NEWSLETTER

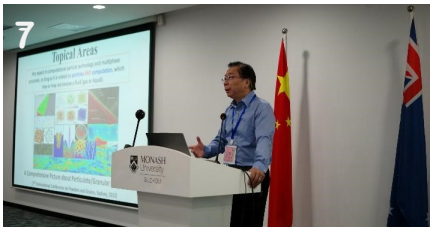
Summer ISSUE 2023

FOCUS

Department of Chemical and Biological Engineering

MONASH University
Engineering

In this issue



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Thank you.

Cover image: Montage of moments captured at the department's open day

Note from the editors

As the year draws to a close, we're thrilled to present our annual newsletter from the Department of Chemical and Biological Engineering.

This newsletter is a snapshot of our achievements, innovations, and community collaborations throughout the year. Inside, you'll find exciting stories, research highlights, and projects that reflect our dedication to advancing the field.

As the holiday season approaches, we extend warm wishes for a Merry Christmas and a Happy New Year to you and your loved ones. Your feedback means a lot to us. Please share your thoughts and suggestions to help us improve future editions.

Thank you for being part of our journey. Enjoy reading and celebrating our collective successes!

As always, please share your thoughts, views and opinions with us.

Janette Anthony and Vasanth Prasad Mohan

Email:

chemeng.hod.ea@monash.edu

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Message from the Head of the Department

The year 2023 is almost ended as we farewell the 2023 batch of undergraduate students at our Malaysia and Clayton campuses. Last month, I was impressed with the enthusiasm and depth of knowledge of the final-year students during their presentations for the Design Project unit. This is the unit where they design a chemical plant using all that they learned in the department. Many of these students will soon be our eyes and ears to the industry, and on behalf of everyone in the department, I extend to them our best wishes for their careers. I also thank my fellow mentors – Dr. van Hag and Professors Maynard, Garnier, Hill, Freeman, and Shastry- for sharing the load of this important teaching assignment in the department.

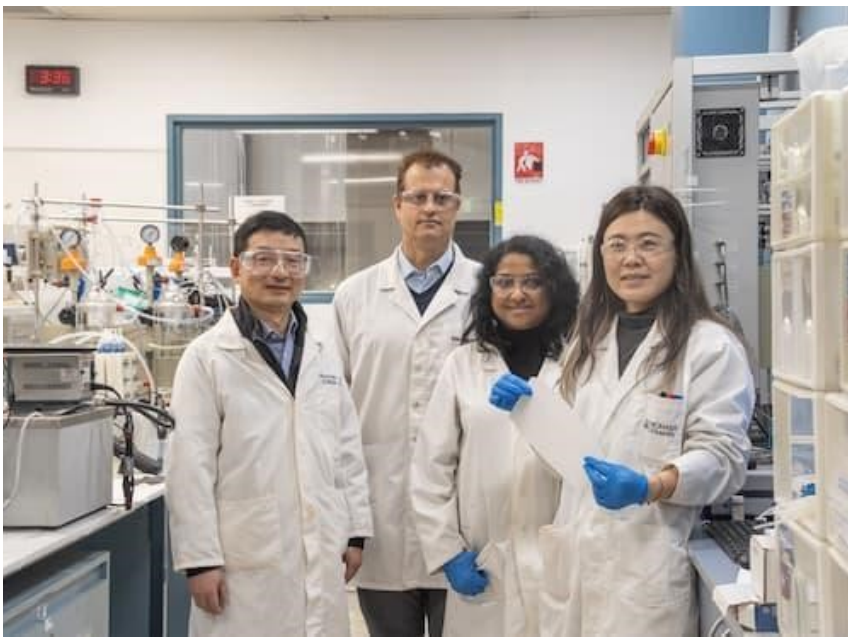
This is also the time to reflect on some of our achievements this year in research. We were awarded three Australian Research Council (ARC) Industrial Transformation Research Hubs (ITRH) in the last fifteen months. One is on carbon utilisation, one on waste processing and another on computational particle technology. These three Hubs take the department's tally to seven, the largest number of Hubs awarded to any department in the country since the ARC introduced the scheme in 2012. There are articles on these Hubs in the newsletter. These Hubs reflect our industry-linked research. This funding would not have been possible without our diverse expertise in multiple research areas of both fundamental and applied nature. Our primary research expertise areas include – Functional Nanomaterials, Fuels and Energy, Waste Processing, Membrane Technology, Food Technology, Modelling of Particles, Soft Matter, and Industrial Biotechnology.

Our industry sponsors are also assisting our undergraduate students with training. In December this year and January 2023, seven undergraduate students will spend two weeks in Burnie receiving exposure to plant commissioning. This is part of the Industry Innovation Program administered by the Faculty of Engineering and financially supported by the Hermal Group, an industry sponsor of the department. I thank the Hermal Group and indeed all the industry sponsors and the our Industry Advisory Board members for their support towards our teaching and research.

Our academics are collaborating more than ever before with colleagues on three campuses in Clayton, Malaysia and Suzhou through co-teaching, cross-campus research nodes and co-supervision of PhD students. The co-supervision of PhD students also extends to our IITB-Monash Academy where we currently have 14 collaborative projects with 27 others completed in the last ten years. The extent of this multi-campus collaboration will continue to increase in the future years

This year two long-standing colleagues, Dr Andrew Hoadley and Professor Wei Shen announced their retirement to be effective in 2024. Also, Dr Lizhong He departed in August this year and Professor Wenlong Cheng announced his departure from February 2024. We sincerely thank them for their contribution over the years and wish them well in their future endeavour.

> “Finally, the festive season is almost upon us. It has been my privilege to lead the department this year with support from my talented colleagues. I take this opportunity to wish all our colleagues, students, Alumni, the readers of this newsletter and their families a joyful time leading to the university break and a Happy New Year.



Professor Huanting Wang, Dr SJ Oosthuizen, Dr Rachel Mathew, Dr Zhouyou Wang with Lithium filtering membrane

Membrane Technology

Promising cleaner, cheaper, faster lithium production for growing battery market

Monash University start-up ElectraLith is building an extraction system to filter Lithium from brine using a membrane-based system, allowing the critical mineral to be extracted from salt lakes, mine tailings and other brine solutions using small amounts of solar generated electricity and without added chemicals or water.

Harnessing the power of cutting-edge electro-filtration membrane technology, ElectraLith seeks to usher in a new era of lithium extraction, propelling the battery market into a cleaner, cheaper and faster future.

At the forefront of this ground-breaking technology is Professor Huanting Wang. An Australian Laureate Fellow and the Director of the ARC Research Hub for Energy-efficient Separation at Monash University's Department of Chemical and Biological Engineering. His pioneering work in nanostructure membranes has paved the way for ElectraLith's game-changing technology.

> "Current lithium extraction methods involve either roasting hard rock at high temperature and dissolving it with hot sulfuric acid, or evaporating brines in a solar pond, both of which use chemicals to precipitate lithium out. It is time consuming, disruptive, expensive and wasteful. My research in nanostructure membranes is all about efficiency and ingenuity to make the most of this limited mineral resource.
>
> - Professor Wang

Recognising the potential of this innovation, Monash Engineering's Dr Zhouyou (Emily) Wang has been awarded an Australian Research Council (ARC) Early Career Industry Fellowship to further develop and commercialise the novel membrane-based technology intended to transform the lithium mining and recycling industries.

"Even though seawater is a brine, the concentration of Lithium is too low for cost effective extraction, but we are already thinking about designing the next generation of membranes to improve Lithium extraction, so maybe in the future we can extract Lithium from new sources," said Dr Wang.

ElectraLith has been selected by Australian technology incubator Cicada Innovations, the two-time winner of 'Top Incubator in the World', to feature its technology at Australia's premier deep tech conference, the newly-named Cicada x Tech23.

Selected from over 130 applications from across Australia, ElectraLith is one of the 'Tech23' set to appear at the conference in July and present solutions on sustainably reshaping global mineral supply chains.

Lithium is a critical mineral and its demand is skyrocketing due to its global use in large-scale batteries for electric vehicles and renewable energy storage. To meet this exponential growth, lithium supply is projected to increase up to 800 per cent or approximately one million tonnes per annum by 2050 to meet renewable energy demand, making the need for efficient extraction methods more critical than ever.

ElectraLith's Chief Technology Officer, Dr SJ Oosthuizen commented that "ElectraLith's team of materials scientists and electrochemists are grateful for the opportunity to discuss the company's transformative technology at this esteemed event.

"We are honoured to demonstrate how scientific innovation can profoundly improve how we produce, use and recycle critical minerals— all while maintaining sustainability and saving costs," said Dr Oosthuizen.

This new technology is compatible with renewable electricity and has the potential to reduce lithium production costs by up to 40 per cent, thereby making onshore processing more competitive with the lowest energy requirement and environmental impact of all approaches to lithium refining.

Spun out of Monash University's Research Hub, Electralith claims to have developed the "cleanest, fastest and most efficient method of extracting and refining lithium". With lithium now of core importance in renewable energy solutions, all eyes are on technology which promises to make its production more sustainable. Electralith's system uses a membrane to filter lithium from sources including brines, geothermal, oil field, recycled material and spodumene deposits. This means no fresh water, chemicals or non renewable energy are required. The company was recently selected for inclusion by deep tech incubator Cicada Innovations in its Tech23 showcase.

⟶ Charlie McGill, Dr Shaun Oosthuizen and Professor Huanting Wang, Electralith.

The Australian Research Council (ARC) Research Hub for Carbon Utilisation and Recycling (RECARB) - On behalf of Professor Paul Webley

RECARB, is a collaborative effort between international and national universities and industry partners with AUD$5 million in ARC funding, along with additional financial support from universities and industry partners, this hub is positioned to act as a catalyst for a fundamental shift in our understanding of carbon emissions.

The central mission of RECARB is to pioneer advanced technologies for the conversion of CO2 emissions generated by the energy and manufacturing sectors into valuable and high-impact products. These products encompass a range of applications, including acetic acid, stock feed, methanol, and various chemicals. RECARB stands as the bridge between academic research and practical industry applications, with a particular focus on challenging-to-abate sectors.

Professor Paul Webley, Director of RECARB, underlines the necessity of reimagining carbon emissions as valuable resources rather than mere pollutants. The hub intends to work closely with industry, government bodies, and university partners to develop high-quality solutions, thereby establishing itself as the forefront research initiative in Australia's decarbonization efforts.

RECARB's research portfolio spans across three primary domains: electrochemical, thermochemical, and biological technologies. Innovative methods, such as direct air capture (DAC) for CO2 recycling, are integral to the research focus. DAC offers a sustainable source of greenhouse gas that can be harnessed to create valuable products, offering benefits to agriculture and various industries.

In the arena of energy and chemical manufacturing, the transformative field of Plasmonic is emerging. This field holds promise for the photochemical conversion of CO2 into valuable chemicals through the utilization of novel multifunctional metal plasmonic nanomaterials. These materials have the potential to revolutionize the way solar energy is employed to drive chemical transformations.

Deputy Director of RECARB, Professor Akshat Tanksale, underscores the practical application of these cutting-edge technologies. The goal is to develop pilot-scale applications for converting CO2 into valuable products, allowing industries to assess and scale up these processes. Additionally, the research aims to establish methods and frameworks for embedded emissions accounting, thereby unlocking markets for carbon products and services. This initiative not only benefits the environment but also cultivates a skilled workforce proficient in carbon-to-products technology and commercialization.

In summary, the Australian Research Council (ARC) Research Hub for Carbon Utilisation and Recycling (RECARB) at Monash University is leading the charge in redefining our approach to carbon emissions. By pioneering innovative technologies and methodologies for converting CO2 into valuable products, RECARB plays a pivotal role in Australia's transition to a net-zero emissions economy. This research hub not only signifies an investment in a sustainable future but also promises to leave a lasting legacy of skilled professionals and a sustainable approach to managing carbon emissions

→ Article in university website.

Snapshots of published papers

Tuning hydrogenation chemistry of Pd-based heterogeneous catalysts by introducing homogeneous-like ligands

R. K. Jianghao Zhang, Wenda Hu, Binbin Qian, Houqian Li, Berlin Sudduth, Mark Engelhard, Lian Zhang, Jianzhi Hu, Junming Sun, Changbin Zhang, Hong He & Yong Wang, Nature publications.

Find paper here

Hierarchically resistive skins as specific and multimetric on-throat wearable biosensors

Shu Gong, Xin Zhang, Xuan Anh Nguyen, Qianqian Shi, Fenge Lin, Sunita Chauhan, Zongyuan Ge & Wenlong Cheng, Nature nanotechnology.

Find paper here

Biomaterial-based platforms for tumour tissue engineering

Rodrigo Curvello, Verena Kast, Paloma Ordóñez-Morán, Alvaro Mata & Daniela Loessner, Nature review materials.

Find paper here

Pyro-layered heterostructured nanosheet membrane for hydrogen separation

R Sharma, Ruoxin Wang, Jianhao Qian, Xiaofang Chen, Ze-Xian Low, Yu Chen, Hongyu Ma, Heng-An Wu, Cara M. Doherty, Durga Acharya, Zongli Xie, Mathew R. Hill, Wei Shen, Fengchao Wang & Huanting Wang, Nature publication.

Find paper here

Effect of Cholesterol on Biomimetic Membrane Curvature and Coronavirus Fusion Peptide Encapsulation.

Izabela Milogrodzka, Duy Tue Nguyen Pham, Gopal R. Sama, Hajar Samadian, Jiali Zhai, Liliana de Campo, Nigel M. Kirby, Timothy F. Scott, Mark M. Banaszak Holl, and Leonie van 't Hagz, ACS Nano publication.

Find paper here

Laccase and LPMO-Driven Biocatalysis Produces Surface Carboxylic Acids on Lignocellulose and Promotes Nanofiber Production

R Sharma, K Putera, MM Banaszak Holl, G Garnier, V Haritos Laccase and LPMO-Driven Biocatalysis Produces ACS Sustainable ..., 2023 - ACS Publications DOI: 10.1021/acssuschemeng.3c01599

Find paper here

Nanoconfinement enabled non-covalently decorated MXene membranes for ion-sieving

Yuan Kang, Ting Hu, Yuqi Wang, Kaiqiang He, Zhuyuan Wang, Yvonne Hora, Wang Zhao, Rongming Xu, Yu Chen, Zongli Xie, Huanting Wang, Qinfen Gu & Xiwang Zhang

Find paper here

Nematic to Cholesteric Transformation in the Cellulose Nanocrystal Droplet Phase

Md. Joynul Abedin, Paul van der Schoot, Gil Garnier, and Mainak Majumder, ACS Publications.

Find paper here

Aqueous phase conversion of CO2 into acetic acid over thermally transformed MIL-88B catalyst

Waqar Ahmad, Paramita Koley, Swarit Dwivedi, Rajan Lakshman, Yun Kyung Shin, Adri C. T. van Duin, Abhijit Shrotri & Akshat Tanksale

Find paper here

Exploring Greener Pathways and Catalytic Systems for Ethylene Carbonate Production

Wriju Kargupta, Wei Lin Ng, Adrian Chun Minh Loy, David McManus, Ashwani K. Gupta, Ajit K. Sarmah, and Sankar Bhattacharya

Find paper here

Design of Polarity-Dependent Immunosensors Based on the Structural Analysis of Engineered Antibodies

Jiaul Islam, Paul Conroy, Christian Fercher, Mijin Kim, Zvi Yaari, Martina Jones, Toby D. M. Bell, Tom Caradoc-Davies, Ruby Law, James Whisstock, Daniel Heller, Stephen Mahler, and Simon Corrie

Find paper here

Intermediate-phase engineering via dimethylammonium cation additive for stable perovskite solar cells

David P. McMeekin, Philippe Holzhey, Sebastian O. Fürer, Steven P. Harvey, Laura T. Schelhas, James M. Ball, Suhas Mahesh, Seongrok Seo, Nicholas Hawkins, Jianfeng Lu, Michael B. Johnston, Joseph J. Berry, Udo Bach & Henry J. Snaith, Nature communication.

Find paper here

Experimental design and optimization of a novel solids feeder device in energy efficient pneumatic conveying systems

Adriano Gomes de Freitas , Ricardo Borges dos Santos , Luis Alberto Martinez Riascos , Jose Eduardo Munive-Hernandez , Shibo Kuang , Ruiping Zou , Aibing Yu

Find paper here

Dilute polymer solutions under shear flow: Comprehensive qualitative analysis using a bead-spring chain model with a FENE-Fraenkel spring

I Pincus, A Rodger, J Ravi Prakash

Find paper here

Sustainable production of nanocellulose: Technoeconomic assessment, energy savings and scalability

Wriju Kargupta, Thomas Stevenson, Scot Sharman, Joanne Tanner, Warren Batchelor

Find paper here

Remarkably Corrosion Resistant Graphene Coating on Steel Enabled Through Metallurgical Tailoring

R.K. Singh Raman, A. Sanjid, Parama Chakraborty Banerjee, Abhishek Kumar Arya, Rahul Parmar, Matteo Amati, Luca Gregoratti

Find paper here

Graphene-Coated Ni–Cu Alloys for Durable Degradation Resistance of Bi-Polar Plates for Proton Exchange Membrane Fuel Cells: Remarkable Role of Alloy Composition

Abhishek Kumar Arya, R.K. Singh Raman,* Rahul Parmar, Matteo Amati,

Luca Gregoratti, and Sumit Saxena

Find paper here

Spatially confined enzymatic tandem system with GOx and HRP

compartmentalized in ultrafiltration membrane

Sara Barricella, Jordi M. Fuertes, Kevin H. Putera, Aubrey E. Quigley, Victoria Haritos, Benny D. Freeman, Gil Garnier

Find paper here

The department students and academicians published close to **200** journal papers in the year– 2023. Hence the given are only the snapshots of selected papers.

Research and Education highlights

Victoria Haritos

Graduated 3 PhDs as main and 1 as associate supervisor.Published 11 journal articles emphasising sustainable engineering

Delivered projects to industry spanning food waste valorisation and precision fermentation of therapeutic products

Paul Webley

Commencement of the ARC Hub for Carbon Utilisation and recycling with projects in electrochemical and thermochemical CO_2 conversion, direct air capture, and life cycle analysis of carbon to products processes

ARC Linkage grant for Solid Oxide CO_2 Electrochemical Reduction to products

ARC Linkage grant for Electrical reforming of natural gas to products.

Huanting Wang

>20 papers: e.g., Development of heterostructured nanosheet membrane for hydrogen separation (Nat. Commun. 2023, 14 (1), 2161); An artificial sodium-selective sub nanochannel (Science Advances 9 (4), eabq1369).

Honours: Top 100 Innovators (with ElectraLith), The Australian Business Review (2023). Highly cited researcher.

Grants: a) 1 ARC Linkage (Protonic ceramic cells for renewable energy, with Woodside, lead CI, b) 1 ARC DP: Unlocking the ion selectivity of lithium superionic conductivity membranes, Sole CI.

Daniela Loessner

R. Curvello, V. Kast, P. Ordóñez-Morán, A. Mata, D. Loessner. Biomaterial-based platforms for tumour tissue engineering. Nature Reviews Materials 8: 314-30, 2023. doi: 10.1038/s41578-023-00535-3

V. Kast, A. Nadernezhad, D. Pette, A. Gabrielyan, M. Fusenig, K.C. Honselmann, D.E. Stange, C. Werner, D. Loessner. A tumor microenvironment model of pancreatic cancer to elucidate responses toward immunotherapy. Advanced Healthcare Materials e2201907, 2022. doi: 10.1002/adhm.202201907

Matthew Hill

Some key highlights include

- A polymer coating that goes directly onto lithium metal, allowing for batteries using this coating to require half the amount of lithium.
- A water stable membrane that can directly extract lithium from brines
- Discovery of a new type of material - a magnetic porous liquid. This material can be circulated easily, but can also capture gases readily with its porosity. Its magnetism can then be used to release the gas on demand.

Leonie van't Hag

The formation of Monash Engineering Education Research Knowledge Advancement Team (The MEERKATs) led by Professor Nicoleta Maynard.

Building on the momentum of 2023's increased collaboration and interest in engineering education, the Monash Engineering Education Research Knowledge Advancement Team (MEERKATs) is set to achieve the following highlights and plans in 2024. These plans for 2024 reflect MEERKATs' dedication to advancing the field of engineering education research, emphasizing collaboration, innovation, and a commitment to addressing the evolving needs of the engineering education community

Extrusion work on sustainable food process engineering work using the Jacktree with incredible ecological productivity:

→ Find paper here

→ Youtube link

Coronavirus Fusion Peptide Encapsulation in Lipid Self-Assembly Materials, Published in ACS Nano:

→ Find paper here

Cellulose nanocrystal coatings to modify surfaces through studying the interactions at the air-water and substrate-water interfaces using pH manipulation, Published in Advanced Materials Interfaces.

→ Find paper here

Nicoleta

Project Developments and activities in 2023, focusing on teacher engagement, practical insights, and the integration of PBL in STEM education

→ Find paper here

The formation of Monash Engineering Education Research Knowledge Advancement Team (The MEERKATs) led by Professor Nicoleta Maynard - I have attached our Logo

Building on the momentum of 2023's increased collaboration and interest in engineering education, the Monash Engineering Education Research Knowledge Advancement Team (MEERKATs) is set to achieve the following highlights and plans in 2024. These plans for 2024 reflect MEERKATs' dedication to advancing the field of engineering education research, emphasizing collaboration, innovation, and a commitment to addressing the evolving needs of the engineering education community.

Sankar Bhattacharya

Some of the research work includes:

CO2 valorisation to methane on highly stable iron impregnated ceria-zirconia based 3D-printed catalyst.

→ Find paper here

Exploring Greener Pathways and Catalytic Systems for Ethylene Carbonate Production

→ Find paper here

Keynotes and invited talks

Benny Freeman

Chiba, Japan

14 July 2023

Emerging Basic Science Questions Regarding Ion Transport in Polymers for Water Purification and Resource Recovery.

International Congress on Membranes (ICOM)

Fundamental Membrane Science Research Addressing the Water-Energy Nexus

American Institute of Chemical Engineers

Separations Division Plenary

Orlando, Florida, USA.

6 Nov 2023

Emerging Basic Science Questions Regarding Water and Ion Transport in Polymers for Water Purification and Resource Recovery

Materials Engineering and Science Division.

Orlando, Florida, USA.

8 Nov 2023

Raman Singh

19th Asian Pacific Corrosion Control Conference (19 APCCC), Guangzhou, 2023

3rd International Meet & Expo on Nanotechnology (NANOMEET 2023), Vancouver 2023

International Summit on Graphene & 2D Materials (ISG2D2023), Valencia, 2023

International Conference on Polymer Science and Engineering 2023 (POLYMERS2023), 2023.

Materials World 2023

Scholars Frontiers in Nanoscience and Nanotechnology Congress (NANOTEK), London, 2023.

Qianqian Shi

PRICM11, the 11th pacific Rim International Conference on Advanced Materials and Processing, Jeju — Korea

12th Asian Photochemistry Conference: Invited talk — Melbourne

2023 Annual Conference of the Membrane Society Australasia. — Perth

Gil Garnier

First International STIMULUS conference smart antimicrobial and sensing material.

Darmstdt, Germany

Sep 2023

Warren Batchelor

Professor Warren Batchelor was invited as a keynote speaker in **Advanced functional materials (ISAFM2) symposium**

Kuala lumpur, Malaysia.

16 & 17 Feb 2023

Akshat Tanksale

International Forum on Hydrogen Production Technologies International.

Centre for Energy Technology.

University of Adelaide.

International Symposium on Technology Needs Assessment for Green Hydrogen and CCUS.

The Technology Information, Forecasting and Assessment Council (TIFAC), Dept. of Science & Technology, Government of India.

India.

International Symposium on Green Transformation of Carbon Dioxide.

The ARC Centre of Excellence for Green Electrochemical Transformation of Carbon Dioxide.

Monash.

Patrick Tang Siah Ying

Pickering Emulsion - A New Promising Microencapsulation System for Controlled Food Delivery. Food Material Research Seminar.

Nanjing Agriculture University

26 July 2023

Sankar Bhattacharya

Chairing Industry panel- "Shaping a sustainable tomorrow– Exploration of Waste to Hydrogen Technologies, and "Beyond Waste to Energy– to Chemicals and high value Metals"

MCC, Melbourne

October 2023

Assessment of liquid fuels, Chemicals and porous material production from end-of-life metal-free tyres– International Freiberg conference.

Rotterdam

Ho Yong Kuen

The state of computational biomass and biopolymer engineering via population balances: What have we achieved today and what's next? Joint International Engineering and Science Symposium on Computational Modelling and Simulation.

Monash University, Malaysia

7 Sep 2023

Discussion on renewable energy from biomass .

ESG Advocates Circles 2023 organised by the Star Media group

Virtual event

30 Nov 2023

Chong Meng Nan

Prospects of Photoelectrochemical Technology for Green Hydrogen Production.

4th International Conference on Recent Advances in Fundamental and Applied Sciences.

Punjab, India

24 & 25 Mar 2023

Integrated Hierarchical Structure of Ag/{111} Ag3PO4/PANI/Pt as a Photoanode with Improved Charge Transfer Kinetics for Photoelectrochemical Water Splitting in a Tandem Cell.

6th International Conference on Materials Design and Applications (ICMDA 2023)

Chiba University, Japan

7—10 April 2023

Conductive Polymer-Semiconductor Integrated Ag/Ag3PO4/PANI/Pt Hybridised Photoanode with Enhanced Photoelectrochemical Water Splitting

IEEE 23rd International Conference on Nanotechnology

Jeju Island, Korea

2-5 July 2023

Performance.

Novel Self-assembled Bismuth Vanadate (001) Exposed Facet Nanowires Enriched with Iron Vanadate for Highly Efficient Photoelectrochemical Water Oxidation .

74th Annual Meeting of the International Society of Electrochemistry

Lyon, France

3-8 Sep 2023

Haunting Wang

MSA-ISPT 2023

Membrane Australia

Perth

3-6 Dec, 2023

The ninth International Zeolite membrane meeting.

izmm-2023

China

23-17 Oct, 2023

Symposium on Bioinspired Intelligent Interface and Materials .

Suzhou, China

29-31 Aug,

Ravi Jagedeeshan

Invited speaker at the Workshop on Theory and simulation on Nonequilibrium fluids, University of

Brisbane

11, 15 Sep, 2023

Saman Ilankoon

E-waste management and recycling in Malaysia: The role of the general public.

MBA Program– UKM Graduate school of Business

UKM, Malaysia.

24 Feb 2023

Close the gap: E-waste recycling for a green telecommunication industry. Axiata and Axiata Digital Labs Sustainability Week

Axiata, Malaysia.

22 May 2023

Power up for a sustainable future: Green technology

Axiata and Axiata Digital Labs Sustainability Week

Axiata, Malaysia.

22 May 2023

Mineral processing techniques for low-grade ores

University of Science and Technology, Beijing

USTB, China

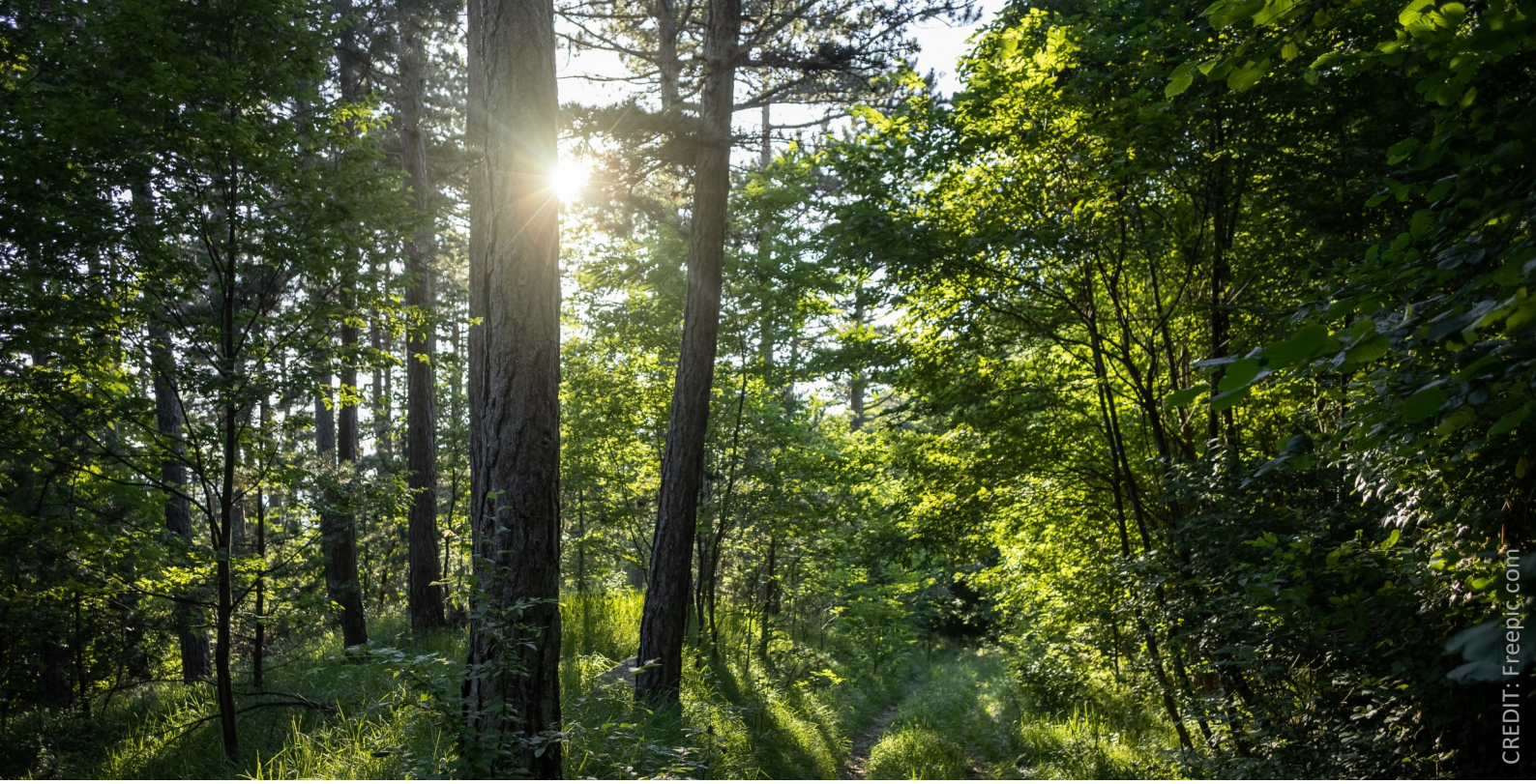
12-19 July 2023

Driving the renewable energy transition: Current rare earth industry, key stakeholders and opportunities with primary and secondary resources .

Minerals and materials seminar, Beijing.

Webinar

28 July 2023



BioPRIA insights: Innovations and Achievements

BioPRIA final PALS review presentation symposium

BioPRIA's August 15th PALS Review at New Horizons, Clayton Campus was a success! Nine compelling talks by PhD candidates and researchers showcased strategic science and engineering focused on deriving high-value chemicals and materials from Australian Biomass for diverse applications.

Highlights from international engagements

Gloria Diaz Arenas presented her research on deriving functional oligomers from hemicellulose at the ISWFPC2023 in Venice, Italy. She collaborated with researchers at URD ABI - AgroParisTech in Pomacle, France, exploring membrane fouling during nanofiltration of steam explosion liquors.

Dr. David Mendoza represented BioPRIA at the ACS Fall Conference in San Francisco, presenting two oral presentations on innovative projects involving nanocellulose and polymerization. His research collaborations were with experts from AgroParisTech and the School of Chemistry.

Craig Stocker attended the ISWFPC in Venice and the CLOCKS Circular Economy summer school in Padua, Italy. He presented his work on enhancing cellulose nanofibers for agriculture applications and engaged with top researchers in wood valorization. The summer school exposed him to the European Union's strides in the circular economy, fostering new friendships and knowledge.

Assoc Prof Brenda Prager's two day visit

Assoc Prof Brenda Prager from the University of Mississippi visited BioPRIA for two insightful days. Impressed by the vibrant community and high-quality research, Brenda explored collaboration opportunities and engaged in fruitful discussions. Her visit involved learning about innovative teaching methods, educational research projects, and networking with department head.

Joint collaboration with the University of British Columbia

During September to October 2023, PhD PALS student Hans Cainglet collaborated with Prof. Mark Martinez at the University of British Columbia, using their micro-CT scanner to enhance our comprehension of cellulose nanofibre films and their binding properties in papermaking.

CREDIT: Freepic.com

From the student's perspective

A Day to Remember: The Capstone Design Project Finale in the department of Chemical Engineering

On a typical cold Melbourne day, we, the final year chemical engineering students at Monash University, gathered with a mix of excitement and nerves. Today marked the culmination of our academic journey – the final presentations of our capstone design projects. It was not just any project - it was the most challenging and rewarding one we had ever undertaken.

Months of hard work had led to this moment. We had explored deep into the core of chemical engineering, embarking on the ambitious task of designing and evaluating a process plant. This year's focus was on producing Bio-Nylon from renewable stock, a project that not only challenged our technical skills but also our ability to innovate for a sustainable future.

As teams, we had navigated the complexities of detailed design, from the intricacies of chemical equipment to the broader considerations of process safety, mechanical integrity, and environmental impact. We learned the importance of equipment selection, process operability, and economic evaluation, integrating these aspects into a coherent and feasible design. It was a testament to the knowledge and skills we had gained over the years.

The presentations were intense yet exhilarating. Each team, in turn, showcased their weeks of effort, articulating their design decisions and defending their methodologies. The questions from our advisors and peers were probing, pushing us to think critically and validate our work. But we were ready. The countless hours spent in computer labs, libraries, and team meetings had prepared us well.

Gathered for lunch, the atmosphere was a mix of these emotions, as some students relaxed after their presentations, while others mentally prepared for their moment in the spotlight. Despite the fatigue, there was an undeniable excitement in the air. We had not only completed a challenging academic task but had also grown immensely, both as engineers and as individuals.

As we came together for the final photo with our advisors and teaching team, there was a moment of realisation. This photo was more than just a snapshot; it was a symbol of our journey, our growth, and our achievements. Standing there, with big smiles, we felt a sense of unity and accomplishment. We were ready to step into the world as engineers, equipped with the knowledge, skills, and experiences that Monash University had imparted to us.

Today was more than just the end of a project. It was the beginning of new adventures, new challenges, and new opportunities to make an impact as chemical engineers. And as we left the campus, we carried with us not just our project

outcomes but also our memories and the confidence to navigate the future.

Reflecting on the Final Year Capstone Project in Chemical Engineering

As the unit coordinator and an advisor for this year's final year capstone design project in Chemical Engineering at Monash University, I observed a typical cold Melbourne day transforming into a significant moment for our students. Today, they presented their final design projects, marking both the pick of their academic journey and a significant transition in their lives.

Over the past months, I have witnessed these students immerse themselves in the challenging yet rewarding endeavour of designing and evaluating a process plant. This year, their focus was on producing Bio-Nylon from renewable stock, a project that tested their limits and pushed the boundaries of innovation in sustainable engineering.

Throughout the project, our role involved guiding these bright minds through the intricacies of chemical engineering. From detailed design, process safety, and mechanical integrity to considerations of environmental impact and economic evaluation, it was fulfilling to see them integrate their learned skills into a practical, coherent design. Their growth from curious students to competent engineers was palpable in every discussion, every problem-solving session.

The presentation day was a testament to their dedication and hard work. As each team presented their design, defending their approaches and methodologies, I felt a deep sense of pride. The depth of their understanding, the critical thinking applied, and their ability to articulate complex concepts were clear indicators of their readiness to step into the professional world.

There was a mix of emotions in the air after the final presentation. For those who had completed their presentations, a sense of relief was evident. For others, a nervous anticipation hung as they prepared for their turn. This contrast was a reminder of the diverse experiences and journeys each student had embarked upon.

During the lunch break, while some students relaxed, relieved to have finished their presentations, others were gathered in corners, going over their notes one last time. This spectrum of emotions – from the calmness post-presentation to the pre-presentation butterflies – was a testament of their entire educational journey they had been on.

As we gathered for the final group photo, I was struck by the significance of the moment. This photograph wasn't just a ceremonial closure; it was a milestone, a celebration of their journey and achievements. Standing with these students and my fellow advisors, I felt a profound connection – a shared journey of learning, challenges, and triumphs.

Today marked the project's end and a transition day, paving the way for future endeavors. As students departed, they took not just project results but also the skills, knowledge, and experiences shaping their future as chemical engineers. As their advisor, it was fulfilling, anticipating their remarkable contributions to engineering. .

Chemical and Biological Engineering platinum seminar series award

60th Anniversary

Department celebrating platinum Seminar Series

The Department of Chemical and Biological Engineering is commemorating it's 60th anniversary with a series of monthly "Platinum Seminars" by high profile researchers from within Australia and around the world on a range of topics that span the variety of research areas being pursued in the Department. Starting in January by a seminar by Professor Gareth McKinley from the Department of Mechanical Engineering at the Massachusetts Institute of Technology, USA, on "Novel Passive and Active Approaches to Fluid Friction Reduction using Polymers & Plastrons", the series will conclude in December by a seminar by Professor Dan Zhao from the Department of Chemical and Biomolecular Engineering at the National University of Singapore on "Advanced Porous Materials in Membrane Technologies". These seminars have provided an opportunity for postgraduate students, postdocs and academics in Monash University to listen to internationally renowned scientists speak on exciting areas at the cutting edge of modern research on varied themes that included making continuous, real-time molecular measurements directly in the living body, to the treatment of organic matter in water and wastewater systems, and the development of soft microfluidic chemical analysis systems for the skin, among many other subjects. Each speaker was gifted with a plaque (shown in the figure) as a token of appreciation for their presentation and to memorialize the special year in the history of the Department.

CREDIT: Freepic.com

→ Visual excerpts from the DOF Conference event day.

International Symposium

Delivery Of Functionality in Complex Food System (DOF 2023)- Compiled by Dr. Leonie Van Hag

From October 25th to 27th, 2023, Monash University hosted the 10th International Symposium on the Delivery of Functionality in Complex Food Systems (DOF 2023). The three-day event gathered global participants to explore sustainability in alternative proteins and their functionality. Presentations covered diverse topics across dairy, egg, meat, seafood, and analogues, including focus on digestability, bioavailability, analytical techniques and life cycle analysis.

There were also plenty of stimulating discussion with industrial speakers from lead Australian startups in the sustainable food area, including AllG Foods, V2 Food, Vow Foods, and Australian Plant Proteins who were invited to talk about the challenges they faced in commercialising plant-based meat alternatives. At the end of the day, Attendees were provided the opportunity to tour the Clayton Campus or Australian Synchrotron facility where some of the most cutting-edge research were done, followed by a conference dinner at the Monash Club.

On the final day, speakers, including Dr. Diana Bogueva from Curtin University and Prof. Raffaele Mezzenga from ETH Zürich, delved into the nutritional and safety risks of plant-based meat alternatives and re-purposing food protein waste, respectively. Overall, the conference saw international participants from Chile, China, New Zealand, Portugal, Switzerland, India, Malaysia as well as most Australian states.

The 10th iteration of the symposium exceeded the expectation set by the predecessor and raises the bar for the next DOF symposium. The success of the symposium was the result of dedication and hard work from this year's organising committee, which is chaired by Monash University's Dr Leonie Van't Hag and consisted of Dr Sushil Dhital, Dr Shanaz Mansouri, Rod Heath, Ben Hargreaves, Aadi Krishna and Dr Malinda Salim. It was a combined effort of the Faculties of Engineering, Science, Monash Institute of Pharmaceutical Sciences and Enterprise through the participation of Monash Food Innovation. The symposium concluded with the announcement of the 11th iteration of the symposium, scheduled for 2025 in Chile, South America.

Lab enhancement project

Brings State-of-the-Art Teaching Equipment to Chemical & Biological Engineering: *Contributed by Dr. Anthony De Girolamo*

The Department of Chemical & Biological Engineering is delighted to share the news of the acquisition of three key equipment items that will enrich the learning experience, following the generous backing and approval from the Faculty of Engineering as part of the Lab Enhancement Project.

This strategic initiative marks a substantial advancement in our teaching capabilities, particularly in the specialised fields of reaction engineering and process control.

We are anticipating the delivery of these equipment items in December 2023, with plans to have them fully commissioned and integrated into our curriculum shortly thereafter.

We look forward to the expanded educational opportunities these new assets will provide to our students and invite further equipment suggestions for future funding opportunities.

Pignat Continuous Reactors

This advanced equipment enables the study and comparison of four different types of glass reactors with the same volume, including a perfectly stirred reactor, a cascade of two perfectly stirred reactors, a plug-flow reactor, and a tubular reactor. The reactors facilitate experiments like the dispersion of NaCl in water for residence time determination and the saponification of ethyl acetate by soda, offering practical insights into chemical reaction dynamics.

Control Room for Pilot Plant

These operator consoles for the wastewater treatment pilot plant will facilitate authentic operation and the implementation of a digital twin. The consoles will enhance the overall efficiency, safety, and effectiveness of operating the pilot plant. Additionally, the proposed upgrade presents an opportunity to explore potential applications for other departments, particularly in the realms of process control, automation, and digitalisation.

50L and 2L Chemical Reactors

Enhancing our department further are two new batch chemical reactors, equipped with advanced features for precise temperature control. These reactors expand the capabilities of the wastewater treatment pilot plant, covering areas like upstream biological water treatment, microbial cell culture and recovery via UF membrane separation, bioproduct separation in the UF and RO membrane pilot.

International symposium– 2023: Curated by Prof. Ruiping Zou

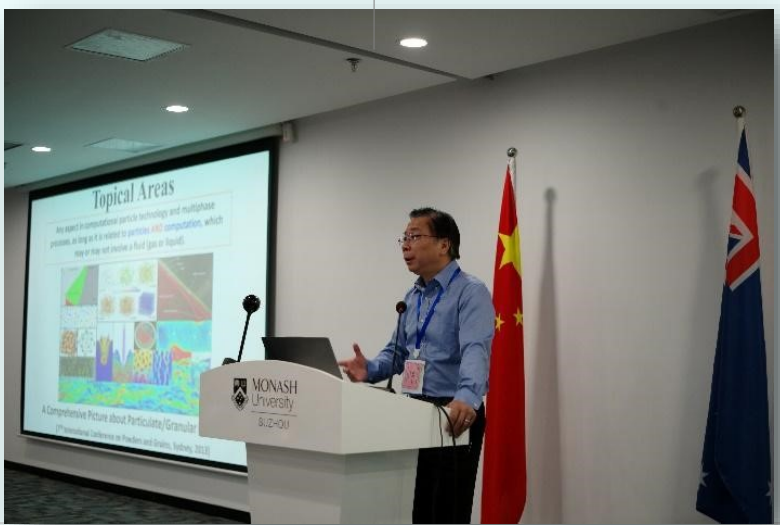
The SIMPAS International Symposium was successfully held on 25-28 Aug 2023, in Monash Suzhou Research Institute, Suzhou, China. This symposium is jointly organised by SIMPAS teams spanning various institutions, including ARC Research Hub for Computational Particle Technology (CPT), Southeast University-Monash Joint Research Institute, Jiangsu Industrial Technology Research Institute (JITRI), Northeastern University, Jiangxi University of Science and Technology (JXUST) and Chinese Society of Particuology.

SIMPAS, the Lab for Simulation and Modelling of Particulate Systems (Simpas: www.monash.edu/engineering/simpas), aims to model and understand the fundamentals governing particle and particle-fluid flows, which is of paramount importance to the design, control and optimisation of particulate and multiphase processes in many industries. This symposium aims to showcase recent achievements, discuss the frontier and challenging problems in the modelling and simulation of complex particulate and multiphase processes, as well as to commemorate Prof Aibing Yu's 60th birthday, and acknowledging his over 35 years of research in particle technology. additionally, it provides a forum to celebrate the achievements of Professor Yu and his research team.

In the past two decades or so, many advanced computational technologies, either discrete or continuum-based, have been developed and applied to tackle problems of various types, which can be evidenced by some established dedicated international symposia. For example, following the spirit of SIMPAS, the ARC Research Hub for Computational Particle Technology initiated the CPT Symposium series since 2016.

The SIMPAS and CPT symposia have provided an outstanding forum to discuss the frontier and challenging problems in the modelling and simulation of complex particulate and multiphase processes, covering a wide spectrum from fundamental research to industrial application. The symposium series also offers outstanding opportunities for idea exchange, networking and research collaboration.

This symposium has attracted over 260 attendees across the globe, including experts from Australia, China, Japan, Netherlands, UK and US.



CREDIT: Freepic.com

Monash Carbon Capture and Conversion Takes Another Step Towards Carbon Neutral Future : Authored by MC³ Club

Our members here at MC³ have one common goal, and that is to create a more sustainable future through developing innovative and viable carbon removal, conversion, and sequestration technologies.

Ever since Monash Carbon Capture and Conversion (MC3) was founded in 2021, MC3 have been continuously working with young and talented Monash students across different disciplines who are passionate about sustainability and improving the wellbeing of the planet.

Award:

After receiving the student prize of **$250,000USD from XPRIZE Carbon Removal Challenge in 2022**, MC3 has not ceased in its efforts to test and upscale the existing designs and has constantly looked for challenges to take on.

In March of 2023, our technical teams successfully submitted a combined proposal and conceptual design to Open Air Carbon Removal Challenge. By April, our team was announced to be one of the five Open Air Carbon Removal Challenge 2023 Finalists selected globally, in which six of our project managers were invited to New York City to present our projects to a panel of experts. It was a great opportunity for our student leaders to exchange knowledge and enrich their skills.

Currently, our team is focusing on testing and optimisation of various aspects in preparation for economical upscaling. One of our technical sub-team, Microalgae, has successfully cultured 30L of *Nannochioropsis oceanica*, our chosen microalgae for carbon capture. The Microalgae team has been working tirelessly to design a floating photobioreactor (PBR) and has recently built a wave simulation tank to test the mixing of the microalgae in the PBR. Our biochar team has finalised their first round of experimentation on fast pyrolysis pyroprobe testing, and based on the results, they aim to investigate other potential methods to achieve better results, moving towards their long term goals..

CREDIT: Freepic.com

Though there has been a shift in focus for our Direct Air Capture (DAC) team from silica-supported amine functionalized adsorbents towards novel aqueous absorbents to facilitate CO2 capture, they have made an enormous progress. DAC is currently in the process of assembling a benchtop scale DAC rig for experimental testing and soon will be optimising the benchtop rig and investigating methods to further improve the purity of the captured CO2 gas stream. **The ChemECCO (Chemical Form Electrical Conversion of CO2) team (previously named Polysynth)** is currently conducting tests on the flow cell body and researching into copper-based catalysts to promote the reduction of CO2 into ethylene. Cross Laminated Timber (CLT) and Artificial Forestry teams are working closely together in finding the best plant species as carbon storage and testing their strength and suitability as alternative construction materials.

On top of technical lab work and research, we also value the closeness of the community within the team. Throughout 2023, we have been actively promoting team engagement and external exposure for our team members. We had our semesterly in-person team wide meetings which gave opportunities for members of the team to interact and connect with one another. We have also had the opportunity to meet **Nicole Iseppi, Managing Director of Energy Innovation at the Bezos Earth Fund**, and learn from her experiences and knowledge. Further, MC3 participated in a tree planting event held by CVA Community. This not only allowed the members of our team to bond with one another, it also gave the students a chance to serve in the local community for a greener and more sustainable future.

With the success in XPRIZE Carbon Removal Challenge in 2021, MC3 and XPRIZE partnered with the Compulsive to produce a documentary crafted by Benj Binks, which brings MC3's ground-breaking work into the light.

This XPRIZE documentary truly gives us a glimpse into the sustainable and eco-friendly technologies that are being developed today, and we are all grateful and proud of the work and effort MC3 members have put in to contribute to a greener planet.

Check our video:
Carbon neutrality quest

Find us:

Webpage

→ Chemical engineering Industrial night at Wilson's hall.– by SMUCE.

Club achievement of 2023

The Society of Monash Undergraduate Chemical Engineers (SMUCE) achievements: Crafted by SMUCE Club

SMUCE is pleased to announce that our club has had a very successful year. Despite a number of unexpected executive changes during the academic year, SMUCE has managed to grow as an active community and is well established to continue this growth trend into 2024.

Academically, we've kept our tradition of hosting semesterly SSLM feedback sessions which provide Unit Coordinators with valuable feedback that has been source directly from the student cohort. Our committee have also hosted over 15 GroupUp study sessions to assist students in their preparation for major assessments.

Industrially, SMUCE published its annual Careers Guide and hosted another successful Victorian Chemical Engineering Industry night at Wilson's Hall. This year's industry night was another joint venture activity with the Chemical Engineering student societies from RMIT and The University of Melbourne. The event drew a crowd of over 100 students and consisted of industry representatives from over 15 companies. Our major sponsorship partners for this event were CSL, Viva Energy, Worley, Orica, ExxonMobil and IChemE. This year we also hosted our first Careers Guide launch and Mentoring event with the JVCEC council. The evening received positive feedback from its 50+ student participants and will become an annual activity. We were additionally given the honour of announcing IChemE's new free student membership to the community.

Socially, SMUCE host our annual Cocktails night with MEES, SMEE and MECC (other Engineering related student societies) at Concrete Boots Bar in Richmond. The evening was enjoyed by all students that participated and was a great opportunity for students to relax and socialize amongst there peers. SMUCE also host our annual final year trivia at Sir John's bar and an end of semester pizza party.

As 2023 comes to its conclusion, our committee would like to thank Prashan De Siliva for his outstanding efforts as SMUCE's president for 2023. He has been the cornerstone of our organisation and lead the way for our many achievements this year. Our committee is additionally pleased to announce our new appointments for the new year.

For 2024, SMUCE is planning to achieve even more. We are aiming to engage more industry partners, host more social events and continue to grow and support our student community.

Honours, Awards and prizes

U.S. National Academy of Engineering

Professor Benny Freeman was formally inducted into the U.S. National Academy of Engineering on Sunday, 1 October, in Washington DC.

Vice- Chancellor's award for research excellence

Dr. Lling-Lling Tan, a senior lecturer at the School of Engineering, Monash University Malaysia, has recently been awarded the prestigious 2023 Vice-Chancellor's Award for Research Excellence in the STEM category. This award recognises her outstanding contributions as an Early Career Researcher in the development of solar-derived fuels, aiming to establish a **sustainable energy strategy for mitigating global CO2 emissions in the long term.**

What is the work ?

Inspired by the intricate processes of photosynthesis, Dr. Tan's work delves into the exploration of Photo-Driven Catalysis, a novel approach that harnesses solar energy to produce high-energy products such as hydrogen and ammonia. Her focus extends to the design and development of advanced photo-active materials, including graphene and its derivatives, perovskites, metal-organic frameworks, bismuth-based systems, and others. Notably, Dr. Tan's research group has achieved a significant milestone by developing a method to **finetune the optical and physicochemical properties of lead-free halide perovskites.**

What are all the findings?

The findings, recently published in Advanced Functional Materials, offer a robust method for harnessing the entire sunlight spectrum for solar fuel production. This outcome represents a significant leap forward in reshaping the energy landscape.

What is the next stage?

By enhancing the scientific foundations of solar-derived fuel development, Dr. Tan aspires to provide the industry with a viable pathway towards achieving carbon negativity, crucial for addressing the challenges of energy scarcity and the escalating levels of CO2 that our future generations face. She remains confident that her ongoing research will forge new frontiers, yielding pivotal discoveries that could pave the way for a **more sustainable and environmentally conscious future.**

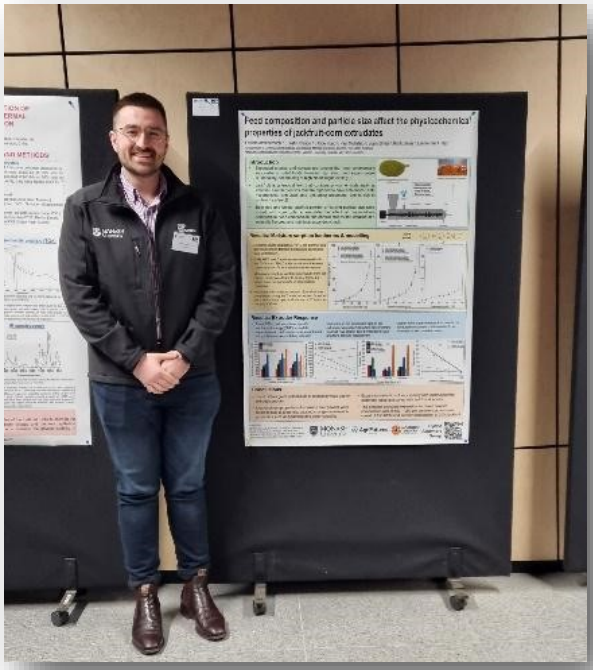
Find paper here

First prize in the poster pitch competition

Edward Attenborough won first place in the Poster Pitch Presentation Competition at The 10th International Symposium on 'Delivery of Functionality in Complex Food Systems' 2023 **(#DOF23)** conducted by Monash University. poster and presentation focused on the incorporation of jackfruit, a highly nutritious yet underutilized tropical fruit in Australia, into puffed snacks and cereal products. Our work looked at its effect on extrusion response and product quality.

Checkout more in the paper!

This experience underscored the significance of elevating nutritional standards in snack products. Thanks so much to my group and collaborators for your support. Let's continue pushing the boundaries of innovation in the pursuit of healthier and tastier options for consumers!



➔ Linkedin Post

CLASS OF 1972

CHEMICAL AND BIOLOGICAL ENGINEERING ENTREPRENEURIAL PRIZE

We are delighted to report that the winners of 2023 entrepreneurial prize are

Mr Max Moolman

Mr Declan McNamara

PhD Student **Laila Halim**, under the supervision of Professor Leonie Van't Hag and Professor Mathew Hill won *ATSE Ezio Rizzardo Polymer Science* Award.

→ Featured in Youtube.

Thanks We are thrilled to share that one of our department professors

Professor. Benny Freeman

was honoured by - The American Institute of Chemical Engineers (AIChE) with BRASKEM AWARD FOR EXCELLENCE for his outstanding contributions to polymer membranes for gas and liquid separation.

Engineering Innovator Leading Australia's Energy Transition

Aritra Santra (PhD July 2021)

Aritra completed his Bachelor and Master's degrees in Chemical Engineering in India from Jadavpur University and Indian Institute of Science Bangalore, respectively. After completing his Ph.D at Monash University in July, 2021, he joined as a Postdoctoral Research Associate in Levich Institute at the City College of New York where he worked with Prof. Jeffrey Morris until December 2022. Since January 2023, he is working as an Assistant Professor in the Department of Chemical Engineering at Indian Institute of Technology (ISM) Dhanbad, India. He is broadly interested in the study of physics of soft matter and rheology of complex fluids using computer simulations and experimental techniques. Understanding the structure-property relation of soft matter and complex fluids under flowing conditions is one of the core areas of his research. He is also interested in developing new tools for computational and mathematical analysis to understand the behaviour of soft matter and complex fluids.

Dr Shaun Ang

I had the privilege of pursuing my PhD at BioPRIA in the Department of Chemical Engineering with A/Prof Warren Bacthelor and A/Prof Victoria Haritos. In my research, I investigated sustainable and recyclable nanocellulose materials for high impact packaging applications. I was awarded my doctorate in 2019, having published 4 papers and attended 2 international conferences. Today, I work as a Consultant at Accenture, one of the world's largest consulting companies in their Strategy & Consulting practice.

At Accenture, I've had the opportunity to work for a wide range of clients and solve complex challenges related to strategy, business, data and artificial intelligence.

Dr Ehsan Ghasemiestahbanati

With a principal background in Chemical Engineering from Iran, Ehsan started his PhD in the department of Chemical and Biological Engineering at Monash University in 2018. Taking the opportunity to work in two state-of-the-art laboratories (Hill applied porous materials & Nanoscale science and engineering) at Monash and CSIRO, Ehsan learned and developed four years of practical research and extensive experience in the material development of separators for lithium and flow batteries.

Under his supervisory team led by Prof. Matthew Hill, he published high impact patent and papers featured in many outlets.

Since his graduation in 2022, Ehsan has been working as R&D lead of advanced battery, Manganese chemistries at Calix. With its new BATMn reactor in Victoria, Calix is developing high performance, affordable, and more recyclable lithium-ion hybrid batteries based on making nano-porous electrode materials,

Dr Prakash Aryal

Prakash embarked on his PhD journey in 2019 to explore the untapped potential of waste grassy biomass as a renewable energy source. His research focused on developing efficient and sustainable methods to convert waste biomass into tar free hydrogen rich syngas, a clean and versatile fuel.

After successfully accomplishing his final review milestone towards the end of 2022, Prakash transitioned from academia to the industry. He joined WSP Australia, which is a multinational consulting company working in more than 45 countries including Australia, as a New Energy Engineer. In his current role at WSP, Prakash continues to push the boundaries of waste biomass utilization for biomethane, syngas and hydrogen production, in addition to supporting clients to design and or review their green field and brownfield energy and process plants via process innovation, process integration, waste heat recovery and renewable energy integration.

Isaac Pincus (PhD September 2022)

Isaac Pincus completed his PhD thesis in 2022 in the Monash University Department of Chemical Engineering, where he was supervised by J. Ravi Prakash and Alison Rodger (at Macquarie University in Sydney). His doctoral research investigated the use of Brownian dynamics simulations to predict Linear Dichroism and rheology of polymer solutions in flow. Isaac is currently a postdoctoral associate in the Qi Lab at Massachusetts Institute of Technology Department of Chemical Engineering. His current research focuses on cellular biomechanics and engineering, with applications to nanomedicine and drug delivery.

R. Kailasham (PhD August 2021)

Kailasham completed his undergraduate degree in chemical engineering from the Sardar Vallabhbhai National Institute of Technology, India (2013) and his master's degree from the University of Pennsylvania (2015). He joined the IIT Bombay-Monash Research Academy in 2016 to pursue his PhD research, jointly supervised by Prof. Rajarshi Chakrabarti (IIT Bombay) and Prof. Ravi Jagadeeshan (Monash). Following his graduation in 2021, Kailasham began postdoctoral research, working with Prof. Aditya Khair in Carnegie Mellon University. In this role, he is investigating the physicochemical dynamics of self-propelled, or active, droplets through simulation and experimental collaboration.

Hui Zhu (PhD in 2017)

Dr. Hui Zhu completed her **PhD in 2017** under the guidance of **Prof. Aibing Yu** in the Department of Chemical Engineering at Monash. With a background in metallurgical engineering and extensive research experience in material characterization, her research focus was on computer simulation of particle flow in microchannels. After graduation, Dr. Zhu joined HRL Technology (HRLT) as an engineering consultant, where she played a significant role in both domestic and international projects.

Applying the knowledge gained from her experience at Monash, she progressed from a consultant to a team leader and, within an impressive three-year span, to the role of a group leader.

Dr. Zhu has maintained connection with Monash since her graduation. Her engagement includes participation in university-industry network events, inspiring talks delivered to engineering students, and mentoring students during their internships to help them gain industry experience.

Currently, she is in charge of the **HRLT Victoria branch of plant integrity**, reliability, and performance. Leading a team of engineers from multiple disciplines, Dr. Zhu is dedicated to delivering comprehensive solutions to challenging engineering problems, including ongoing research and development efforts that support Australia's energy transition.

Kiran Kumari (PhD July 2021)

Kiran got her Master's degree in Chemical Engineering from the Indian Institute of Technology Dhanbad. She completed her PhD at Monash University as a student of the IITB -Monash Research Academy in 2021. During her PhD, she developed a model to reconstruct the chromatin configurations with 95% accuracy and predicted the structure and dynamics of the alpha-globin gene. Currently, she is a Postdoctoral Fellow at the University of Texas at Austin. Her current research includes studying the role of epigenetic markers in the chromatin organization of cancer cells.

Anurag Parihar (PhD 2019)

Anurag Parihar completed his PhD under the supervision of professor. Sankar Bhattacharya by 2019. Demonstrated commercial acumen by liaising with industry partner to develop a catalytic process for waste and biomass conversion to green chemicals . He's currently working as a Senior Manager in CSL, Melbourne, Victoria.