesis followed by calcination. The material characterisation of the synthesized catalyst involved employing various techniques, including Raman spectroscopy, Fourier transform infrared spectroscopy, X-ray diffraction, and morphology assessment through Scanning Electron Microscope, High-Resolution Transmission Electron Microscope confirms the formation of NiP@rGO. Further, the three-electrode configuration on the rotating ring disc electrode (RRDE) using NiP@rGO electrocatalyst as working electrode, Ag/AgCl as reference electrode and Platinum wire as an counter electrode in 0.1 M KOH electrolyte has been fabricated and tested. It showed a good oxygen reduction reaction (ORR) and oxygen evolution reaction (OER) activities. The detailed synthesis and characterisation for metal air battery performances of the nanostructured NiP@rGO will be presented



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I23

Compositionally Engineered NiCoLDH@rGO as Bifunctional Cathode Catalyst for Rechargeable Lithium-Air Battery

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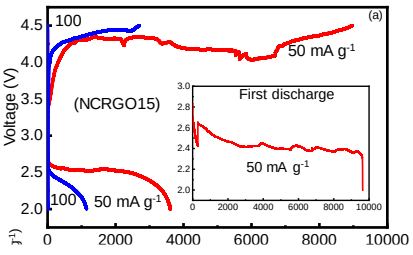
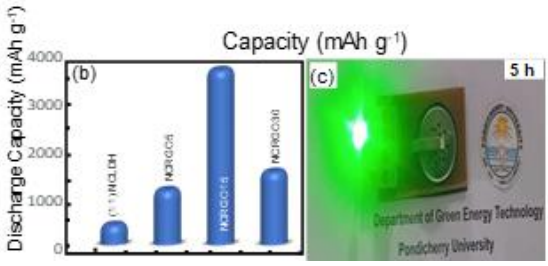
Abstract:

Compositionally tuned nickel-cobalt layered double hydroxides (NCLDHs) and NCLDH@reduced graphene-oxide (NCLDH@rGO) were synthesized through a facile solvothermal synthesis route. The formation of the synthesized NCLDH and the NCLDH@rGO with the intercalated carbonate and nitrate anions, has been confirmed utilizing different characterization techniques. Rotating ring disc electrode (RRDE) voltammetry was utilized to analyze the oxygen reduction reaction (ORR), oxygen evolution reaction (OER) and carbon dioxide reduction reaction (CO2RR) kinetics on each of the pristine (1:1), (2:1), (3:1) and (4:1) NCLDH catalysts and the NCLDH@rGO composites. The RRDE data revealed that the electrochemical activity towards ORR/OER/CO2RR could be largely increased by tuning mole ratio of the (Ni2+/Co3+) or the amount of the rGO in the NCLDH. It turned out that among the pristine electrocatalysts, the (1:1) NCLDH catalyst exhibited enhanced ORR/OER kinetics. Consequently, the NCLDH@rGO composites as cathode catalyst for Li-O2 battery in the CR2032 prototype coin-cell exhibited a stable open circuit voltage (OCV). Among the NCLDH@rGO composites, the NCLDH with 15 wt.% rGO (NCRGO15) exhibited a high discharge capacity of 3616 mAh g-1 at 50 Ag-1 for the Li-O2 battery and a discharge capacity of 45 mAh g-1 at a current density of 100 Ag-1 for the CR2032 coin-type Li-CO2 battery. As a practical use, a commercial 2.8 V green LED bulb was lit continuously for about 20 h using the fabricated Li-O2 battery that consisted of lithium anode and (1:1) NCLDH@rGO15 wt.% (NCRGO15) air-breathing cathode. Detailed synthesis, characterization and its performance will be presented. This work is under revision in Electrochimica Acta.





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I24

Influence of Synthetic Methods on the Na^+ Energy Storage of Na0.6MnO2 Cathode for Sodium-ion Battery

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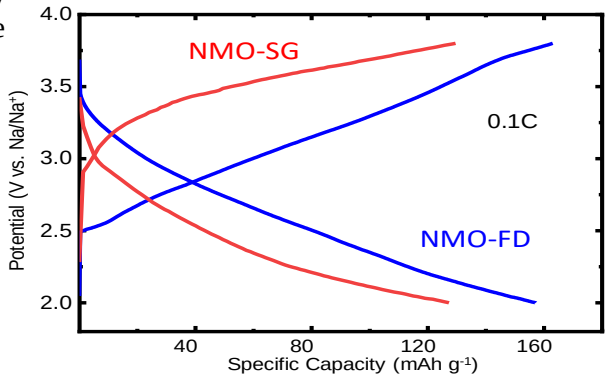
Abstract:

Layered sodium Manganese Oxides (NaMnO2) (NMO) are one of the promising cathodes for sodium-ion battery. However, sodium ions are closely arranged in the layered NMO's which causes strong Columbic repulsion resulting in Na+/vacancy ordering. [1] This phenomenon is highly disadvantages for battery application as it will cause structural instability due to phase transformation, formation of intermediate phases, decrease in Na+ diffusion and poor electrochemical cycling. In order to overcome these issues, structural modifications are necessary. [2] Thus, it is important to probe the influence of synthetic routes on the electrochemical performance of the sodium layered manganese oxide (NMO). Herein, sodium manganese oxide was synthesized using sol-gel method (NMO-SG) and Freeze-drying route (NMO-FD). The synthesized samples (NMO-SG and NMO-FD) were characterized using X-ray diffraction (XRD), Raman studies. Morphological and elemental features of the samples were confirmed using scanning electron microscope (SEM) and X-ray photoelectron spectroscopy analyses. The NMO-SG cathode exhibited a passable discharge capacity of 130 mAh g^{-1} at 0.1C-rate, whereas the NMO-FD cathode exhibited a high discharge capacity of 160 mAh g^{-1} at 0.1C-rate. The detailed charge storage modes of the NMO synthesized through the Freeze-drying synthesis (NMO-FD) and the sol-gel (NMO-SG) will be presented.



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I25

The Optimisation of Orthorhombic phase of Anodized MoO3 Crystals under different Annealing Temperature

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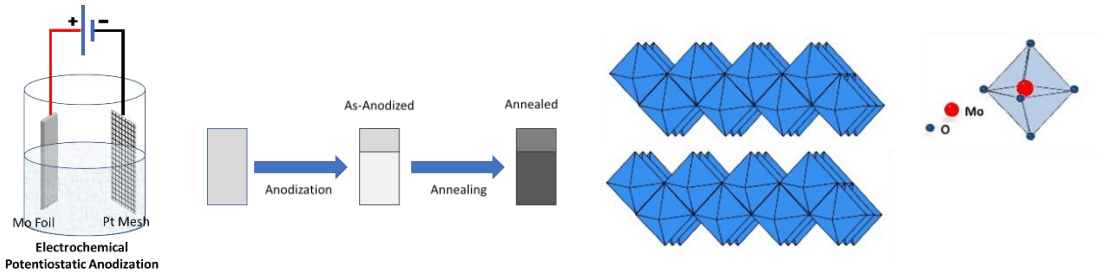
Abstract:

Molybdenum Trioxide is one of the metal oxides having versatile properties that can be optimized for various applications. In Nature Molybdenum tri oxide predominantly exits in three vital crystal phases namely- orthorhombic (α MoO_3), Meta Stable Monoclinic (β MoO_3) and Hexagonal (h MoO_3). Among them the orthorhombic phase is thermodynamically stable and exist as two-dimensional Layered structure made of MoO_6 Octahedral which can be used for various applications such as electrocatalysts, Photo catalysts, Batteries, Supercapacitors, etc. In our work we successfully synthesized MoO_3 using Electrochemical anodization under constant potential with optimized electrolyte conditions (1). The As prepared MoO_3 was exists in Amorphous nature (2). The post synthesis treatment of as prepared oxides was carried out under controlled annealing to obtain pure crystalline α MoO_3. The change in crystal structure was analyzed using X-ray Diffraction method and Raman Spectroscopy for samples annealed under different range of temperatures (3). The Samples annealed under 450°C shows prominent results with high purity of Orthorhombic phase of Molybdenum Oxide



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I26

Solvothermal synthesis and its characterization studies of Sb_2Se_3 nanocrystallites

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Abstract:

Antimony selenide (Sb_2Se_3) has emerged as a promising light absorber material for thin-film solar cells due to its desirable structural and optoelectronic properties. Sb_2Se_3 exhibits several key characteristics suitable for solar cell fabrication such as optical band gap (1.2 eV), high absorption coefficient (>105 cm-1), and high carrier mobility demonstrated with a conversion efficiency of 10.5% [1]. Despite these favorable characteristics, challenges such as the synthesis of pure-phase of Sb2Se3 with high film quality, improved carrier generation, and reduced surface defects are still noticed as challenging tasks to enhance the efficiency of solar cells [2]. Considering these facts, we tried to synthesize pure-phase Sb_2Se_3 nanocrystallites to achieve reduced surface defects using a surfactant-assisted solvothermal method with precise control over reaction temperature and reaction duration. Characterization techniques including XRD, Raman, FESEM, HRTEM, UV-visible, XPS, electrical conductivity, and Seebeck measurements were utilized to study the structural, morphological, optical, and electrical properties. The XRD and Raman analysis confirms the successful synthesis of pure-phase Sb_2Se_3 nanocrystallites with characteristic peaks corresponding to the orthorhombic crystal structure. FESEM and HRTEM reveal the one-dimensional (1D) morphology of the nanocrystallites exhibiting elongated rod-like structures. UV-visible studies confirm the characteristic absorption feature of the Sb_2Se_3 with an estimated band gap value of 1.2 eV. Electrical and Seebeck measurements confirmed the semiconducting property with p-type conductivity. In summary, the synthesized Sb_2Se_3 nanocrystallites exhibit promising properties for applications in photovoltaics and thermoelectrics. More details about the synthesis optimizations and characterization analysis will be presented during the presentation.

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I27

Development of nanomaterial catalysts and their role in hydrothermal liquefaction of microalgae biomass to produce biofuels and high value chemicals

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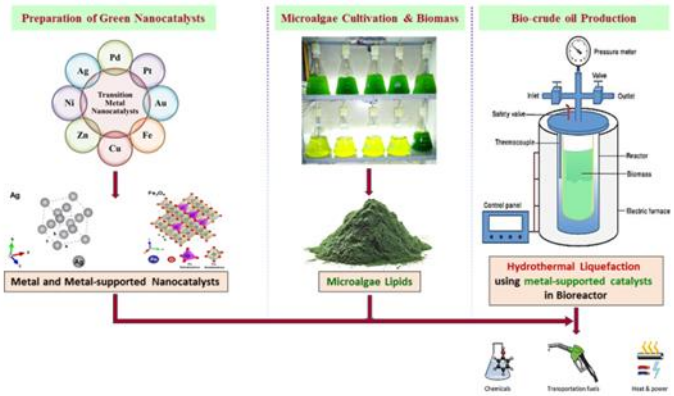
Abstract:

Sustainable production of biofuels or bio-crude oil via hydrothermal liquefaction (HTL) is evolving as an effective technology for competent valorization and efficient energy densification of various aquatic biomass feedstocks (e.g., microalgae). HTL is a commonly used thermochemical conversion process that can convert biomass into renewable biofuels and value-added chemicals without pretreatment [1]. However, the yield and quality of bio-oil cannot satisfy commercial operation under normal conditions. In this work, catalytic-HTL has been emphasized as an effective approach to upgrade HTL bio-crude oils and value-added chemicals. The uses of green catalysts have conferred to improve the quality and yield of the bio-oil by reducing the activation energy of the reaction. Transition metals (e.g., Ni, Co, Mo, Cu, and Ce) are also deliberated as prominent active catalysts to promote the reforming of bio-oil components into hydrocarbons [2]. This study aims to explore exclusively the catalytic-HTL of microalgae biomass under the synthesized metallic nanomaterials and the synergistic effect of metal-supported catalysts. The synthesized metal-supported catalysts may determine the effect of catalysts on bio-oil yield, elemental composition, heating value, etc. Thus, the development of efficient green nanomaterials and metal-supported catalysts for catalytic-HTL may enhance to produce microalgal bio-oils and high-value chemicals along with the CO2 sequestration and green bio-economy.



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I28

Highly Emissive Azaflavanone – Phenyl Vinyl Sulfone-Based Organic Fluorophores: Synthesis and Photophysical Studies

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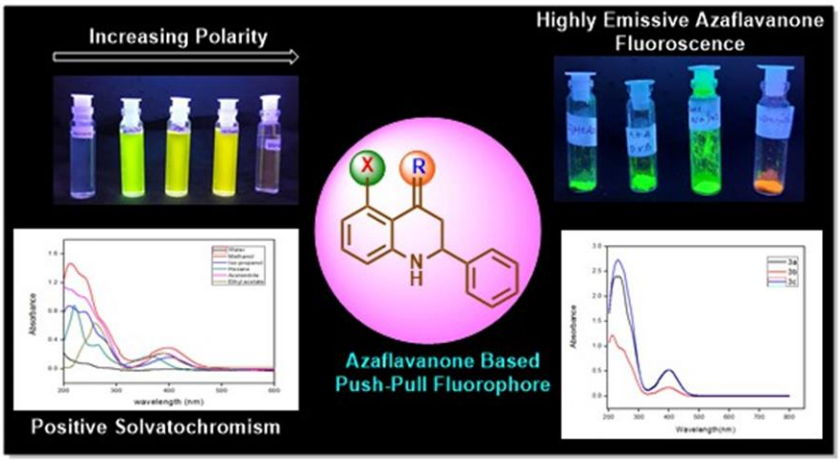
Abstract:

Organic fluorophores based on the D-π-A architecture have prospective uses in OLED, OFET, OPV, lasers, imaging, and sensors and they have made significant advancements in a wide variety of application areas. In this work, Azaflavanone-Phenyl vinyl sulfone-based (D-π-A) materials were synthesized and characterized. The photophysical studies of synthesized organic emissive materials were performed which showed absorption and emission maxima at around 400 and 520 nm, respectively. The positive solvatochromism was observed with the increase of solvent polarity which is associated with the intramolecular charge transfer at excited state. Among synthesized organic fluorophores, D3 dye was highly emissive in solid state under long UV (365 nm). This work reveals the potential of D- π-A type Azaflavanone – Phenyl vinyl sulfone-based materials as versatile organic emitting materials.



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I29

Effect Of Zinc Doping On The Structural And Optical Properties Of Nanostructured SnO2 Thin Films Fabricated By Spray Pyrolysis Method.

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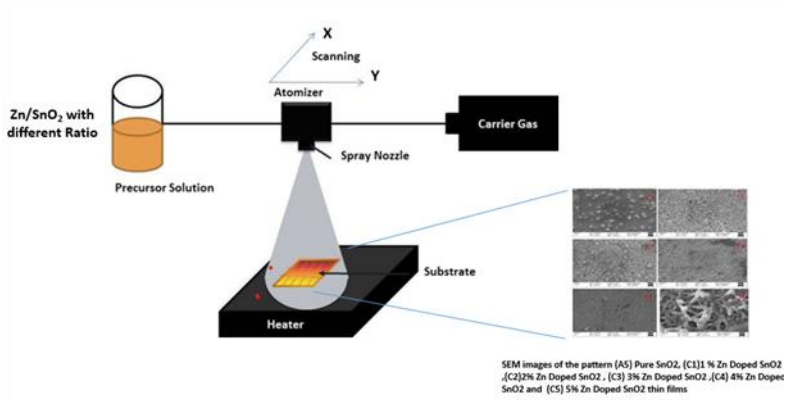
Abstract:

In this study, pure Tin Oxide (SnO2) and Zinc (Zn) doped SnO2 nanostructured thin film with varying at % Zn/Sn contents were successfully prepared by spray pyrolysis method. The prepared thin films were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), and Ultra violet–Visible and transmittance spectroscopies. XRD results suggested that all the thin films exhibited a tetragonal rutile crystal structure, while the average crystallite size increases with Zn/Sn content. SEM images of the thin films showed the presence of both nano and micro-sized grains in the range around 200 nm. The vibrational bands associated with the thin films were verified from the FTIR spectra. Change in transparency and bandgap narrowing were also noticed from the transmittance and UV–Vis spectra.



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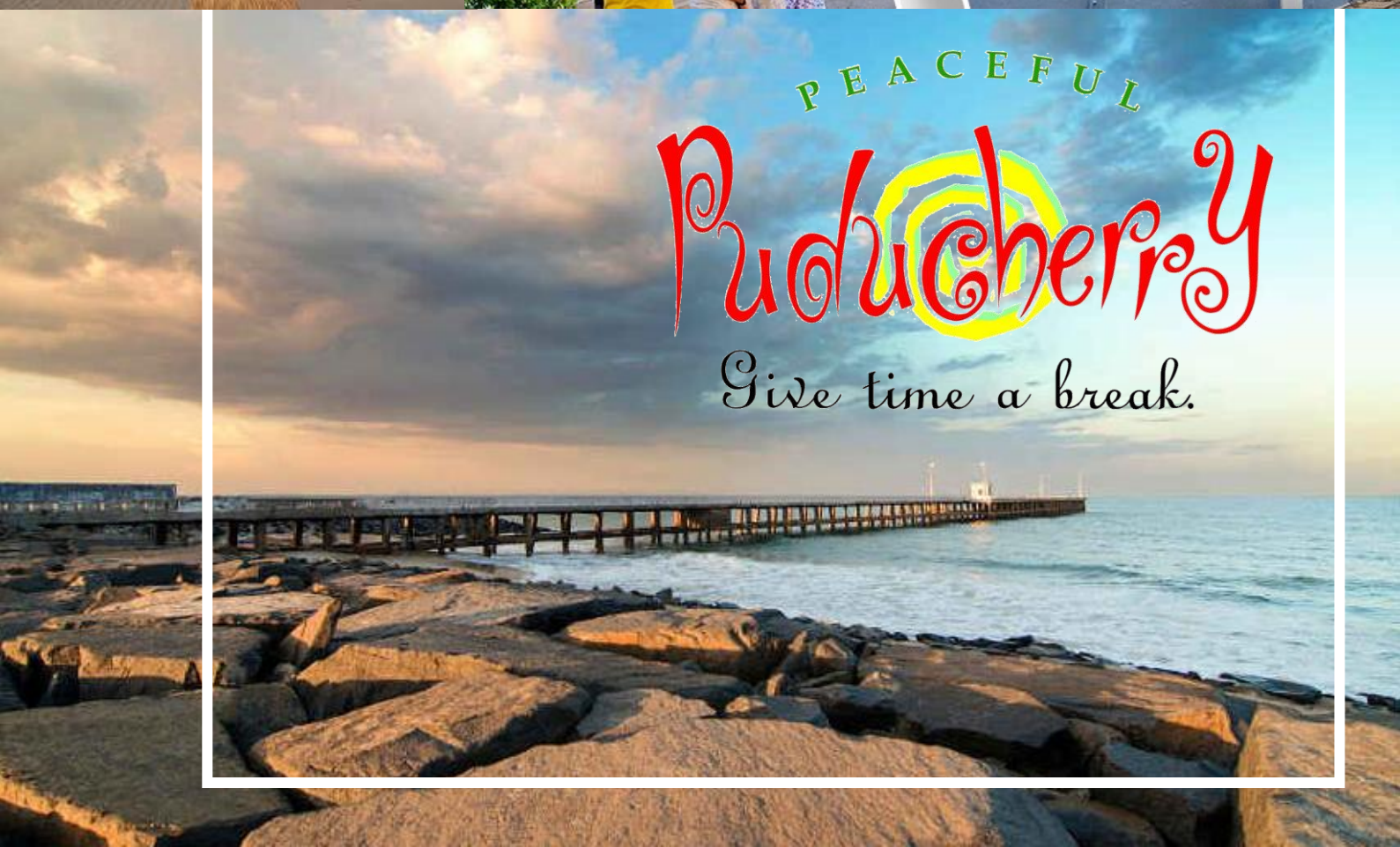

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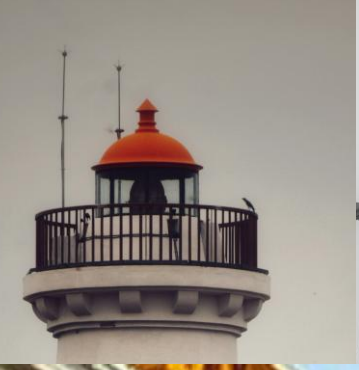



PEACEFUL

Puducherry

Give time a break.

IT´S TIME TO EXPLORE

Where time stops and unravels history

கனரா வங்கி केनरा बैंक Canara Bank

ஒரு இந்திய அரசு நிறுவனம்

भारत सरकार का उपक्रम

A Government of India Undertaking

சிண்டிகேட் सिंडिकेट Syndicate

Together We Can

Canara Bank is an Indian public sector bank founded as **'Canara Bank Hindu Permanent Fund'** in **1906**, by late **Sri. Ammembal Subba Rao Pai,** now Canara Bank emerged as the "Best Preferred Bank to Bank with" by pursuing industry benchmarks in profitability, operational efficiency, asset quality, risk management and digital innovation having business crossed Rs.22.13 lakhs crores. We offer a wide range of banking services like a savings account, Fixed Deposit, debit card, Education ,Housing, Vehicle Loan etc.

Canara Bank launched Special Package for Housing Loan, Vehicle Loan and Personal Loan exclusively to the Employees of Pondicherry University

- **11.30 crore customers** with **9,585 branches** across all Indian states and Union Territories.
- Received **"Exemplary Award"** from PFRDA for achievement under **Atal Pension Yojana** "
- Received **Inclusive Finance India award 2023** under Priority sector lending by Bank
- "**Banker's Bank of the Year 2022".**
- Ranked **Number 1** for 2 consecutive years for digital initiatives by Ministry of Electronics & Information Technology (**MeitY**), Govt. of India

Contact Address: No 45, First Floor, Bussy street , Pondicherry 605001
www.canarabank.com

Ather Energy

India's first intelligent electric vehicle manufacturer was founded in 2013 by IIT Madras alumni, Tarun Mehta & Swapnil Jain. Backed by founders of Flipkart, Sachin Bansal & Binny Bansal, Hero MotorCorp & Tiger Global. Ather Energy launched India's first truly intelligent electric scooter - The Ather 450 in 2018, followed by their flagship offering Ather 450X IN 2020 followed by the GEN3 of the 450X in 2022. With 1500+ charging points across 100+ cities, Ather Grid is one of the country's largest fast-charging networks for electric vehicles. Ather Energy currently operates in 120+ cities around India

ATHER

Book Your EV

Ather Space - Electric Scooter Experience Center

Address: 27, 100 Feet Rd, Sundararaja Nagar, Anna Nagar, Puducherry, 605004 Phone: 088842 04411

About Solon India

Establised in 2011

Experienced and Reliable
Driving innovation

At Solon, we pride ourselves on being trailblazers in the solar industry. But we don't stop there - we constantly evolve to stay ahead of the game. We achieve this by offering solutions that are tailored to the needs of our clients. It's our commitment to innovation and client satisfaction that sets us apart from the competition.

Design & Engineering

Procurement

Installation & Commisionning

Operations & Maintenance


Rooftop Panelling


Solar Car Port

Containerized Hybrid Units

Asset Management
Monitor and Control every activity in order to optimize the investment

Administrative Assistance
Energy Accounting Statement of the Solar PV Power Plant to the Client

Remote Monitoring
Skilled personnel analyze energy generation and performance of the plants.

Real-Time Monitoring
24X7X365 monitoring of "State of Health" of the plants.

Preventive and Corrective Maintenance Activities
Technical inspection of the plant, Focusing on Electrical and Mechanical Checks

SOLON operates to fix problem promptly and proactively

Contact us For More

Email
info@solonindia.com

Website
www.solonindia.com

Association for Promoting Sustainability in Campuses & Communities (APSCC)

A professional organization for promoting sustainability in every area among the educational institutions and local communities, based on the principle of intergenerational equity: "as members of the present generation, we hold the earth in full trust for future generations."

APSCC helps the higher educational institutions, and other educational institutes along with schools and other campuses in framing policies, implementing action and research plans, empowering the students and staffs community with the required skills and hand out resources to sustainably implement and manage the conservation strategies and projects related to energy, water, waste, healthy food and biodiversity.

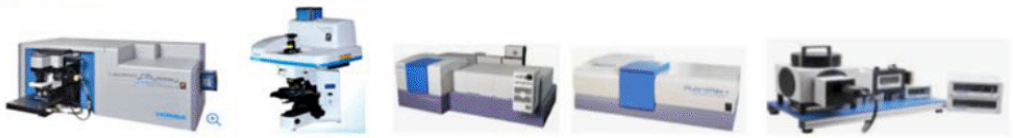
APSCC

Association for Promoting Sustainability in Campuses & Communities (APSCC)

No.23, Kamaraj Salai
Thattanchavady
Puducherry- 605009, India.
Email: info@apsccindia.org

LASER SPECTRA SERVICES INDIA PVT LTD

HORIBA



Labram Odyssey | XploRA Plus | Fluorolog-QM | Fluoromax Plus | DeltaFlex

Confocal Micro Raman | Fluorescence Spectrometer | TCSPC Lifetime

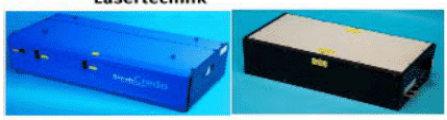
mks | Spectra-Physics

Ultrafast Amplifiers, Oscillators, CW Pulsed Lasers

mks | Newport

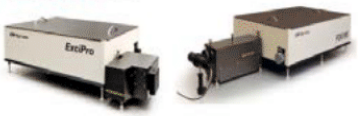
Solar Simulator-Light Source-Optical Table-Optics-Stages

Sirah Lasertechnik



Dye Laser & Fully Automated Ti:Sa CW Ring Laser

CDP



Transient Absorption Spectrometer & Time-Resolved Spectrometer

Nanosecond Lasers

Chemfab Alkalis Limited (CCAL) has established the first membrane cell plant for Chloralkali production in India. CCAL is one of the first major chemical organisations in India to introduce and implement innovative technologies successfully, and stay at the forefront of the industry. With considerable investment in processes and quality improvement, CCAL's operations have been at the cutting-edge of technology since its inception.

CCAL, established by Dr. Rao in 1985, has received numerous patents and worldwide recognition for the viability and implementation of various innovative technologies in the Chloralkali sector. Adoption of Membrane Technology in Kalapet facility has resulted in nationwide reform of the sector.

Our Founder's vision, perseverance and quest for excellence have driven our success. His 'green' stance has resulted in innovations for the betterment of the environment and the well-being of the earth's citizens.

CCAL
CHEMFAB ALKALIS LIMITED

www.chemfabalkalis.com

Great Place To Work. Certified MAY 2023 – MAY 2024 INDIA

CHEMFAB ALKALIS LIMITED

CCAL www.chemfabalkalis.com

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