CONCEPT 10

BOOK OF ABSTRACTS

A Hybrid Mode Conference

10th Conference on Emerging Energy & Process Technology 2023

(CONCEPT10)

in conjunction with

3rd International Conference on Renewable Energy 2023

(I-CORE)

with theme

Green, Growth and Sustain

1st – 2nd November 2023

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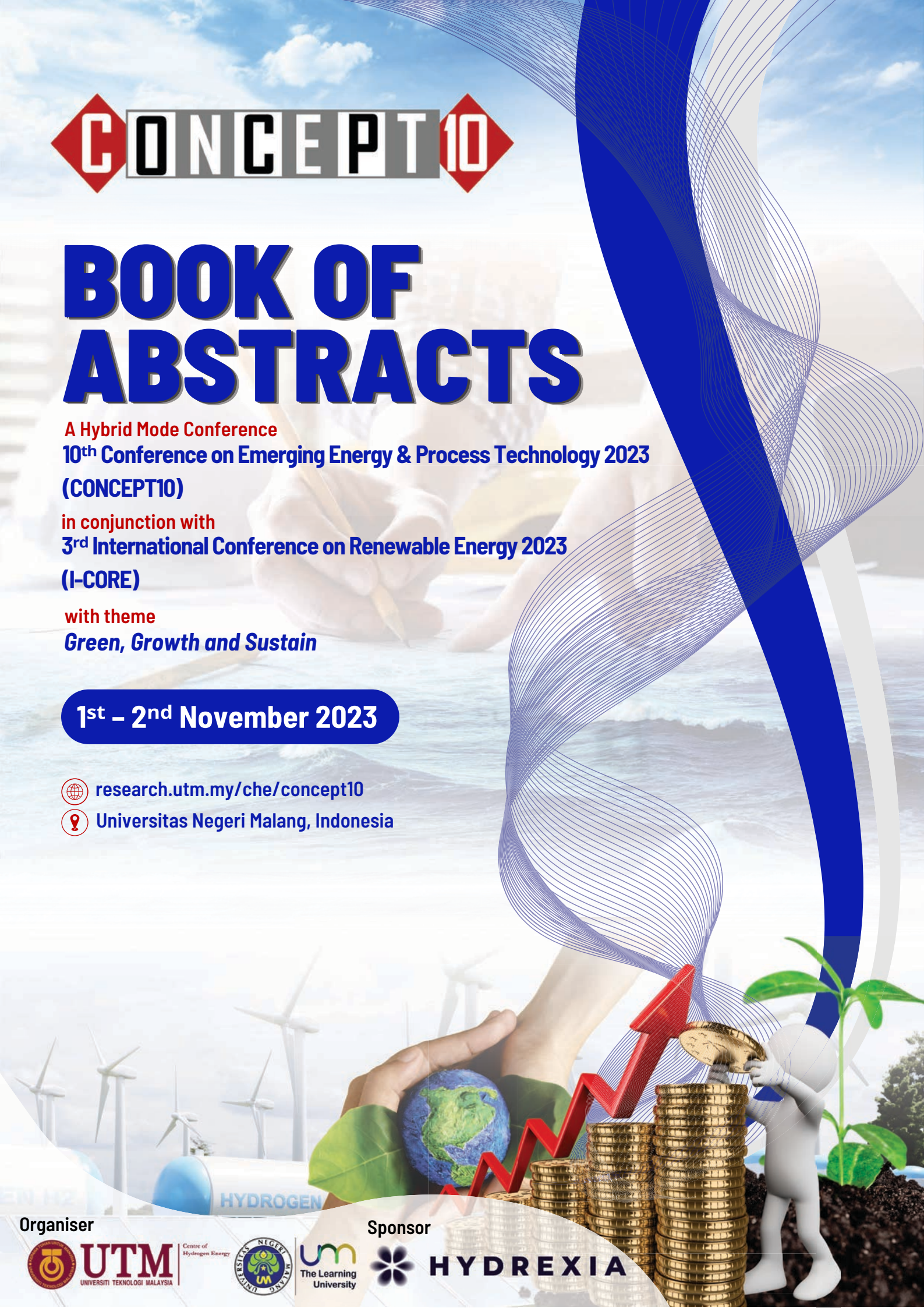
Universitas Negeri Malang, Indonesia



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UTM Universiti Teknologi Malaysia | Centre of Hydrogen Energy

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10th CONCEPT 2023

10th CONFERENCE ON EMERGING ENERGY AND PROCESS TECHNOLOGY 2023

Hybrid Conference | Universitas Negeri Malang

FOREWORD FROM ADVISOR OF CONCEPT 10 (2023)

It is a great pleasure to welcome you to the 10th Conference on Emerging Energy & Process Technology 2023 (CONCEPT10) being held in Malang, Indonesia.

The CONCEPT10 is a joint effort between Center of Hydrogen Energy (CHE), Universiti Teknologi Malaysia (UTM) with Universiti Malang (UM), Indonesia. I would like to take this opportunity to congratulate both universities for coming together in this joint effort and also the members of both organizing committee for their efforts in organizing this conference.

The theme for this year CONCEPT10 is "*Green, Grow and Sustain*", covers multi-disciplinary research areas from fundamental science and technology to engineering applications. This is in consistent with the goal of CONCEPT in bringing together post graduate students, researchers, academicians, relevant industrial players, and government and private agencies from both countries to share their latest research interests and confer on the state-of-the-art and future development specifically in the areas of sustainable energy and process technology.

Last but not least, I would like to express my sincere gratitude to all committee members, reviewers, International Advisory Panels, Keynote speakers, Sponsors, Journal Guest Editors, Journal Guest Editorial Board and CHE-UTM and UM staffs for their great efforts and continuous support in making this conference a success.

Hope you will get the most from this two-day conference.

Thank You.

Professor Dr. Aishah Abdul Jalil
Director of Centre of Hydrogen Energy
Institute of Future Energy
Universiti Teknologi Malaysia
81310 Johor Bahru Malaysia

MESSAGE FROM THE CHAIR OF CONCEPT 10 (2023)

Welcome to the CONCEPT 2023, dedicated to the critical theme of "Green, Grow, and Sustain." As the conference chair, I am delighted to witness the collective enthusiasm and commitment of our global community towards fostering sustainable practices for a greener and more resilient future.

The intersection of environmental consciousness, economic growth, and sustainable development has never been more crucial. This conference serves as a significant platform for thought leaders, researchers, and innovators to deliberate on strategies that reconcile the imperative of growth with the imperative of environmental preservation.

Through collaborative discussions, knowledge sharing, and innovative thinking, we aim to cultivate actionable solutions that harmonize economic advancement with the conservation of our natural resources. It is our shared responsibility to leverage our collective expertise and creativity to propel the transition towards a more sustainable and equitable global landscape. I extend my sincere gratitude to the organizing committee, the speakers, presenters, and participants for their dedication and contributions to this event.

I extend my heartfelt appreciation to our esteemed sponsor, Hydrexia Sdn Bhd for their generous support, which has played an instrumental role in making this conference a resounding success.

May our deliberations and collaborations at this conference pave the way for a greener, more prosperous, and sustainable future for generations to come.

Thank You.

Dr. Nurfatehah Wahyuny Che Jusoh
Chairperson CONCEPT 10 (2023)
Centre of Hydrogen Energy
Institute of Future Energy
Universiti Teknologi Malaysia
81310 Johor Bahru, Johor

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CONFERENCE SCHEDULE

10th Conference on Emerging Energy and Process Technology 2023 (CONCEPT 10)

Universitas Negeri Malang

Date: 1st –2nd November 2023

Wednesday, 1st November 2023	
07.00 – 08.00 am	**Registration**
08.00 – 09.00 am	**Opening Ceremony at** Main **Hall, A20 HALL BUILDING 9TH FLOOR**
09.00 – 09.30 am	**Keynote Speaker 1: Prof. Dr. Yuki Nagao** **Title: The Organized Structure of Polymer Electrolytes: Paving a New Path to Energy Storage and Tactile Technology** **Chairperson: Dr. Nurfatehah Wahyuny Che Jusoh**
09.30 – 09.45 am	**Keynote Speaker 1 [Q&A session]**
09.45 – 10.15 am	**TEA BREAK**
10.10 – 11.40 am	**Keynote Speaker 2: Prof. Dr. Arif Nur Afandi** **Chairperson: Dr Hassan (iCORE)**
11.40 – 10.55 am	**Keynote Speaker 2 [Q&A session]**
10.55 – 11.25 am	**Keynote Speaker 3: Dr. Alireza Rahbari** **Chairperson: Dr Hassan (iCORE)**
11.25 – 11.40 am	**Keynote Speaker 1 [Q&A session]**
12.00 – 1.00 pm	**LUNCH**

SESSION 1
4 Parallel Session (10 min/Presenter + 5 min Q&A)

1.00 pm – 4.00pm

Session 1 - P1: Advanced Material (AM)- Room 1 Lantai 3 A19

Session Chairman: Dr Fazilah Farhana Abd Aziz

Asst. Chairman: Ms. Suhailah Surani

Time	Paper ID	Paper Title / Authors
1.00 pm – 1.10 pm	**BRFG**	**Briefing Session**
1.15 pm – 1.30 pm	**AM1-008**	Layer-by-layer Membranes for Vanadium Redox Flow Battery ***Saidatul Sophia Sha'rani, Nurfatehah Wahyuny Che Jusoh*, Mohamed Mahmoud El-Sayed Nasef and Roshafima Rasit Ali***
1.30 pm – 1.45 pm	**AM2-013**	Graphitic Carbon Nitride Loaded on Fibrous Silica Iron for Simultaneous Removal of Hexavalent Chromium and Methyl Orange Under Visible Light Irradiation ***Nur Izzati Hannani Hazril, Aishah Abdul Jalil* and Nurul Sahida Hassan***

1.45 pm – 2.00 pm	**AM3-018**	Fibrous Silica Bismuth Sulfide: An Advanced Material Towards Promising Photoelectrochemical Water-Splitting ***Nik Muhammad Izzudin Nik Lah, Aishah Abdul Jalil*, Nurul Sahida Hassan and Muhammad Hakimi Shawal***
2.00 pm – 2.15 pm	**AM4-021**	Synthesis Of Fibrous Silica BEA For Methanol to Olefin Reaction ***Muhammad Hafizuddin Bin Mohd Sofi, Muhamed Yusuf bin Shahul Hamid* and Aishah Abdul Jalil***
2.15 pm – 2.30 pm	**AM5-030**	pH-Responsive Electrospun Polymeric Mesoporous Silica Nanoparticles for an Enhanced Localized Drug Delivery ***Ainul Rasyidah Abdul Rahim, Jafreena Adira Jaafar, and Nur Hidayatul Nazirah Kamarudin****
2.30 pm – 2.45 pm	**AM6-046**	Photocatalytic Conversion of Carbon Dioxide to Methanol Over Different Precursors of Graphitic Carbon Nitride Supported on Fibrous Silica Iron ***Aishah Abdul Jalil*, Nurul Sahida Hassan, Norain Zulkifli***
2.45 pm – 3.00 pm	**AM7-054**	Recent Advances on Simultaneous Removal of Tetracycline and Hexavalent Chromium ***Nurul Sahida Hassan, Aishah Abdul Jalil*, Mahadi B. Bahari***

Session 1 – P2: Energy Management and Technology (EMT)- Room 4 Lantai 3 A19
Session Chairman: Dr Tuan Amran Tuan Abdullah
Asst. Chairman: Ms. Nur Fatimah Azmi

Time	Paper ID	Paper Title / Authors
1.00 pm – 1.15 pm	**BRFG**	**Briefing Session**
1.15 pm – 1.30 pm	**EMT1-045**	Numerical Analysis of Vapor Dispersion from Compressed Hydrogen (H2) Storage Vessels **Rafiziana Md. Kasmani*, Norafneeza Norazahar, Aishah Abd. Jalil, and Mohd. Fadzhir Ahmad Kamaroddin**
1.30 pm – 1.45 pm	**EMT2-017**	A Comparative Study of Fibrous Silica-Based Catalysts for Improving Methane Production via CO_2 Methanation ***Muhammad Akmal Aziz, Aishah Abdul Jalil*, Nurul Sahida Hassan and Mahadi B. Mahadi***

Session 1 – P3: Renewable Energy and Technology (RET)-Room 3 Lantai 3 A19
Session Chairman: Assoc Prof Dr Norzanah Rosmin
Asst. Chairman:Dr Nurul Sahida Hassan

Time	Paper ID	Paper Title / Authors
1.15 pm – 1.30 pm	**RET1-012**	Unravelling The Potential of Fibrous Silica Zirconia Catalyst for Co Methanation in Energy Production ***Abdul Hakim Hatta, Aishah Abdul Jalil*, Nurul Sahida Hassan, Muhamed Yusuf Shahul Hamid, and Mahadi B. Bahari***

1.30 pm – 1.45 pm	**RET2-016**	A Short Review on Graphene Derivatives towards Photoelectrochemical Water Splitting ***R. Abdullah Rashid Albalushi, Aishah Abdul Jalil****
1.45 pm – 2.00 pm	**RET3-019**	Effect of Aging Times of Fibrous Silica Cadmium Sulfide Photoanodes for Enhanced Photoelectrochemical Water Splitting ***Muhammad Hakimi Sawal, Aishah Abdul Jalil*, Amreen Chowdhury, Nur Farahain Khusnun, Nurul Sahida Hassan***
2.00 pm – 2.15 pm	**RET4-051**	Advancements in Cadmium-based Photoanodes for Photoelectrochemical Water Splitting: A Short Review ***Mahadi B. Bahari, Aishah Abd Jalil, Che Rozid Mamat*, and Nurul Sahida Hassan***
2.15 pm – 2.30 pm	**RET5-054**	Morphology and Porosity of Biochar Derived from Arthrospira platensis Microalgae Pyrolysis ***Sukarni Sukarni*, Bayu Setiawan, Ahmad Yusril Aminullah and Mohammad Mirza Yuniar Romaz***
2.30 pm – 2.45 pm	**iCORE-1570947120**	Monitoring the Potential of Solar Power Plants Based on the Internet of Things ***Hartawan Abdillah***
Session 1 – P4: General Topics for Engineer (GTE)- Room 2 Lantai 3 A19 **Session Chairman: UM** **Asst. Chairman:UM**		
Time	**Paper ID**	**Paper Title / Authors**
1.15 pm – 1.30 pm	**GTE2-029**	Heart Rate Sensor with IoT Features ***Norazliani Md. Sapari, Khairul Huda Yusof, Nurul 'Ain Amirrudin, Muhammad Nazreen, Mohd Amir Syafiq, Muhammad Hafiz Irwan, Fajar Aqhari Bolang, Achmad Tegar Andika Putra and Aizan Ariffin***
1.30 pm – 1.45 pm	**GTE3-034**	Green Synthesis of Selenium Nanoparticles and their Electrochemical Properties ***Afifah Mardhiah Mohamed Radzi, Zatil Izzah Ahmad Tarmizi*, Nur Anis Afifah Abdul Ghafar, Siti Husna Mohd Talib, and Eleen Dayana Mohamed Isa***
1.45 pm – 2.00 pm	**GTE4-048**	Predicting Country-Specific Financing Capacity for Renewable Energy Projects ***Mohd Suhaimi Mohamed-Ariffin*, Mazlifa Md Daud, Haslinah Muhammad, and Abdul Rahim Abdul Samad[1]***
2.15 pm – 2.30 pm	**iCORE-1570966164**	*Development of Interactive Virtual Laboratory Media with Tinkercad Platform on Analog Electronics Material* ***Anik Nur Handayani***
2.30 pm – 2.45pm	**iCORE-1570953594**	*Sensorless Speed Control of PMSM in Low-Speed by High Frequency Pulsating Injection with Double Modulation Error Compensation* ***Indra Ferdiansyah***
Closing Day 1		

Thursday, 2nd November 2023	
07.00 – 08.00 am	**Registration**
08.00 – 08.30 am	**Keynote Speaker 4: Prof. Dr. Yuchun Xu** **Chairperson: Dr. Atif Fikri**
08.30 – 08.45 am	**Keynote Speaker 4 [Q&A session]**
08.45 – 09.15 am	**Keynote Speaker 5: Assoc. Prof. Dr. Herma Dina Setiabudi** **Title: Recent Advances in Catalyst Development for Greenhouse Gas Conversion into Hydrogen** **Chairperson: Assoc. Prof. Dr. Roshafima Rasit Ali**
09.15 – 9.30 am	**Keynote Speaker 5 [Q&A session]**
9.30 – 10.00 am	**TEA BREAK**
10.00 – 10.30 am	**Keynote Speaker 6: Dr. Mohammad Saifuddin Bin Mohd Azami** **Title: Strategic Designing of Composite Heterogeneous Photocatalyst for the Degradation of Water Contaminats** **Chairperson: Assoc. Prof. Dr. Anwar Johari**
10.30 – 10.45 am	**Keynote Speaker 5 [Q&A session]**

SESSION 2

4 Parallel Session (10 min/Presenter + 5 min Q&A)

10.45 am – 12.00 pm

Session 2 - P1: Advance Material (AM)-Room 1 (Virtual)
Session Chairman: Dr Muhamed Yusuf Shahul Hamid

Time	Paper ID	Paper Title / Authors
10.45 am – 10.55 am	**BRFG**	**Briefing Session**
11.00 am – 11.15 am	**AM8-007**	Effect of Kenaf Fiber Loading on the Mechanical and Morphological Properties of Polyurethane Shape Memory Polymer Composites ***Nor Hanim Khiyon, Mohd Fadzil Arshad, Mohd Khairul Kamarudin, Nurshamimie Muhammad Fauzi,***
11.15 am – 11.30 am	**AM9-023**	Preparation and characterization of graphene film using Biogas derived from OPEFB by CVD method ***Wan Nur Aina Wan Zainal, Nur Idayu Ayob, Alya Naili Rozhan, Nurhafizah Abu Talip @ Yusof, Zurita Zulkifli***

Session 2 – P2: Energy Management and Technology (EMT) - Room 2 (Virtual) **Session Chairman:** Dr Zatil Izzah Ahmad Tarmizi		
Time	**Paper ID**	**Paper Title / Authors**
10.45 am – 10.55 am	**BRFG**	**Briefing Session**
11.00 am – 11.15 am	**EMT03-011**	Enhancing the Environmental Sustainability of Water Treatment Sludge (WTS) Disposal through Blended Binder Solidification/Stabilisation ***Nurshamimie Muhammad Fauzi, Mohd Fadzil Arshad, Ramadhansyah Putra Jaya, Mazidah Mukri, Nor Hanim Khiyon***
11.15 am – 11.30 am	**EMT04-022**	Biogas production from hospital food waste: Composition and Effect of pH ***Nadia Isa, Pramila Tamunaidu***
11.25 am - 11.40 am	**GTE05-042**	Finite Element Modelling of Mechano-electrochemical Effect of Corroded Pipeline ***Umair Sarwar, Ainul Akmar, Masdi Muhammad, Majid Ali***
11.40 am - 11.45 am	**RET7-006**	Semi Empirical Modeling for Thin Sliced Potato Drying Under Active-Mode Solar Dryer **BNorerama D Pagukuman, M Kamel Wan Ibrahim, M.A.M.Roni**
12.00 – 1.00 pm		**LUNCH**
SESSION 3 4 Parallel Session (10 min/Presenter + 5 min Q&A) **1.00 pm – 4.00pm**		
Session 3 – P1: Advanced Material (AM)-Room 1 (Virtual) **Session Chairman:** Dr Nurul Sahida Hassan		
Time	**Paper ID**	**Paper Title / Authors**
1.00 pm – 1.15 pm	**BRFG**	**Briefing Session**
1.15 pm – 1.30 pm	**AM10-027**	Structural Elucidation of Cr_2O_3-Al_2O_3 catalyst: Synthesis & Characterization ***Zulaikha Athirah Alexzmana, Nur Hazirah Rozali Annuar***
1.30 pm – 1.45 pm	**AM11-031**	Banana Peels Based Zinc Oxide Doped Silver Nanoparticles for Enhanced Photocatalytic Degradation of Paracetamol ***Mohamad Aizad Mohd Mokhtar, Roshafima Rasit Ali, Zhongfang Lei, Nurfatehah Wahyuny Che Jusoh, Zatil Izzah Tarmizi***

1.45 pm – 2.00 pm	**AM12-032**	Adsorption Of Chloramphenicol onto Cobalt-Based Zeolitic–Imidazolate Framework (Co-ZIF-67) – Kinetic and isotherm models ***Thuan Van Tran, Aishah Abdul Jalil, Duyen Thi Cam Nguyen, Dai-Viet N. Vo***
2.00 pm – 2.15 pm	**AM13-033**	Low-cost Activated Carbon Preparation from Bidens Pilosa L. Weed Chemically Activated Using H_3PO_4 and KOH: Application to Organic Dyes Adsorption ***Duyen Thi Cam Nguyen, Aishah Abdul Jalil, Nguyen Chi Huynh, Thuan Van Tran***
2.15 pm – 2.30 pm	**AM14-040**	Modified UiO-66-SO_3H Metal-Organic Framework for CO_2 Adsorption ***Siva Rubini Devi Raveendran, Lee Peng Teh, Roohaida Othman, Chin-hua Chia***
2.30 pm – 2.45 pm	**AM15-041**	Fabrication and Characterization of Highly Hydrophobic PVDF Membrane by Phase Inversion Method with High Anti-Wettability Characteristics ***Hasan Muhammad Enamul, Muhammad Rashid Shamsuddin, Nik Abdul Hadi Md Nordin***
2.45 pm – 3.00 pm	**AM16-050**	Advancements in CO_2 Thermocatalytic Conversion Processes using Core-Shell Nanostructured Catalysts ***Nisa Afiqah Rusdan, Wan Nor Roslam Wan Isahak, Zahira Yaakob, Sharifah Najiha Timmiati***
3.00 pm – 3.15 pm	**AM17-043**	Utilizing Metal Oxide/Fabric Composites for Photocatalytic Degradation of Wastewater ***Nur Alia Farhana Ros Madi, Nurfatehah Wahyuny Che Jusoh, Lian See Tan, Mariam Firdhaus Mad Nordin***

Session 3 – P2: Energy Management and Technology (EMT)-Room 2 (Virtual)

Session Chairman: Dr Mahadi Bahari

Time	Paper ID	Paper Title / Authors
1.00 pm – 1.10 pm	**BRFG**	**Briefing Session**
1.15 pm – 1.30 pm	**EMT5-035**	A Comprehensive Study of Components Microgrid Sizing and Performance Optimization by Metaheuristic Algorithms for Energy Management Strategies ***Muhammad Zahid Zainul 'Abidin, Dalila Mat Said, Nik Noordini Nik Abd Malik, Najla Ilyana Abd Majid***
1.30 pm – 1.45 pm	**EMT6-037**	A review of global carbon capture and storage (CCS) and carbon capture, utilization, and storage (CCUS) ***Wan Mohd Shaharizuan Mat Latif, Norassyikin Mausa @ Sabdullah, Siti Nur Aenun, Nur Aisyamirah Bosamah***
1.45 pm – 2.00 pm	**EMT7-038**	Power Loss Minimization by Optimal Allocation and Sizing of STATCOM via Particle Swarm Optimization ***Akmal Razak, Norzanah Rosmin, Aede Hatib Musta'amal, Siti Maherah Hussin, Dalila Mat Said, Aripriharta***

2.00 pm – 2.15 pm	**EMT8-044**	Statistical Adhesion Study of The Composition of Lignin-Epoxy Coating for Hydro Power Plants ***Nasimul Eshan Chowdhury, Puteri Sri Melor Megat Yusoff, Mazli Mustapha, Nuur Fahanis Che Lah***
Session 3 – P3: Renewable Energy and Technology (RET)- Room 3 (Virtual) **Session Chairman:** Dr. Muhamed Yusuf Shahul Hamid		
Time	**Paper ID**	**Paper Title / Authors**
1.00 pm – 1.10 pm	**BRFG**	**Briefing Session**
1.15 pm – 1.30 pm	**RET8-009**	Enhancing Nutritional Value of Banana Peels as Animal Feed Pellet using Subcritical Water Technology ***Nurhamieza Md Huzir, Pramila Tamunaidu,, Muhammad Bukhari Rosly, Muhammad Hidayat Hussin, Azlan Nur Rasyid Amin***
1.30 pm – 1.45 pm	**RET9-014**	Non-Noble Metal Catalysts for Dry Reforming of Methane: Challenges, Opportunities, And Future Directions ***Mansur Alhassan, Aishah Abdul Jalil, Mohammed Yusuf Shahul Hamid, Norafneeza Binti Norazahar Abdelrahman Hamad Khalifa Owgi, Thuan Van Tran***
1.45 pm – 2.00 pm	**RET10-039**	Optimization Analysis of Solid Oxide Fuel Cells with Ceria-Based Single Cells Using Computational Fluid Dynamics ***Tan Kang Huai, Mohammad Saifulddin Mohd Azami, Hamimah Abd.Rahman, Nurul Farhana Abd Rahman, Mohd Faizal Tukimon, Zol Hafizi Jaidi***
2.00 pm – 2.15 pm	**RET11-053**	Non-Noble Metal Catalysts for Dry Reforming of Methane: Challenges, Opportunities, And Future Directions ***Amirul Hafiiz Ruhaimi, Muhammad Arif Ab Aziz***
Closing Ceremony and Award Presentation		

LIST OF ATTENDEES

Dr. Nor Farhah Saidin
Universiti Pendidikan Sultan Idris

Dr. Ainul Hakimah Karim
Universiti Kuala Lumpur – MITEC

Mr Mohammed Abdelilah Daoulhadj
Universiti Teknologi Malaysia

ABSTRACT

KEYNOTE SPEAKER 1

The Organized Structure of Polymer Electrolytes: Paving a New Path to Energy Storage and Tactile Technology

Professor Dr Yuki Nagao
School of Materials Science, Japan Advanced Institute of Science and Technology, 1-1 Asahidai, Nomi, Ishikawa 923-1292, Japan

ABSTRACT - Highly ion-conductive polymers have long attracted the attention of researchers for use in energy conversion, sensors, catalysts, and other applications for a smart society (Fig. 1). The electrochemical reaction of fuel cell and Li ion battery occurs at the interface where the junction of ion-conductive electrolyte, electronic conductor (carbon etc.), and electrochemical catalyst (plus fuel/oxidant in fuel cells). The presenter and his research group mainly investigated interfacial ion transport in oriented and/or polymer electrolytes. The presenter will introduce polymer organized structures based on a lyotropic liquid crystalline property and their application in lithium-ion battery and tactile sensing.

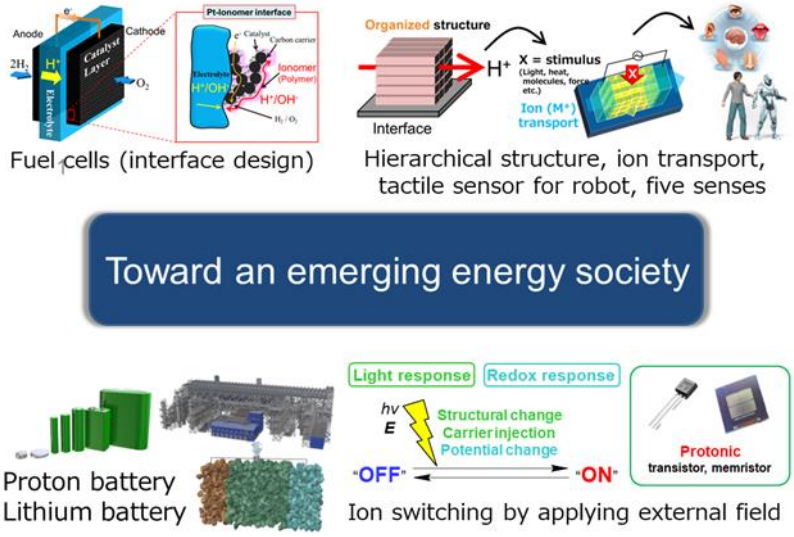

Figure 1. Toward an emerging energy society.

KEYNOTE SPEAKER 2

Recent Advances in Catalyst Development for Greenhouse Gas Conversion into Hydrogen

Assoc. Prof. Ts. Dr. Herma Dina Setiabudi
Universiti Malaysia Pahang Al-Sultan Abdullah

ABSTRACT - The urgent need to address climate change and reduce greenhouse gas emissions has driven extensive research into innovative technologies for sustainable hydrogen production. Among these, the conversion of greenhouse gases (GHGs), such as carbon dioxide (CO_2) and methane (CH_4), into high-value hydrogen (H_2) gas has gained significant attention as it offers a dual solution, which mitigates GHGs emissions while providing a clean energy source. Remarkable progress in designing and optimizing catalysts to enhance the efficiency of GHGs conversion and H_2 production has been explored. Various catalyst types, including metal-based catalysts, have been studied to facilitate GHGs conversion reactions. Furthermore, the optimization of catalyst support materials has improved the overall performance of GHGs conversion reactions. Advances in catalyst engineering, properties-activity correlation, and mechanistic insights have led to increased reaction rates, enhanced selectivity towards H_2 production, and reduced energy consumption. In conclusion, recent developments in catalyst design have significantly advanced the field of hydrogen production from GHGs utilization, paving the way for sustainable and environmentally friendly solutions that contribute to the transition to a low-carbon future.

KEYNOTE SPEAKER 3

Strategic Designing of Composite Heterogeneous Photocatalyst for the degradation of water contaminants

Dr Mohammad Saifulddin bin Mohd Azami
Faculty of Applied Sciences, Universiti Teknologi MARA Perlis Branch, 02600 Arau Perlis

ABSTRACT - Global concern on water pollution has increased in recent times due to the cumulative harmful impact on the human health caused by the various toxic substances released into water bodies such as rivers and dams. This pollution has caused the demand of clean water supply for human, agricultural and industrial uses reduced, thus an effective water treatment process must be developed to solve the issue. In this context, the photocatalytic processes are the most convenient due to their unique features such as low-cost, harmless effects, and completely mineralize the pollutants, thus practicable for water treatment application. This research focuses on the strategic design of the composite photocatalyst development for the decontamination of pollutions, including pesticide, heavy metal, dyes, and pharmaceuticals, which was widely found in the hydrosphere. The selection of the photocatalyst semiconductor is basically based on the electronic band that could preserve the strong redox ability in the water removal process. Our research is focusing on the development of the novel composites via the hybridization between strong oxidation ability and strong reduction ability. Therefore, we have implemented the hybridization of composite using several semiconductors such as, titanium dioxide, graphitic carbon nitride, silver oxosalts, metal phosphate and cadmium sulphate. Whilst, this research also provides some knowledges regarding on the movement of electron, which can be determined using specific characterizations in order to emphasize the construction of the heterojunction mechanism. These sustainable composite strategies provide an insightful approach to the researchers to develop a novel composite photocatalyst, which is effective and environmentally friendly for removal of contaminants from water bodies.

ADVANCED MATERIAL (AM)

AM1-008

Layer-by-layer Membranes for Vanadium Redox Flow Battery

Saidatul Sophia Sha'rani[1, 2, b)] Nurfatehah Wahyuny Che Jusoh[1, 2, a)] Mohamed Mahmoud El-Sayed Nasef[1,2] Roshafima Rasit Ali[1, 2]

[1]*Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia, Jalan Sultan Yahya Petra, 54100 Kuala Lumpur, Malaysia*
[2]*Center of Hydrogen Energy, Institute of Future Energy, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia*

ABSTRACT - Layer-by-layer (LbL) is a widely utilized method for enhancing the selectivity, efficiency, and long-term stability of ion exchange membranes (IEMs) in various applications. This technique involves the deposition of charged thin films on IEM surface through electrostatic interactions using polycations and polyanions. The simplicity and straightforwardness of the LbL modification technique make it a preferred choice due to its reduced preparation steps and time. This method is found to be suitable for preparation of IEMs with excellent vanadium barrier properties for Vanadium Redox Flow Battery (VRFB), a battery that is highly sought to promote renewable energy to the grid level. The objective of this article provides an overview for progress in the development of IEMs for VRFB using LbL method. This includes not only description of the basics of the LbL method and its pros and cons but also factors affect membrane functions and stability. The current applications of various LbL prepared membranes in VRFB and the challenges to their performance are pointed out. The research future directions to enhance membranes characteristics are discussed. Overall, this short review offers valuable insights into the exploration of LbL techniques for the preparation of highly selective, efficient, and stable membranes for VRFB applications.

AM2-013

Graphitic Carbon Nitride Loaded on Fibrous Silica Iron for Simultaneous Removal of Hexavalent Chromium and Methyl Orange Under Visible Light Irradiation

Nur Izzati Hannani Hazril[1], Aishah Abdul Jalil[1, 2], Nurul Sahida Hassan[1]

[1]Faculty of Chemical and Energy Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia
[2]Centre of Hydrogen Energy, Institute of Future Energy, 81310 UTM Johor Bahru, Johor, Malaysia

Abstract - Graphitic carbon nitride (g-C_3N_4)/fibrous silica iron (FSFe) catalysts are successfully synthesized via impregnation and hydrothermal methods without calcination at different g-C_3N_4 loadings. The physicochemical properties of the g-C_3N_4/FSFe were studied using FTIR and UV-Vis DRS spectroscopy to determine the functional group present and the bandgap of the catalyst respectively. The band gap shows the higher the loading of g-C_3N_4, the smaller the band gap becomes. The photocatalytic activity on the removal of Cr(VI) and methyl orange (MO) was studied in a simultaneous system. The efficient photocatalytic activity of Cr(VI) and MO could be due to the decreased bandgap of the synthesized catalysts. Hence, modification of FSFe catalyst with the addition of g-C_4N_4 offers an ideal strategy for the simultaneous photocatalytic removal of heavy metals and organic pollutants.

AM3-018

Fibrous Silica Bismuth Sulfide: An Advanced Material Towards Promising Photoelectrochemical Water-Splitting

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Abstract - Since decades ago, hydrogen energy has captivated significant eyes due to its highly exothermic reaction and potential of zero carbon emission, and deemed as a potential candidate to replace conventional fossil fuels. Moreover, the production of hydrogen via the photoelectrochemical (PEC) water-splitting approach has been regarded as an outstanding approach due low cost of operation, highly efficient and environmentally friendly. Significant semiconductor materials such as TiO2, CdS, Fe2O3 and Co3O4 have been devoted to the PEC study. However, the performance of these materials still remained unsatisfactory due to their own severe limitations. Bi2S3 on the other hand, exhibited a narrow bandgap, a reasonable incident photon to current efficiency, and an appropriate band edge position which make it an exceptional photoanode material for PEC water-splitting. However, ascribed to the rapid carrier recombination and sluggish water oxidation kinetic, the PEC performance of Bi2S3 is still restricted. Impressively, fibrous silica morphology is one of the outstanding strategies which not only eliminates the aforementioned obstacles but also can improve the stability of the Bi2S3 in the electrolyte solution. Herein, we innovatively fabricated fibrous silica bismuth sulfide (FSBS) for PEC water-splitting study. The FSBS photoanode was successfully developed via microemulsion method which was proven by the FTIR and SEM analyses. More importantly, FSBS photoanode also demonstrated an outstanding PEC water-splitting performance with a photocurrent density enhanced more than two folds as compared to the commercial Bi2S3. This study provides new insight into the potential of fibrous morphology for enhanced PEC water-splitting activity.

AM4-021

Synthesis of fibrous silica BEA for methanol to olefin reaction

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Abstract - Conventional olefin production relies significantly on fossil fuels, which are a major contributor to environmental problems. Methanol to olefin (MTO) is among non-fossil fuel alternatives to produce olefinic products from abundant resources, such as biomass, coal, and natural gas. However, the catalytic reaction of MTO over commercial zeolite catalysts is hindered by their low activity, primarily attributed to the micropore structure and excessive acidity within the zeolite. Herein, BEA zeolite with fibrous silica structure was successfully synthesized via the microemulsion BEA seed-assisted method. The catalysts were characterized using FESEM, nitrogen physisorption, and ammonia-TPD. FESEM results revealed a well-ordered spherical morphology of FSBEA with uniform particle size distribution. In surface analysis, the FSBEA exhibits higher BET surface area and mesopore volume compared to commercial BEA. The introduction of fibrous silica within the BEA structure led to a significant drop in strong acid sites, as shown in Ammonia-TPD results. These led to superior catalytic performance of FSBEA in the MTO process.

AM5-030

pH-Responsive Electrospun Polymeric Mesoporous Silica Nanoparticles for an Enhanced Localized Drug Delivery

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Abstract - Mesoporous silica nanoparticles (MSN) are widely recognized in nanotechnology for drug delivery application due to their unique properties, biocompatibility, and non-toxic nature. However, a significant challenge in the field of nanomaterials is ensuring the controlled release of drugs to specific targets, which affects their overall effectiveness. Localized anticancer drug delivery systems with acidity-responsive features hold great promise in improving cancer treatment outcomes while reducing the side effects and toxicity associated with traditional systemic chemotherapy. To comply with this issue, researchers have explored incorporating an acidic-responsive polymer to MSN. This study unleashed the potential of using several electrospun polymers as a coating for MSN loaded with a model drug, quercetin (QT), in a thin film. Various aspects of the materials were analyzed, including functional groups, crystallinity, surface characteristics, and hydration properties. Different combinations of MSN-polymeric membrane ratio were explored and the results revealed that under neutral pH conditions, MSN without polymer released the highest amount of QT, whereas MSN-polymeric membrane showed no significant drug release. In contrast, in an acidic environment, MSN-polymeric membrane exhibited a slower and sustained release, reaching only 33.5% within 20 hours. These differences were attributed to the morphology, solubility, and chemical interactions between MSN/drug and the polymer. In conclusion, the study suggests that efficiently electrospun polymer as carrier-drug molecules offers a promising approach for improving drug delivery applications.

AM6-046

Photocatalytic Conversion of Carbon Dioxide to Methanol Over Different Precursors of Graphitic Carbon Nitride Supported on Fibrous Silica Iron

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Abstract - In this study, the graphitic carbon nitride was successfully synthesized through thermal polymerization under three different g-C_3N_4 precursors such as urea (U-gC_3N_4), melamine (M-gC_3N_4) and dicyandiamide (D-gC_3N_4) for photocatalytic conversion of carbon dioxide (CO_2) to methanol (CH_3OH). Then, the synthesized catalysts were doped into the fibrous silica iron (FSFe). The synthesized catalysts were characterized using X-ray Diffraction (XRD), Fourier Transform Infrared Spectrometer (FTIR) and UV-Vis Diffuse Reflectance Spectroscopy (UV-Vis/DRS). The result showed that the FSFe structure is preserved even after doping with g-C_3N_4.The hybrid of g-C_3N_4/FSFe showed lower band gap energy and this result led to the potential use of it in visible light responsive photocatalytic reaction. The photocatalytic performance of U-gC_3N_4/FSFe (23 316 $\mu mol/gcat$) catalysts towards conversion of CO_2 to methanol for 240 minutes is highest compared to bare U-gC_3N_4 (3 106 $\mu mol/gcat$) and FSFe (19 007 $\mu mol/gcat$).

AM7-054

Recent Advances on Simultaneous Removal of Tetracycline and Hexavalent Chromium

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Abstract - Contamination of water sources with various organic and inorganic non-biodegradable pollutants is becoming a growing concern due to industrialization, urbanization, and the inefficiency of traditional wastewater treatment processes. Simultaneous removal of dual pollutants via photocatalytic redox reaction has been tremendously explored in the last five years due to effective decontamination of pollutants compared to a single pollutants system. In a photocatalysis mechanism, the holes in the valence band can remarkably promote the oxidation of a pollutant. At the same time, photoexcited electrons are also consumed for the reduction reaction. The synergistic between the reduction and oxidation inhibits the recombination of electron-hole pairs extending their lifetime. Here we review the use metal oxide-based photocatalysts for the removal of tetracycline and hexavalent chromium. Several strategies for the enhancement of this treatment method which are designation of catalysts, pH of mixed pollutants and addition of additive was discussed This review offers a recent perspective on the development of photocatalysis system for industrial applications.

AM8-007

Effect of Kenaf Fiber Loading on the Mechanical and Morphological Properties of Polyurethane Shape Memory Polymer Composites

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Abstract - Shape memory polymers (SMPs) have captivated researchers and engineers with their unique ability to recover their original shape after deformation. Among them, shape memory polyurethane (SMPU) shows great promise due to its easy processing, cost-effectiveness, and biocompatibility. However, its application in structural fields is limited by its relatively low strength and modulus. To overcome these limitations, researchers have explored incorporating reinforcements, such as glass fibers, but concerns about their environmental impact have driven the search for sustainable alternative. This research delves into the investigation of the mechanical properties of shape memory polyurethane (SMPU) composites (SMPCs) that have been reinforced with varying weight percentages (5%,10%, 15%, 20%, 30%, and 40%) of kenaf fiber (KF). A hand lay-up technique was initially employed to fabricate these composites, followed by compression molding to achieve desired shapes. The mechanical evaluation primarily focused on conducting tensile testing to assess the composites' tensile strength, elongation at break, and modulus of elasticity. Scanning electron microscope (SEM) analysis was also performed to investigate the fiber dispersion and interfacial bonding within the composites. The results reveal a clear correlation between the kenaf fiber content and the mechanical properties. Specifically, the tensile strength and tensile strain exhibited a continuous enhancement up to a 20% kenaf fiber content, with the composite containing 20% kenaf fiber showing the highest values. However, at higher fiber contents (30% and 40%) led to decreased performance due to issues such as fiber agglomeration and void formation. The SEM analysis further revealed the evidence of the fiber-matrix adhesion and interactions by offering valuable insights into the observed mechanical trends. By shedding light on the mechanical behavior of SMPC with kenaf fiber reinforcements, this study paves the way for developing high-performance composites tailored for shape memory applications.

AM9-023

Preparation and characterization of graphene film using Biogas derived from OPEFB by CVD method

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Abstract - Graphene is known to have distinct properties such as its conductivity, transmittance, flexibility, and strength, making it highly suitable for a wide range of applications. The current methods of graphene production involve the use of expensive and toxic reagents, which makes the process environmentally unfriendly and economically unfeasible. Therefore, the development of an eco-friendly and cost-effective method for graphene production from oil palm waste is important research for graphene fabrication industry and to overcome the overabundance and disposal issue of oil palm empty fruit bunch (OPEFB) in Malaysia. Thus, this project aimed to fabricate graphene film using biogas derived from OPEFB as carbon precursors. The fabricated graphene films will be deposited on copper substrate under different temperatures and gas composition. In this study, Scanning Electron Microscopy (SEM), Raman Spectroscopy, and I-V test were used to analyze and characterize the properties of the fabricated film. From the characterization results, SEM images of film grown at 800°C (without additional H_2 gas), 900°C (without additional H_2 gas) shows that it not so well-defined hexagonal domain shape with non-uniform morphology with variations in domain shape and orientation while Raman spectra shows it has only D band and G band which attributed to graphene oxide. While at 900°C (with additional H_2 gas), the SEM image shows more defined hexagonal domain shape and variations in domain shape and orientation as well as D, G band and 2D band on Raman spectra which is similar to graphene with defects structure. Hence, it is concluded that graphene film was successfully produced at 900°C with additional H_2 gas.

AM10-027

Structural elucidation of Cr_2O_3-Al_2O_3 catalyst: Synthesis & Characterization

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Abstract - The development of active, stable, and low-cost catalysts for efficient reactions is appealing but difficult. The objectives of this study are to synthesize Cr_2O_3-Al_2O_3 catalysts and analyze their physical properties using SEM, XRD, TGA-DTA, and FTIR. The impregnation method was used to create Cr_2O_3-Al_2O_3 catalysts with five different chromium oxide loadings (3wt%, 6wt%, 9wt%, 12wt%, and 15wt%). The physical properties of the catalysts were characterized using FTIR, SEM, BET, and TGA. The FTIR spectra and SEM images of the samples confirmed that Cr_2O_3 was successfully incorporated on Al_2O_3 support. TGA was used to evaluate the weight loss and thermal stability of the catalysts during the calcination process. The hydroxyl groups of alumina, as well as its water affinity, cause more mass loss when heated because water molecules are released. The addition of chromium oxide, on the other hand, alters thermal interactions, resulting in different mass loss behavior for chromium oxide alumina. The surface area changes seen by BET analysis gave insights into the structural flexibility of the catalyst across varied loading levels. The physical properties of synthesized catalysts demonstrated their ability to be utilized in a variety of catalytic reactions.

AM11-031

Banana Peels Based Zinc Oxide Doped Silver Nanoparticles for Enhanced Photocatalytic Degradation of Paracetamol

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Abstract - Emerging contaminants are organic compounds that can harm humans and the environment via water, pollution. Among emerging contaminants available, pharmaceutical waste is abundant due to urbanization, an increase in world population and improper discharge from industries. Paracetamol (PCM) is a common drug for daily use in each household and considering PCM's availability and huge production, traces of waste PCM present in water sources are concerned. Photocatalysis technology shows promising results with the utilization of semiconductor materials and light energy to degrade and remove organic pollutants. In this study, zinc oxide/silver nanoparticles (ZnO/Ag NPs) photocatalyst were synthesized via sol-gel and co-precipitation technique with the aid of banana peels extract (BPE) for photodegradation of PCM. The produced photocatalysts were characterized by Ultraviolet-Visible Spectroscopy (UV-Vis), X-ray Diffraction (XRD), surface area and pore analysis and Field Emission Scanning Electron Microscope (FESEM). Results shows that a blue shift phenomenon occurs between ZnO NPs and ZnO/Ag NPs while XRD analysis suggested that all samples exhibit hexagonal wurtzite structure. ZnO/Ag NPs portrayed a spherical and hexagonal surface morphology with average particles size of 25.68 nm and mesoporous structure. ZnO/Ag NPs shows the highest photodegradation of PCM with 96 % with five repeated cycles compared to pristine ZnO NPs. The main species responsible for PCM degradation via ZnO/Ag are hydroxyl radical and electron. The prepared BPE based ZnO/Ag has a high potential as advanced materials for pharmaceutical wastewater treatment.

AM12-032

Adsorption Of Chloramphenicol onto Cobalt-Based Zeolitic–Imidazolate Framework (Co-ZIF-67) – Kinetic and isotherm models

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Abstract - Chloramphenicol is identified as one of the emerging antibiotic contaminants in the environment. This compound involves in binding to bacterial ribosomal subunits, thereby hindering protein synthesis. As a pharmaceutical, chloramphenicol is used to treat diseases caused by both gram-(+), gram-(-), and anaerobic bacteria. In terms of commercialization, chloramphenicol boasts two key advantages, involving cost-effective production and remarkable stability. Chloramphenicol has contributed to enhanced health care in the world. The use of chloramphenicol for livestock and aquaculture activities is also intensified. Recently, chloramphenicol has been detected in surface water at high concentrations as a result of discharge of untreated wastewaters such as hospital effluents, aquaculturing wastewater, etc. into the aquatic media. This leads to potential threats to human health and aquatic animals. Therefore, it is necessary to remove chloramphenicol from water using feasible and sustainable techniques such as adsorption. Here, our study focused on the synthesis of cobalt-based zeolitic–imidazolate framework (Co-ZIF-67) using a solvothermal method, and then assess the adsorbability of chloramphenicol on Co-ZIF-67 adsorbent. The scanning electron microscopy (SEM) and energy dispersive X-ray (EDX) analyses were used to characterize the Co-ZIF-67 adsorbent. Results revealed the Co-ZIF-67 crystals have a microspherical shape with the average particle size between 300 and 400 nm. The presence of main elements such as C (61.35%), O (10.64%), Co (7.3%) and N (20.71%) without any impurities, indicating the Co-ZIF-67 crystals have been successfully produced. The effect of contact time (0–120 min) and concentration (5–50 mg/L) on the chloramphenicol adsorption was suggested. Moreover, kinetic and isotherm models were fitted to examine the chloramphenicol adsorption behavior. We observed that this adsorption process obeyed pseudo second order model (R2 = 0.99), and Langmuir models (R2 = 0.97). Therefore, the chemisorption via surface functionality and monolayer behavior played a crucial role in the adsorption of chloramphenicol. The study postulated the involvement of hydrogen bonding and π–π interactions as primary mechanisms. The importance of this study is to better understand the adsorption of chloramphenicol in water, and gain insight into the adsorption models and mechanisms.

AM13-033

Low-cost Activated Carbon Preparation from Bidens Pilosa L. Weed Chemically Activated Using H_3PO_4 and KOH: Application to Organic Dyes Adsorption

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Abstract - Water pollution is a pressing global concern, exacerbated by various pollutants, including organic dyes that resist degradation, especially in the textile industry. Rhodamine B (RhB), a common cationic dye, is water-soluble and toxic to humans and animals upon contact. Methyl orange (MO) and Acid yellow (AY), anionic dyes, exhibit mutagenic properties, while Methyl red (MR), a non-ionic dye, is mutagenic, carcinogenic, and persistent in aquatic environments, emphasizing the need for effective treatment and elimination of these harmful dyes to mitigate their impact. Activated carbon (AC) has emerged as a highly effective adsorbent for wastewater treatment due to its porous structure and abundant functional groups. However, the cost and limited affinity for larger contaminants associated with commercial activated carbons (CAC) have led researchers to explore the production of AC from low-cost precursors, such as weed biomass, which urgent need of environmental protection and ecological sustainability. Bidens pilosa L. is a globally invasive weed that poses a substantial ecological threat through the displacement of native vegetation, disruption of ecosystems, and economic losses, ultimately contributing to a decline in biodiversity losses. In the present study, the dye removal efficiency of RhB, MO, MR, and AY, from aqueous solutions onto activated carbon (AC) derived from Bidens pilosa weed (BPW) treated through traditional pyrolysis, were explored. The influence of impregnated ratios (1:0.5, 1:1, 1:1.5, and 1:2) of potassium hydroxide (KOH) and phosphoric acid (H_3PO_4) as chemical activation agents on adsorption efficiency was investigated. The results showed that for all investigated dyes, the carbon activated by H_3PO_4 agent at an impregnated ratio of 1:2 (ACH_4) exhibited the best adsorbent for dye removal. After 5 h of uptake experiments, the adsorption reached equilibrium, with adsorption efficiencies of 98.3, 96.2, 95.6, and 87.3% for RhB, MO, MR, and AY, respectively. ACH_4 was characterized by Fourier Transform Infrared Spectroscopy (FTIR) spectra, scanning electron microscopy (SEM), and the point of zero charge (pHpzc). The SEM image revealed a progressive development of pores resulting from the removal of volatile substances and impurities. FTIR analysis indicated the predominance of acidic surface functional groups, which favored the adsorption process. Therefore, ACH_4 prepared from Bidens pilosa weed promise as an adsorbent material for the adsorption of dyes from aqueous solutions.

AM14-040

Modified UiO-66-SO_3H Metal-Organic Framework for CO_2 Adsorption

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Abstract - Concerns about climate change and global warming have led to substantial global-scale efforts to remove carbon dioxide (CO_2) from both emission sources and the atmosphere. Metal-organic frameworks (MOFs), a new class of porous material have been considered for this application due to their ultrahigh surface, tuneable properties, and surface functions. Therefore, UiO-66-SO_3H was investigated in this study. UiO-66-SO_3H was synthesized using the solvothermal method and it was modified using a mixed-ligand strategy with a presence of 2-amino terephthalic acid as a second linker. The physicochemical properties of these materials were characterized using X-ray diffraction (XRD), Fourier transforms infrared spectroscopy (FTIR), thermogravimetric analysis (TGA), field emission scanning electron microscopy (FESEM), and N_2 physisorption to determine its crystalline structure, functional groups, thermal stability, morphology, and BET surface area, respectively. The CO_2 adsorption capacity and recyclability were measured at 1 atm and 25 ˚C. Pristine UiO-66-SO_3H shows a low CO_2 adsorption capacity with good recyclability meanwhile the modified MOFs show a high CO_2 adsorption capacity with good recyclability. The improvement in CO_2 adsorption is due to the presence of NH_2 groups, which provide additional hydrogen bridge interaction with CO_2. Significant improvement in properties can be observed in crystallinity and BET surface area. This study concludes that the mixed ligand method improves the CO_2 adsorption up to five times as well as the physicochemical properties.

AM15-041

Fabrication and Characterization of Highly Hydrophobic PVDF Membrane by Phase Inversion Method with High Anti-Wettability Characteristics

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Abstract - Membrane gas-liquid separation technology has garnered significant attention in applications such as membrane desalination, distillation, and gas absorption due to its operational flexibility, compact design, and large specific interfacial area. The membrane serves as a semi-permeable barrier between gas and liquid solvents, enabling gas molecule diffusion through pressure differentials. However, the currently used membranes are prone to pore wetting under high operational pressures, transitioning from a non-wetted state to partially or fully wetted conditions. These undesired wetting increases mass transfer resistance for gas molecules, ultimately leading to reduced removal efficiency. To address this issue and enhance wetting resistance, membrane hydrophobicity needs to be improved. In this study, a highly hydrophobic polyvinylidene fluoride (PVDF) membrane was developed using the phase inversion method for membrane distillation applications. We mixed a 16wt% polymer concentration with N-Methylpyrrolidone (NMP) as a solvent at 50°C for 24 hours. Subsequently, the polymer solution was cast and exposed to different non-solvents, namely water and methanol, to investigate their impact. Surface morphology and hydrophobic properties of the synthesized membranes were analyzed using Scanning Electron Microscope (SEM) and a Goniometer. Our findings indicate that the PVDF membrane fabricated with methanol as the non-solvent exhibited a significantly higher water contact angle of 126°, compared to 70° when deionized water was used as the non-solvent. This change from water to methanol as the non-solvent resulted in a more symmetrical membrane structure, enhancing the water contact angle from 70° to 126°.

AM16-050

Advancements in CO_2 Thermocatalytic Conversion Processes using Core-Shell Nanostructured Catalysts

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Abstract - Carbon-intensive industries must deem carbon capture, utilization, and storage initiatives to mitigate rising CO_2 concentration by 2050. A 45% national reduction in CO_2 emissions has been projected by government to realize net zero carbon in 2030. CO_2 utilization is the prominent solution to curb not only CO_2 but other greenhouse gases, such as methane, on a large scale. For decades, thermocatalytic CO_2 conversions into clean fuels and specialty chemicals through catalytic CO_2 hydrogenation and CO_2 reforming using green hydrogen and pure methane sources have been under scrutiny. However, these processes are still immature for industrial applications because of their thermodynamic and kinetic limitations caused by rapid catalyst deactivation due to fouling, sintering, and poisoning under harsh conditions. Therefore, a key research focus on thermocatalytic CO_2 conversion is to develop high-performance and selective catalysts even at low temperatures while suppressing side reactions. Conventional catalysts suffer from a lack of precise structural control, which is detrimental toward selectivity, activity, and stability. Core-shell is a recently emerged nanomaterial that offers confinement effect to preserve multiple functionalities from sintering in CO_2 conversions. Substantial progress has been achieved to implement core-shell in direct or indirect thermocatalytic CO_2 reactions, such as methanation, methanol synthesis, Fischer–Tropsch synthesis, and dry reforming methane. However, cost-effective and simple synthesis methods and feasible mechanisms on core-shell catalysts remain to be developed. This review provides insights into recent works on core-shell catalysts for thermocatalytic CO_2 conversion into syngas and fuels.

AM17-043

Utilizing Metal Oxide/Fabric Composites for Photocatalytic Degradation of Wastewater

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Abstract - The growing concern over water pollution has increased the search for innovative and sustainable approaches to wastewater treatment. This manuscript offers a concise exploration of the utilization of composite materials comprising metal oxides and fabrics for the purpose of photocatalytic degradation. Metal oxides, including titanium dioxide (TiO_2), zinc oxide (ZnO), and etc possess inherent photocatalytic properties that, when combined with fabric matrices, present a synergistic approach for pollutant removal. The incorporation of metal oxides and fabrics enhances the photocatalytic performance through the improvement of the catalyst properties. This review covers the photocatalytic mechanisms and properties of metal oxide fabric composites as well as the applications of these composites in environmental remediation and wastewater treatment. As a promising avenue for sustainable pollutant mitigation, further research in this field holds the key to unlocking the full potential of metal oxide fabric composites in diverse environmental applications.

ENERGY MANAGEMENT AND TECHNOLOGY (EMT)

EMT1-045

Numerical Analysis of Vapor Dispersion from Compressed Hydrogen (H_2) Storage Vessels

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ABSTRACT - Demand for hydrogen fuel increases with the introduction of fuel cell electric vehicles, giving increased pressure to minimize refueling station footprints and lower costs while maintaining safety and performance. Compressed gas hydrogen (H2) storage is a viable approach to assuring sufficient hydrogen capacity at commercial fuelling stations. Safe practices in the production, storage, distribution, and use of hydrogen are essential for the widespread acceptance of hydrogen and fuel cell technologies as transition to enhanced global sustainable development by facilitating the safe introduction and commercialisation of hydrogen as an energy carrier of the future. A catastrophic failure in any hydrogen project could damage public perception of hydrogen and fuel cells, focusing on the risk of hydrogen leakage on the storage vessels and related devices, specifically the compressor and the dispenser. Due to the high pressure at which hydrogen is usually stored and dispensed, consequence analysis for risk assessment and power reduction is very crucial. In this regard, the present study aims to investigate the hydrogen dispersion profiling along with consequence analyses for such events as jet fire and vapor cloud explosion. Dispersion consequence analysis was performed adopting ALOHA, HyRAM and PHAST integral model, followed by the evaluation of the effect of environmental (i.e., stability, ambient temperature, surface roughness, wind speed, and humidity) and process (i.e., vessel temperature and pressure, and leakage diameter) parameters on maximum size flammable vapor cloud and maximum level jet fire radiation on the ground. In this work, different cases of hydrogen leakage and combustion are evaluated for high pressure storage vessels with respect to different application situations, based on the prototype car developed by Mirai Toyota and global layout of hydrogen refuelling stations. The investigation covered the hydrogen refuelling station dispensing system, including bulk hydrogen storage, compressors, buffer storage and dispensers; and Fuel Cell Energy Vehicles (FCEVs) storage used in ground support vehicles (e.g., cars and buses). From the findings, it was observed that the size of flammable vapor cloud (consequence dispersion index) and the maximum flux of radiation were affected by process parameters more than ambient parameters. Leakage diameter was found to have the highest impact on the operational parameters. Highlight on the common safety gaps and vulnerabilities in FCEVs and safety separation distance in refuelling station system are elaborated, considering the prescriptive and performance-based approach in accordance with consensus international regulation, codes and standard (RCS).

EMT2-017

A Comparative Study of Fibrous Silica-Based Catalysts for Improving Methane Production via CO_2 Methanation

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ABSTRACT - The process of utilizing the greenhouse gas carbon dioxide (CO_2) is crucial in addressing and reducing the impact of climate change. The CO_2 methanation process, also known as Sabatier reaction, is considered one of the appealing approaches since it provides synthetic natural gas (SNG), fulfilling the present needs. However, the CO_2 methanation reaction demands an exceptionally effective catalyst capable of surpassing the energy barrier associated with eight proton-electron transfers from H_2 molecules. Herein, we reported the application of fibrous silica nanospheres along with the fibrous modification of mesostructured silica nanoparticles (MSN) towards CO_2 methanation, called Centre of Hydrogen energy silica (CHE-Si) and CHE-SM. Both catalysts were successfully synthesized by utilizing micro-emulsion technique and subsequently were characterized with x-ray diffraction, Fourier transform infrared (FTIR) spectroscopy, and N_2 adsorption-desorption. FTIR results revealed that CHE-SM possessed superior Si-OH and Si-O species than CHE-Si despite displayed low surface area and pore volume. Consequently, CHE-SM achieved above 50% CO_2 conversion and CH_4 yield at 500 °C while CHE-Si exhibited lower performance. This discrepancy in catalytic performance was due to the facts that CHE-SM was comprised with more active sites that could adsorbed and dissociates CO_2 and H_2 reactants.

EMT3-011

Enhancing the Environmental Sustainability of Water Treatment Sludge (WTS) Disposal through Blended Binder Solidification/Stabilisation

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ABSTRACT - Water treatment sludge (WTS) management presents a pressing challenge due to its continuous generation and environmental implications. Traditionally, landfill disposal has been widely adopted due to its simplicity and costeffectiveness, but it poses significant risks of groundwater contamination. As a result, researchers have turned their focus towards solidification/stabilisation (S/S) methods to address this concern. This study explores the efficacy of a blended binder system as an alternative approach for treating WTS. The primary objective is to develop an eco-friendly and economically viable solution by replacing a portion of Ordinary Portland Cement (OPC) with waste materials. The study evaluates Waste Paper Sludge Ash (WPSA), Palm Oil Fuel Ash (POFA), and Fly Ash (FA) as potential cement replacements. These waste materials not only contribute to environmental sustainability by reducing environmental waste but also lead to a decrease in cement consumption. The Atterberg Limits of the treated sludge are analysed to design the appropriate S/S method, providing essential data to classify the sludge's physical and mechanical properties. The study shows that using waste materials as binders effectively stabilises sludge, reducing reliance on cement, cutting disposal costs, and freeing up land for other purposes while decreasing environmental pollution. Higher moisture content leads to more fluid mix, while PL value determines binder characteristics. The result of the study shows that the WPSA is the most suitable replacement material with self-cementing properties, and LI value influences flow properties. Combining WPSA, OPC, and WTS creates a stable mix with resistance to liquefaction under sudden shocks, attributed to the significant clay material content. Using waste materials as binders for the S/S technique offers a promising, cost-effective, and environmentally friendly solution for managing sludge.

EMT4-022

Biogas production from hospital food waste: Composition and Effect of pH

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ABSTRACT - Municipal solid waste management (MWM) in Malaysia has become a challenging task in recent years due to the growth of population, industrialisation and an increase in quantity and variation in the types of waste generated. Major solid waste generated in Malaysia is of 45% organic waste that include household food waste, food processing food waste, market waste and restaurant waste. Therefore, it is crucial to identify the way to manage the increment of food waste properly and improve the energy recovery efficiency in a cleaner view. This paper aimed to study the food waste generated in Hospital Pakar Sultanah Fatimah (HPSF) by determining the trend of total food waste daily for 14 days. The solid waste was segregated and the weight were measured according to cooked and uncooked food waste. Total solid waste generated was 2,301 kg with 67% majority waste from lunch session followed by 31% waste from breakfast session. However, there are a small portion of 2% waste comes from the extra cooked food that was not consumed by the patients as some may have been discharged from hospital. Moreover, the effect of pH towards of the segregated sample was investigated after thermally pre-treated for the production of biogas. It was found out that pH is an important factor for enhancement of biogas production. This is proven by adding suitable inoculum, it will stabilize the pH of the medium to neutral value. Hence, increased the biogas volume up to 1,033.53 mL after digestion of 30 days.

EMT5-035

A Comprehensive Study of Components Microgrid Sizing and Performance Optimization by Metaheuristic Algorithms for Energy Management Strategies

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ABSTRACT - The conventional methodology for designing power systems frequently adopts a single objective strategy, focusing primarily on minimizing overall expenses or enhancing system efficiency. However, this approach tends to neglect significant considerations and the inherent tradeoffs, particularly within the domain of microgrid dimensioning that employs multi-objective energy optimization. In the realm of microgrid design, intricate trade-offs often arise among factors such as initial investment cost, efficiency of energy generation, system dependability, and ecological sustainability. Adopting a single-objective strategy in this scenario could result in suboptimal resolutions due to the disregard of these trade-offs. Consequently, the conventional techniques for modeling and optimizing exhibit numerous limitations as the power grid continues to produce substantial volumes of high-dimensional and diverse data types. This review paper examines the use of metaheuristic algorithms in the context of multi-objective energy optimization for hybrid renewable energy-integrated microgrids. Microgrids are autonomous energy systems that combine renewable energy sources and conventional generators. The optimization of the size of renewable sources is crucial to maximizing their effectiveness. In contrast to conventional single-objective optimization, the multi-objective technique aims to achieve a trade-off between energy cost and power supply reliability. A comparative analysis of diverse metaheuristic algorithms for microgrid optimization is provided in this paper, which emulates natural phenomena, such as evolutionary processes and swarm dynamics. Based on the findings of case studies, it can be concluded that tradeoffs exist between various objectives, eventually leading to the development of both resilient and efficient microgrid designs. By reviewing sustainable energy solutions, and advocating microgrids as viable alternatives to conventional centralized power systems, the review enhances the advancement of sustainable energy solutions. The primary objective of this comprehensive review is to provide guidance to electrical engineering researchers, so that energy optimization measures are more effective. Ultimately, the goal is to achieve a more sustainable and environmentally friendly future for energy.

EMT6-037

A review of global carbon capture and storage (CCS) and carbon capture, utilization, and storage (CCUS)

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ABSTRACT - To attain zero carbon emissions while combating climate change, this paper presents an overview status of the global carbon capture and storage (CCS) in four main worldwide regions: North America, Europe, Russia & Central Asia, and Asia Pacific. Main countries for each region are discussed in terms of their respective field, CCS, CCS-enhanced oil recovery (CCS-EOR), carbon capture, utilization, and storage (CCUS), and the concerned issues, e.g., policy, regulation, operational approaches, current progress, problems, and lessons. In the end, this study summarizes the final potential of the global CCS in achieving the Sustainable Development Goals (SDG).

EMT7-038

Power Loss Minimization by Optimal Allocation and Sizing of STATCOM via Particle Swarm Optimization

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ABSTRACT - The provision of electricity is problematic in remote and rural areas. The distribution system is insufficiently efficient to provide rural areas with electricity. Long distance between the power supply and rural areas is the reason why there is insufficient electricity. Static synchronous compensator (STATCOM) technology is one of the solutions that have more positive effects, such as reducing power losses, and can therefore increase the system's efficacy. However, the non-optimal allocation and magnitude of STATCOM may increase losses and have a negative impact on power, resulting in a decrease in system efficiency. This paper introduces the Particle Swarm Optimization (PSO) algorithm as the proposed algorithm to optimize the location and capacity of STATCOM in order to reduce power losses in the distribution system. The proposed technique is implemented on a 15-bus IEEE system and simulated using the MATLAB program. The simulation results demonstrate that the optimal location and quantity of the STATCOM proposed by PSO effectively reduces power loss by 6.058% compared to without PSO implementation.

EMT8-044

Statistical adhesion study of the composition of lignin-epoxy coating for hydro power plants

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ABSTRACT - The ecological impact of coating compounds used on submerged metallic structures in hydroelectric power plants is a less noticeable factor for the ecological impacts of the plants. Mitigating the impacts of hydro power can play a vital role in the competition of green energy enhancement. Bisophenol apicholohydrine (BPA-EC) is a common epoxy compound used in coating, which has a noticeable toxicity reading. BPA-EC erodes and disperses from the coated submerged structures into aqueous medium, due to the subjected high stream velocity in water circuit in hydro power plants, which further affects the marine ecosystem. Since the BPA-EC plays a role in enhancing the adhesive strength of the coating, systematically decreasing the content of BPA-EC in the coating can be a more feasible approach. The current study attempted to decrease the BPA-EC in the epoxy augmented lignin-based coating by statistical means using box behnken model, without compromising the mechanical strength of the coating. The P value was found below 0.05 and the result showed that due to the robustness of aminopropyltriethoxysilane (APTES) as curing agent the absence of BPA-EC from the coating can be compromised, since APTES cured purely lignin coating with strength of 683 psi can compete with APTES cured lignin/BPA-EC coating with the strength of 685 psi.

RENEWABLE ENERGY AND TECHNOLOGY (RET)

RET1-012

Unravelling The Potential of Fibrous Silica Zirconia Catalyst for Co Methanation in Energy Production

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ABSTRACT - In this contemporary era of rapid progress, the global demand for energy has reached unprecedented levels, placing considerable strain on existing energy supplies. To address this challenge, synthetic natural gas (SNG) has emerged as a groundbreaking energy resource obtained through the methanation reaction of hydrogen and carbon monoxide (CO). This conference paper unveils a successful synthesis method for fibrous silica zirconia (FSZr) utilizing the microemulsion process, subsequently applied in the CO methanation process. The catalyst underwent comprehensive characterization using advanced techniques, including Fourier Transform Infrared (FTIR) spectroscopy, Field-Emission Scanning Electron Microscopy, x-ray diffraction (XRD), and N_2 adsorption-desorption. The experimental results clearly demonstrate the exceptional catalytic performance of FSZr when compared to commercially available ZrO_2. At a temperature of 500 ºC, FSZr achieved a CO conversion and CH_4 yield of 20.76% and 11.52%, respectively. This superior performance is attributed to the unique fibrous morphology and high surface area exhibited by FSZr. The increased surface area allows for improved accessibility to active sites, enhancing the catalytic efficiency of the CO methanation process. These findings underscore the significance of fibrous morphology in zirconia catalysts for CO methanation, presenting a promising avenue for further research and insights into meeting the global energy demands efficiently.

RET2-016

A Short Review on Graphene Derivatives towards Photoelectrochemical Water Splitting

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ABSTRACT - Graphene oxide plays a vital role in photoelectrochemical (PEC) water splitting, serving as essential photoanode material. Its semiconducting nature allows for the generation of photocurrents, promoting water oxidation at the anode and contributing to hydrogen production efficiency. Additionally, graphene is a two-dimensional carbon allotrope that has quickly emerged as a highly promising material in PEC water splitting, potentially transforming renewable energy and sustainable hydrogen generation. Graphene improves PEC water splitting efficiency by facilitating efficient charge transport, rapid electron transfer, and effective redox reactions at the electrode-electrolyte interface. It possesses high electrical conductivity, a large specific surface area, and excellent charge carrier mobility. Its unique band structure enables efficient light absorption across a broad spectrum, including visible light, resulting in better light-to-electricity conversion. Furthermore, the inherent catalytic activity of graphene speeds up the oxygen evolution process (OER), increasing water oxidation and aiding hydrogen gas production.

RET3-019

Effect of Aging Times of Fibrous Silica Cadmium Sulfide Photoanodes for Enhanced Photoelectrochemical Water Splitting

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ABSTRACT - The use of photoelectrochemical (PEC) water splitting to produce hydrogen from intermittent solar sources is an alluring potential address to the world's energy and environmental problems. Cadmium Sulfide (CdS) is a potential visible light response photoanode of PEC water splitting, but practical use remains a significant barrier due to its low charge carrier separation efficiency. To address this disadvantage, modifications to the morphology of CdS is necessary. Herein, fibrous silica cadmium sulfide (FSCdS) photoanode for PEC water splitting was synthesized using microemulsion method reported in this study. In this study, it will be focused on effect of aging times on the structure of FSCdS towards the PEC water splitting. The physicochemical and electrical properties of the photoanodes were investigated using XRD, UV-Vis DRS, FTIR and EIS Nyquist Plot. FSCdS-4H had a higher photocurrent density of 22.1 mA/cm^2 at 1.23 V_{RHE} and a higher solar-to-hydrogen (STH) efficiency of 27.2% when compared to commercial FSCdS-8H with 15.9 mA/cm^2 and STH of 19.5%. This is due to the better crystallinity, higher Si-Cd-S interaction, and lower electron hole recombination rate of FSCdS-4H photoanode. Fabrication of fibrous silica-based photoanodes revealed significant insight for the creation of high-performance photoanodes for improved PEC water splitting performance.

RET4-051

Advancements in Cadmium-based Photoanodes for Photoelectrochemical Water Splitting: A Short Review

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ABSTRACT - Photoelectrochemical (PEC) water splitting, which directly converts sunlight into storable hydrogen fuel, has emerged as a promising technology in pursuing renewable energy. This process relies on semiconductor materials functioning as photoelectrodes to harness solar energy and drive water electrolysis into hydrogen and oxygen. However, PEC systems' efficiency and cost-effectiveness face formidable challenges, primarily centred around developing robust and efficient photoanodes. Cadmium-based catalysts, belonging to the II-VI n-type semiconductor family, exhibit exceptional properties conducive to PEC applications, such as tunable band gaps and superior light absorption capabilities. Yet, their practical utility has been hindered by issues related to photocorrosion and inadequate charge carrier separation. Recent breakthroughs in cadmium-based photoanodes have addressed these limitations through innovative strategies. In regards to this matter, this review provides a comprehensive overview of recent advancements in cadmium-based photoanodes, shedding light on their innovative applications in PEC water splitting.

RET5-054

Morphology and Porosity of Biochar Derived from *Arthrospira platensis* Microalgae Pyrolysis

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ABSTRACT - Biochar, a carbon-rich material derived from biomass pyrolysis, has garnered considerable interest for its versatile applications encompassing environmental remediation, catalysis, and carbon sequestration. This study investigates the morphology and porosity characteristics of biochar produced through the pyrolysis of *Arthrospira platensis* microalgae, a promising feedstock due to its rapid growth and sustainable nature. The study aimed to elucidate the structural attributes of *Arthrospira platensis*-derived biochar and its potential implications for diverse applications. Pyrolysis experiments were conducted at varying temperatures (450, 500, 550, and 600 °C) under microwave irradiation to discern the impact of thermal conditions on biochar characteristics. Scanning Electron Microscopy (SEM) facilitated high-resolution surface imaging of the produced char, enabling a detailed analysis of its morphological and porosity features. The research findings revealed that *Arthrospira platensis* microalgae had an intact structure with minimal pore formation. However, the pyrolysis process yielded biochar with a notably rough surface and substantial porosity, particularly evident at 600 °C, where the porosity reached 74.09%. This revelation of high porosity positions *Arthrospira platensis*-derived biochar as a promising candidate for catalytic applications. The study's insights contribute to the optimization of biochar production from microalgae feedstocks, aligning with the broader goal of advancing sustainable and efficient technologies for diverse applications.

RET7-006

Semi Empirical Modeling for Thin Sliced Potato Drying Under Active-Mode Solar Dryer

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ABSTRACT - This paper aims to select the best semi-empirical model for thinly sliced potato drying under active mode solar dryer at variations of the exhaust air velocities. The exhaust air velocities were set at 0.2m/s, 0.4m/s, 0.6m/s, and 0.8m/s. The solar intensities, drying temperature, ambient temperatures, relative humidity of the chamber, and ambient relative humidity were measured to find the correlation between the drying external factors and the variation of exhaust air velocities. The Sigmaplot software was used to select the thin layer drying model for sliced potatoes drying under an indirect solar dryer assisted with a solar accumulator. From the result, drying with 0.2m/s of exhaust air velocity shows a significant drying performance with reduced mass percentages at 69%. The lowest the exhaust air velocity, the better reduction of the mass percentages and the higher the evaporation rate. Consequently, a Rational four (4) parameter was selected as the best of all the drying models, according to r^2, RSME, and x^2. This study was focused on finding the best setup of an active mode indirect solar dryer assisted with exhaust fan varying at 0.2m/s, 0.4m/s, 0.6m/s, and 0.8m/s to remove the vaporized moisture from the thinly sliced potatoes placed on the drying trays inside the drying chamber. The research paper gives a useful understanding of the significant effect of the variations of the exhaust air velocities on the dryer performance.

RET8-009

Enhancing Nutritional Value of Banana Peels as Animal Feed Pellet using Subcritical Water Technology

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ABSTRACT - Banana peels is a good source of fiber which has potential for formulation of animal feed. Although it has high fiber content, lignocellulosic fibers and tannins in banana peels limit its utilization and pretreatment are required to improve its nutritional quality. This study highlights the use of subcritical water technology to enhance nutritional value of banana peels and converting it to ruminant feed pellet. The proximate analysis of treated banana peels (SCW-BC) contains 6.9% of crude fat, 47.3% of crude fiber and 10.6% crude protein. In order to produce balanced nutritional diet for ruminant feed, 54% of SCW-BC was mixed with 46% of sorghum to attain 15% of crude protein by using Pearson square method. Thus, the formulated pellet produced meets the nutrient requirement by the ruminants.

RET9-014

Non-Noble Metal Catalysts for Dry Reforming of Methane: Challenges, Opportunities, And Future Directions

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ABSTRACT - The utilization of non-noble metal catalysts for the dry reforming of methane (DRM) has gained significant attention in recent years due to the increasing demand for clean and sustainable energy sources. The DRM directly converts methane and carbon dioxide into synthesis gas (syngas), a valuable mixture of hydrogen and carbon monoxide. However, developing efficient non-noble metal catalysts for this reaction presents several challenges that must be addressed to achieve practical implementation. This short review discusses the challenges, opportunities, and future directions of non-noble metal catalysts for DRM. First, the limitations associated with the intrinsic activity and stability of non-noble metals, such as nickel, cobalt, and iron, are explored. Strategies for enhancing catalyst performance through compositional modifications, including incorporating promoters and supports, are examined to overcome these challenges. Furthermore, the issue of carbon deposition, or coke formation, which can deactivate catalysts during DRM, is thoroughly analyzed. The mechanisms leading to coke formation on non-noble metal surfaces are assessed, and various mitigation techniques, including catalyst pre-treatment and reactor design, are proposed to improve catalyst longevity. Research directions that hold promise for advancing non-noble metal catalysts in DRM, including exploring bimetallic catalysts for synergistic effects and integrating non-noble metals into novel catalytic systems, were among the future proposals. In contrast, non-noble metal catalysts have the potential to revolutionize the production of syngas and contribute significantly to the transition towards sustainable energy solutions.

RET10-039

Optimization Analysis of Solid Oxide Fuel Cells with Ceria-Based Single Cells Using Computational Fluid Dynamics

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ABSTRACT - The primary objective of this study is to optimize the design of ceria-based single-cell solid oxide fuel cells (SOFCs) by assessing temperature distribution and cell performance through computational fluid dynamics (CFD). The SOFC simulations in this research are conducted at temperatures of 600°C, 700°C, and 800°C, focusing on the Ni-SDC anode, SDC electrolyte, and LSCF-SDC materials used in the SOFC single cell. Initially, the single-cell model is created using CAD software, followed by the development of a computational fluid dynamics (CFD) model with the requisite material properties. The study then proceeds to simulate temperature distribution and cell performance for various supported SOFC stack models (electrode and electrolyte supported) at intermediate temperatures. Subsequently, the study examines cell performance with varying thicknesses of the anode, electrolyte, and cathode components within the specific supported single cell. In summary, the CFD results indicate that cathode-supported SOFCs exhibit higher power density, specifically 938.28 mW/cm^2 at 800°C, surpassing anode-supported and electrolyte-supported configurations. The power density reaches 1495.40 mW/cm^2 when the single-cell layer thickness is 0.35 mm for the cathode, 0.02 mm for the anode, and 0.01 mm for the electrolyte, resulting in a temperature difference of 0.69°C. However, electrolyte-supported single cells display the lowest temperature difference, at 0.23°C. The simulation results demonstrate that reducing the thicknesses of all electrodes and the electrolyte leads to increased current density, power density, and temperature distribution difference.

RET11-053

Non-Noble Metal Catalysts for Dry Reforming of Methane: Challenges, Opportunities, And Future Directions

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ABSTRACT - The hierarchical fibrous cellulosic filter paper has displayed a promising bio-templating material for the MgO adsorbent fabrication, which has affected the improvement of the MgO's CO_2 adsorption performance. The filter paper templated MgO (MgO-FPT) has been subjected to several characterisation analyses, and it has revealed that MgO-FPT demonstrated a positive outcome of the physicochemical features of high volume in surface functional group and surface area about more than two (2) times higher than conventional thermal degraded MgO (MgO-CT). As a surface-rich functional group of the MgO-FPT, it has contributed to the increase of the CO_2 affinity binding site, thus enhancing the surface basicity of the MgO. Together with the improved structural features, it has significantly improved the CO_2 adsorption uptake capacity to almost 15 times higher than MgO-CT with only 0.247 mmol/g. This shows the potential use of cellulosic fibrous filter paper as a bio-material templating for the metal oxide-based adsorbent for CO_2 adsorption application.

GENERAL TOPICS FOR ENGINEER (GTE)

GTE1-025

Effect of Silver Inhibition on The Ceramic Foam as Flame Suppression

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ABSTRACT - Aluminium dust explosions pose significant safety and economic challenges in various industrial processes. Due to this, the current research explores an innovative approach by inhibiting the silver nanoparticles (Ag NPs) to ceramic porous form substrate as a flame suppressant in order to mitigate the risks associated with these explosions. Silver nanoparticles (Ag NPs) are chosen considering their good electrical conduction and thermal abilities. The antimicrobial and non-toxic qualities of silver are also attractive to be applied in medical and food technology. However, the interfacial adhesion between the metallic (nanosilver) and non-metallic (silica-based-ceramic) is still vaguely studied due to the mechanical and surface energy mismatch between the organic surface and the inorganic layers. From this study, the physicochemical and mechanical properties of the silver-coated ceramic foam were analyzed using X-ray diffraction, field emission scanning electron microscopy with energy dispersive X-ray, thermogravimetric analysis, and compression test. XRD results showed no obvious changes in the crystallinity and phase content of silver-coated foams before and after the explosion due to the lower susceptibility of silver to oxidation leading to a coherent interaction with the aluminium powder to form multiple combustion products and thus, successfully quenching the flame more effectively. The findings revealed that Ag NPs coated on ceramic foams are non-uniform with obvious agglomerations of metallic-silica present on the strut structure as confirmed by FESEM analysis. This agglomeration phenomenon could have an impact on the overall pressure development. From the mechanical testing, it was found that the percentage increase of maximum load for silver-ceramic foam from the original ceramic foam was about 60%. The results indicate that silver-coated foam has a better compressive strength of 0.93 MPa as compared to 0.58 MPa by the original ceramic. The presence of Ag NPs coating on the ceramic foam's surface significantly influences the ability to suppress the flame's progress through the porous structure of the ceramic substrates with a coating, causing a dual inhibition of the explosion. The inhibition effect of Ag NPs powder on the explosion pressure evolution and flame spread mechanism of aluminium powder at different concentrations and particle sizes was tested using the Hartmann experimental system. The silver-coated ceramic foam exhibited a 15% reduction in maximum pressure (P_{max}) compared to the original ceramic foam which suggests that the integration of silver metal coatings onto ceramic foam structures significantly alters the combustion behavior during aluminium dust explosions contributing to the quenching of aluminium dust flame and suppressing the overpressure.

GTE2-029

Heart Rate Sensor with IoT Features

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ABSTRACT - This paper describes the working of a heartbeat sensor project aimed at creating an internet-enabled heart rate monitoring device, combining the ESP32 microcontroller, MAX30102 pulse oximeter sensor, and OLED display. The device transmits real-time data to a webpage, allowing users to monitor their heart rate conveniently. Challenges included securing a stable internet connection and optimizing power consumption. Potential applications range from remote patient monitoring to fitness tracking, promoting healthier lifestyles. The project demonstrated the convergence of IoT and health monitoring technologies. Plans involve refining the device's capabilities and enhancing user experience.

GTE3-034

Green Synthesis of Selenium Nanoparticles and their Electrochemical Properties

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ABSTRACT - Green synthesis of selenium nanoparticles (SeNP) is produced by mixing *Curcuma longa* leaves extract and sodium hydrogen selenite ($NaHSeO_3$) solution. *Curcuma longa* leaves extract act as reducing, stabilizing and capping agent. Selenium nanoparticles formation was assisted by using microwave-assisted method. This work focusing on determining the electrochemical properties of the selenium nanoparticles (SeNP) through characterization and application. Formation of SeNP confirmed using UV-Vis spectrophotometer, morphological and size of the SeNP through Field Emission Scanning Electron Microscopy (FESEM) presence of functional groups using Fourier-Transform Infrared Spectrophotometer (FTIR), amorphic nature of the SeNP through X-Ray Diffraction (XRD) where spherical and average size of 251nm were observed. For its electrochemical properties, the SeNP was used electrocatalytic of bare glassy carbon electrode (GCE) and SeNP/GCE for electrooxidation of nitrite was examined via cyclic voltammetry.

GET4-048

Predicting Country-Specific Financing Capacity for Renewable Energy Projects

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ABSTRACT - This study aims to examine the correlation between renewal energy generation target with several variables namely debt to GDP percentage, country's bond rating, interbank interest rate and technology index. These variables are important when predicting the ability of a given country to achieve the desired renewal energy generation level because financing such projects typically are on a long-term basis and carries a high cost. Secondary research using published data by government publications and non-governmental databases is the research method for the present study. The data derived from these databases organized into tables to allow for regression analysis to be conducted to address the research objectives. The findings and results from the regression analysis shall suggest the way forward with respect to the present study. The present study shall forward few recommendations in line with the objective of the study.

GTE5-042

Finite Element Modelling of Mechano-electrochemical Effect of Corroded Pipeline

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ABSTRACT - Corrosion defect growth with time seriously threatens the safe operation of steel pipelines and the study about its effects on strength degradation is essential for pipeline integrity management. The finite element method (FEM) using miltiphysics field coupling technique is discussed in this research to investigate the mechanoelectrochemical effect of pipeline corrosion. The results of finite element analysis (FEA) were verified using experimental measurements. The results of the model, which include the corrosion current density and corrosion potential, agree well with the experimental measurements for piping steel in a near neutral pH solution. The study reveals that stress increases consistently through the pipe wall as the tensile strain increases, while a more profound corrosion defect leads to concentrated stress at the center of defect. If corrosion defect experiences elastic deformation, no clear effect of mechano-electrochemical relation on corrosion is observed. However, when the geometry of corrosion defect or the applied tensile strain is adequate to induce plastic deformation at the corrosion defect, the local corrosion activity increases significantly.

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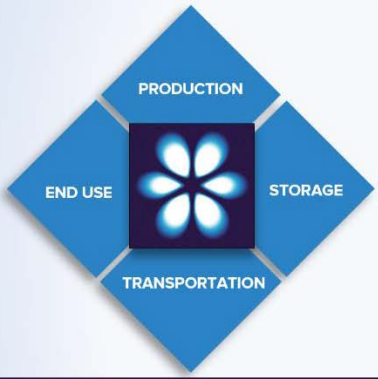

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