ARC RESEARCH HUB
ENERGY EFFICIENT SEPARATION

HUB NEWSLETTER ISSUE 4, February 2020

DIRECTOR'S WELCOME

Welcome to our first newsletter for 2020. We would like to wish all our collaborators and supporters the very best for the year ahead and hope it is filled with health and happiness.

The last few months of 2019 were very busy for our Hub, with the highlight being our annual conference in November. We welcomed over 200 delegates to Melbourne, where we also hosted a number of parallel workshops.

As part of our focus is to ensure that we nurture mutually beneficial collaborations with industry, we were pleased to bring together our researchers with staff from CSL Berhing to discuss potential solutions to their challenges. We hosted a similar meeting with WaterRA in November, where our brainstorming event raised a number of important ideas for future collaborations.

In August a group from Melbourne headed north to Queensland to visit Hub members at QUT and The University of Queensland. Two of our Queensland CIs are profiled in this newsletter.

I would also like to extend my congratulations to Hub Deputy Director Professor Huanting Wang, who has been honoured with numerous awards, included being elected Fellow to ATSE.

Professor Xiwang Zhang

(Hub Director)

CSL Behring Meeting

The Hub works closely with CSL Behring and met with their staff to discuss opportunities to transform biotechnology through research.

The Hub is uniquely placed to tackle complex problems, bringing together world class researchers across multiple disciplines (e.g., chemical engineering, material science, chemistry, biotechnology and mechanical engineering). The objective of this meeting last December was to share our current research outcomes and to discuss whether they address technical problems at CSL Behring.

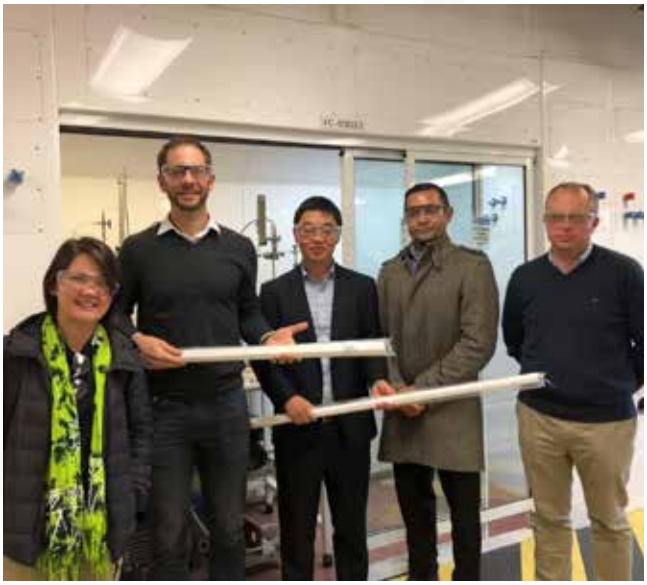
The meeting was attended by Dr Hung Pham and Dr Germano Coppola from CSL Behring, and, Prof Mark Banazak Holl, Prof Xiwang Zhang, Prof San Thang AC, Prof Bayden Wood, Dr Phillip Herauld, Dr Victor Cardas, Dr Qinfu Hou, Dr Wang Zhao, and Dr Soo Leong (Monash Unvoersty), Dr Xing Yang, Dr Andrea Merenda, Dr Ludovic Dumee, Prof Lingxue Kong, and Prof Rosainne Guijt (Deakin University), and Prof Todor Vasiljevic (Victoria University).

Visiting the UQ hub team

In August last year we had the pleasure of heading north to visit the team based at The University of Queensland.

The team has been researching the effect of water vapour in oil and gas products. They have successfully developed techniques to remove the water, saving the industry significant losses.

We congratulate the team led by UQ and Arrow Energy, including Prof Joe da Costa, A/Prof Simon Smart, Mr Christopher Williams, Dr Julius Montuzas, Ms Charmaine Lamiel, and Ms Yue Yuan.



Hub conference 2019

The 2nd International Conference on Energy-Efficient Separation (iEESEP2019) was held last November in Melbourne.

About 200 delegates including researchers and industry key players gathered in Melbourne to learn about the latest findings in the area of membrane technologies and sustainable urban water systems. The delegates heard from a number of keynote and invited talks, and breakout sessions provided opportunities to discuss research and further collaboration.

Themes and sessions included functional materials for energy-efficient separation, mixed-matrix membranes, water treatment and desalination, wastewater treatment and recycling, aerobic and, anaerobic membrane bioreactors, integrated processes for energy-efficient separation, new applications of membrane technologies, and underground water management.

The Dean of the Faculty of Engineering of Monash University, Prof Elizabeth Croft opened the conference. Distinguished guests included Prof Ana Deletic (Pro Vice-Chancellor (Research), UNSW), Prof Jiuhui Qu (Tshinghua University, Fellow of Chinese Academy of Engineering and Foreign Fellow of American National Academy of Engineering), Prof Rong Wang (Director of Singapore Membrane Technology Center, Nanyang Technological University), Prof Benny Freeman (William J. (Bill) Murray, Jr. Endowed Chair in Engineering in University of Texas at Austin), Prof Sandra Kentish (Head of the School of Chemical and Biochemical Engineering at the University of Melbourne), Prof Ranil Wickramasinghe (Director of Membrane, Science, Engineering and Technology Center (MAST), University of Arkansas) and Prof Hokyong Shon (The president of the Membrane Society Australasia).

MDPI Best Oral Presentation

Congratulations to the following speakers, who were awarded the top 3 oral presentations prizes at the conference.

1st Prize - Dr Yaoxin Hu (Monash University)

2nd Prize - Dr Xiaoxiao Song (Zhejiang University of Technology)

3rd Prize - Dr Jue Hou (CSIRO)

Conference Poster Presentation

More than 30 posters were presented during iEESEP2019. The judging session for the *MDPI* Best Poster presentation was held on the first afternoon of the conference.

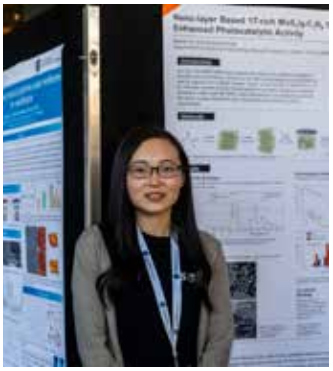
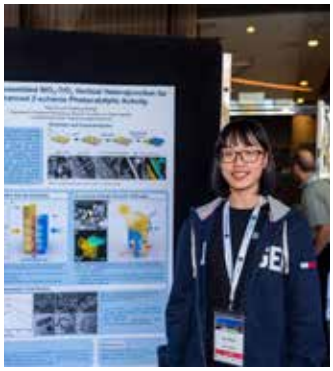
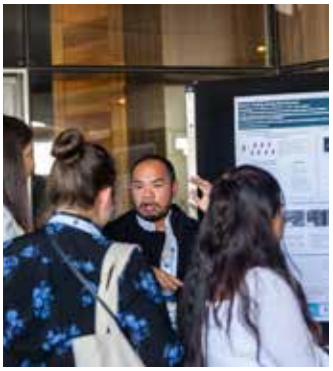
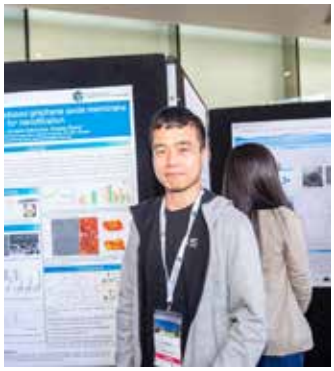
Our special thanks to Dr Lizhong He (Monash University), A/Prof Simon Smart (The University of Queensland) and Prof Long Nghiem (UTS) for their efforts and time to judge and evaluate the posters.

Three prizes were awarded for the *MDPI* Best Poster Presentation and three for the People's Choice Poster Presentation, which was selected by all the delegates via an app.

The winners of the awards are listed below:

MDPI Best Poster Presentation
1st Prize - Miss Yue Liu (Monash University)
2nd Prize - Dr Jinxing Ma (UNSW)
3rd Prize - Mr Yun Xia (Monash University)

People's Choice Poster Presentation
1st Prize - Mr Yuan Kang (Monash University)
2nd Prize - Mr Roberto Katigbak (Deakin University)
3rd Prize - Mr Milad Lagnaei (Deakin University)

Thank you to our wonderful conference volunteers

The organising committee would like to express their appreciation and gratitude to all volunteers including, Mr Jian Hu, Dr Meipeng Jian, Mr Shi Yuan, Dr Yaoxin Hu, Ms Yue Liu, Dr Wang Zhao, Dr Xiaofang Chen, Dr Emily Wang, Dr Xiangkang Zeng, Ms Xiaoyi Hu, Ms Rujing Hou, Mr Yun Xia, Mr Yang Li, Mr Hamidreza Mahdavi, Ms Leena Melag, Mr Yuan Kang, and Dr Bhuvana Shanbhag.

These Hub members contributed their valuable time without expecting anything in return, and worked together to make the conference so successful.

They demonstrated their commitment to everything from the planning, preparation, airport pickup, registration, design and day to day conference duties.

Again, the organisers would like to thank them and wish them all the best in their research.

Hub Advisory Committee Meeting

The Hub was grateful to receive valuable feedback and advice from the committee members, in particular on how to engage with industry and transform the research findings into industry application.

The Agenda of the most recent meeting was as follows:

Prof Xiwang Zhang - welcomed the members, introduced the SAC & IAC, and briefed activities Hub activities.

Emeritus Prof Tamarapu Sridhar - delivered his talk as a leader of SAC.

Dr Dharma Dharmabalan - as leader of IAC, he raised his concerns on how to close the gap between the academics and industry.

Prof Jiuhui Qu - shared his experience on leading the China Sponge City Project as an academic.

Dr Keith Murphy - shared his industry perspective to encourage researchers to examine the potential to transform results from the lab to industry application.

Prof Benny Freeman - shared his experience on working with industry in the US from the perspective of an academic.

2019 Hub Awards

The last two years have been very successful for the Hub with many achievements and outcomes delivered by the ARC-EESep Research Team. The Hub has a total of 22 active and on-going projects with fruitful industry collaborations leading to genuine transformations.

This year, the Hub established two new awards, including *The Hub Best Poster Presentation Award* and *The Hub Excellence Project Award*. Each of the projects submitted a poster, which clearly demonstrates the project nature and more importantly displays the significant outcomes, especially the impacts to the industry.

The excellence awards were given to the teams who demonstrated great commitment, high industry impact and excellent outcomes, especially in regard to return on investment. The awards were presented during the iEESEP2019 Conference Dinner.

The winners of the awards are listed below.

The Hub Poster Presentation Award

1st Prize: Project IH17.3 - Victoria University & Activated Water Technologies
Prof Mikel Duke, Mr Bahay Ozcakmak, Dr Xing Yang, Mr Johnson Luo & Dr Peter Sanciolo

2nd Prize: Project IH17.5 - Monash University
Dr He Lizhong & Dr Bhuvana Kamath Shanbhag

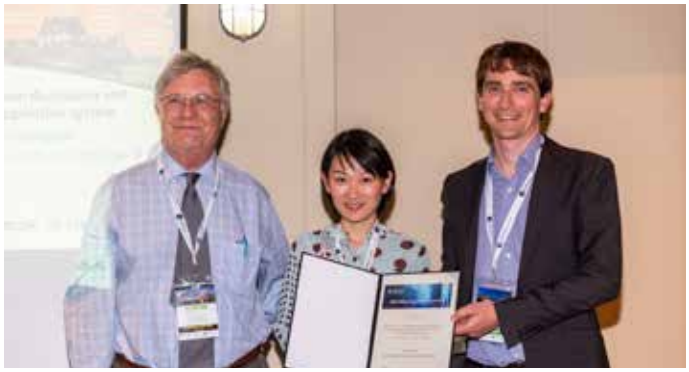
3rd Prize: Project 17.9 - Monash University & Jiangsu Easthigh Environmental Holdings Co. Ltd.
Prof Xiwang Zhang & Dr Meipeng Jian

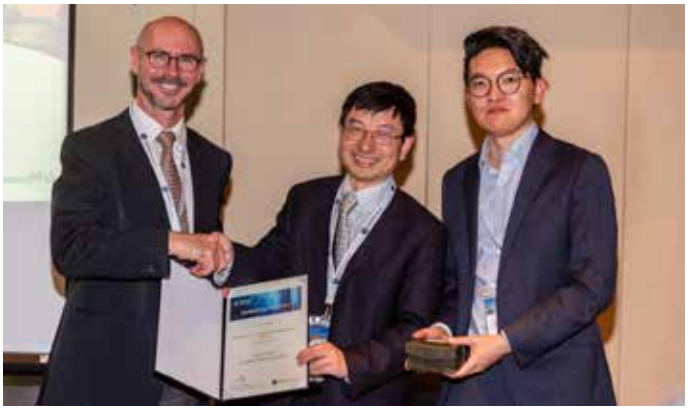
The Hub Excellence Award

1st Prize: Project IH17.7 - The University of Queensland and Arrow Energy
A/Prof Simon Smart, Mr Christopher Williams, Dr Julius Motuzas, Ms Charmaine Lamiel and Ms Yue Yuan

2nd Prize: Project IH17.2 - Monash University & 2D Water
Prof Huanting Wang, Dr Nicholas (Ze-Xian) Low & Dr Zhouyou(Emily) Wang

3rd Prize: Project IH17.3 - Victoria University & Activated Water Technologies
Prof Mikel Duke, Mr Bahay Ozcakmak, Dr Xing Yang, Mr Johnson Luo & Dr Peter Sanciolo





ECR Workshop: Preparing for a Post-PhD Career

As part of the conference, a workshop was held for postgraduate students and postdoctoral fellows to explore opportunities post PhD.

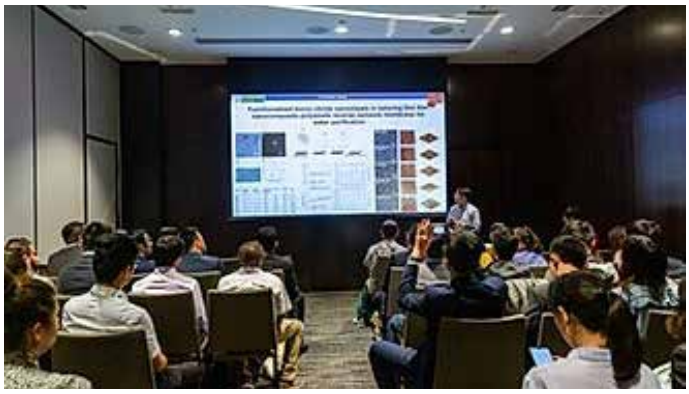
We were grateful to have Dr Catherine Rees (Melbourne Water), Prof Long Nghiem (UTS), Dr Rebecca Yee (Biofuel Innovations) and Dr Adam Brotchie (Monash University) at the workshop who shared their own experience about life after PhDs. The workshop was attended by more than 50 postgraduate students and post-doctorate researchers.

iEESEP2019: 3M Short Talk

In conjunction with iEESEP2019, a 3M Short Talk competition was held for the postgraduate students to present their research project with only one slide and three minutes. We were very pleased that 23 PhD students participated this event. Six awards were presented.

3M Short Talk: Best Overall Awards
1st Prize - Mr Lei Zheng (UTS)
2nd Prize - Ms Priyanka Kumari (Deakin University)
3rd Prize - Mr Xingya Li (Monash University)

3M Short Talk: People's Choice Awards
1st Prize - Ms Ruosang Qiu (Monash University)
2nd Prize - Mr Ruoxin Wang (Monash University)
3rd Prize - Ms Shasha Liu (Monash University)



ARC-EESep & WaterRA Joint Membrane Workshop

A Membrane Workshop was successfully co-organised by ARC-EESep and WaterRA last November.

More than 50 participants attended the workshop, which discussed research solutions for industry challenges.

Ideas were brainstormed during the round table discussions and we hope may result in future collaboration opportunities between industry and academia.

We would like to extend our particular thanks to Dr Dharma Dharmabalan (Water Practitioner, Victoria & Tasmania), Prof Stephen Gray (Victoria University), Mr Bradley Rhodes (Veolia), Ms Linda Nappa (Veolia), Prof Xiwang Zhang (Director of ARC-EESep, Monash University), Prof Rong Wang (Nanyang Technological University, Singapore), Mr Daneil Bonini (SA Water), Mr Duncan Middleton (SEQ), and Prof Benny Freeman (The University of Texas at Austin, USA) for attending the event and delivering talks during the workshop.

In profile: Hub CI Simon Smart

Hub CI Simon Smart is an Associate Professor in the School of Chemical Engineering at The University of Queensland. He is also part of the senior leadership team of the Dow Centre for Sustainable Engineering Innovation and Director of the Functional Interfacial Materials and Membranes Laboratory (FIM2Lab) at The University of Queensland.

He has more than 100 publications including nine book chapters and 96 international journal articles at an h-index of 28. He has two Highly Cited papers in chemistry and geoscience and was selected as one of the 2018 Class of Influential Researchers by Industrial & Engineering Chemistry Research.

A/Prof Smart's research is centred around the sustainable production and use of energy and chemicals, namely developing and applying innovative chemical engineering solutions to reduce greenhouse gas emissions.

In the ARC Hub for Energy Efficient Separation A/Prof Smart has been working with Arrow Energy on membrane technology to dehydrate natural gas. Raw coal seam gas is saturated with water which needs to be removed before it is compressed into the main gas pipelines.

Traditionally this water is stripped out using solvents. These are proven and effective but have considerable operational and capital costs as well as environmental considerations. The membranes developed by the team aim to remove the water in a more cost effective and sustainable way.

CI A/Prof Simon Smart

In profile: Hub CI Graeme Millar

Hub CI Professor Graeme Millar from the Queensland University of Technology (QUT). Prof Millar has considerable experience in industry, having worked for 10 years in a start-up company which developed catalysts and sorbents for water/ wastewater treatment. He has successfully commercialised two technologies; one of these technologies involved the design of a new zeolite material, which had exceptional capacity for ammonium ions; the second technology was a silver catalyst employed in the global formaldehyde industry.

At QUT his research group focuses their efforts on technologies relevant to the Cleantech sector, in particular to challenges related to water purification, conversion of mining waste to value added products, renewable hydrogen production for the energy sector, biomass transformation and industrial chemistry.

To meet the challenge of applied research, the group not only carry out laboratory 'bench testing', but also manage several pilot plants. For example, for the treatment of water his research group has a 100,000 L/day filtration/adsorption/ion exchange plant, a 200,000 L/day ammonia removal and recovery unit, and also a 1000 L/day membrane distillation system.

We asked Professor Millar about his Hub research project:

Project Title: Development of natural zeolites for advanced separation processes

Partner Organization: Zeolite Australia

What are the aims of project?

We hope to (i) develop modified natural zeolite using innovative approaches to produce unique materials for separation applications; (ii) focus on scalable and cost effective technologies; and (iii) understand how to customize technology to a range of natural zeolite deposits which have inherently different compositions

Which challenges being addressed and what are the potential applications

Challenges:

1. To enhance performance of natural zeolites while under the constraint not to make the technology too expensive for industry uptake
2. To remove the problem of poor column performance of natural zeolites due to issues with slow diffusion
3. To ensure that the technology can eventually be transferred to production of tonnage quantities of modified natural zeolites
4. To expand the product portfolio from one material (natural zeolite) to a wide range of modified materials with greater range of application and improved performance

Potential Applications:

1. Removal and recovery of ammonia from wastewater
2. Treatment of water contaminated with heavy metals
3. Additives to anerobic digesters
4. Removal of turbidity causing materials from solution
5. Prevention of nutrient run-off from agricultural operations

What have been the highlights of the project to date?

1. New knowledge relating to the relationship between zeolite composition and influence of heat or acid modification
2. Creation of hybrid zeolite/organic material which can be used in continuous batch processes
3. First ever reported binding of zeolite powder to produce beads which exhibit superior performance in column environments relevant to industry application
4. Process to transform natural zeolites into high value materials

How has the Hub network helped your work?

The hub facilitates and coordinates contact with a range of potential users of the zeolite based technologies. The hub network may also provide deeper insights as to the separation problems which may benefit from zeolite integration.

CI Professor Graeme Millar

Prof Huanting Wang Elected as Fellow of Australian Academy of Technology and Engineering

Congratulations to Hub Deputy Director Professor Huanting Wang who has been elected as Fellow of Australian Academy of Technology and Engineering.

He is internationally recognised for his achievements in the development of advanced membranes for clean water and sustainable separation technologies.

He has been a highly successful leader in building university-industry linkages and translating research discoveries into industry practice. The separation membranes that he has invented have been commercialised and deployed in the diverse fields of water, mining and manufacturing industries.

Professor Wang is a Professor of the Department of Chemical Engineering, Associate Dean (International) of the Faculty of Engineering, and Director of the Monash Centre for Membrane Innovation at Monash University. Originally qualified in material science and engineering at the University of Science and Technology of China, he completed a postdoctoral research fellowship in Chemical Engineering at the California Institute of Technology and University of California Riverside.

I&EC Research Appoints Huanting Wang as Associate Editor

We are pleased to announce that Prof Huanting Wang (Deputy Director of the Hub has been appointed as Associate Editor for I&EC Research. Prof Wang brings expertise in nanoporous materials, membranes, separations, catalysis, and fuel cells. He is the first editor appointment to be based in Australia to make the editors team of I&EC Research, a team which now includes four continents.

Professor Wang has published over 300 research articles, several of which have earned 'highly cited' status for being in the top 1% in their field. He was also recognized with an Excellence in Review award from I&EC Research in 2019.

2019 R.K Murphy Medal for Hub Deputy Director

Further Congratulations to Prof Huanting Wang (Deputy Director of the Hub) whose achievements have been recognised with the 2019 R.K Murphy Medal by the Royal Australian Chemical Institute (RACI). Prof Wang received his award at Chemeca 2019 in Sydney.

Prof Wang was honoured by the Institute's Industrial Chemistry Division for his outstanding career achievements in chemical engineering, with his nomination agreed upon unanimously by the selection committee.

Professor Wang's research expertise covers areas such as nanomaterials and membranes, green chemical technology, gas separation, wastewater treatment and water desalination, electrocatalysis and fuel cells. He has made significant contributions to advancing membrane science and technology, with his research group pioneering the development of several new membranes, four of which have recently been licensed for commercial development and deployment.

Hub CI receives Solomon Award

A/Prof Matthew Hill (CI of the Hub) received the Solomon Award for developing 'magic crystals' with dozens of applications from cleaning gases and liquids to mining and drug production.

A/Prof Hill's team at CSIRO (Australia's national science agency) and Monash University has partnered with US company EnergyX to commercialise a new production process that uses MOFs to create lithium.

A/Prof Hill received the inaugural David and Valerie Solomon Award, presented by the Australian Academy of Technology and Engineering (ATSE) last November at an event in Melbourne. David Solomon was the principal inventor of Australia's plastic banknotes, and has developed a range of new technologies used widely in the plastics and polymers industries.

A/Prof Hill will receive $15,000 and 12 months mentoring from a senior entrepreneur/industry Fellow of the Academy, with $5000 travel expenses to enhance this mentoring experience.

Special thanks to the sponsors of IEESEP2019

Anton Paar MEMCOR an EVOQUA brand AIR PRODUCTS MSA 2D WATER membranes an Open Access Journal by MDPI

UPCOMING EVENTS

Membrane Technologies in the Food Industry Workshop
21 July 2020 (Tuesday)
Monash University

The International Membrane Science & Technology Conference (IMSTEC)
4 -8 December, 2022
Australia

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