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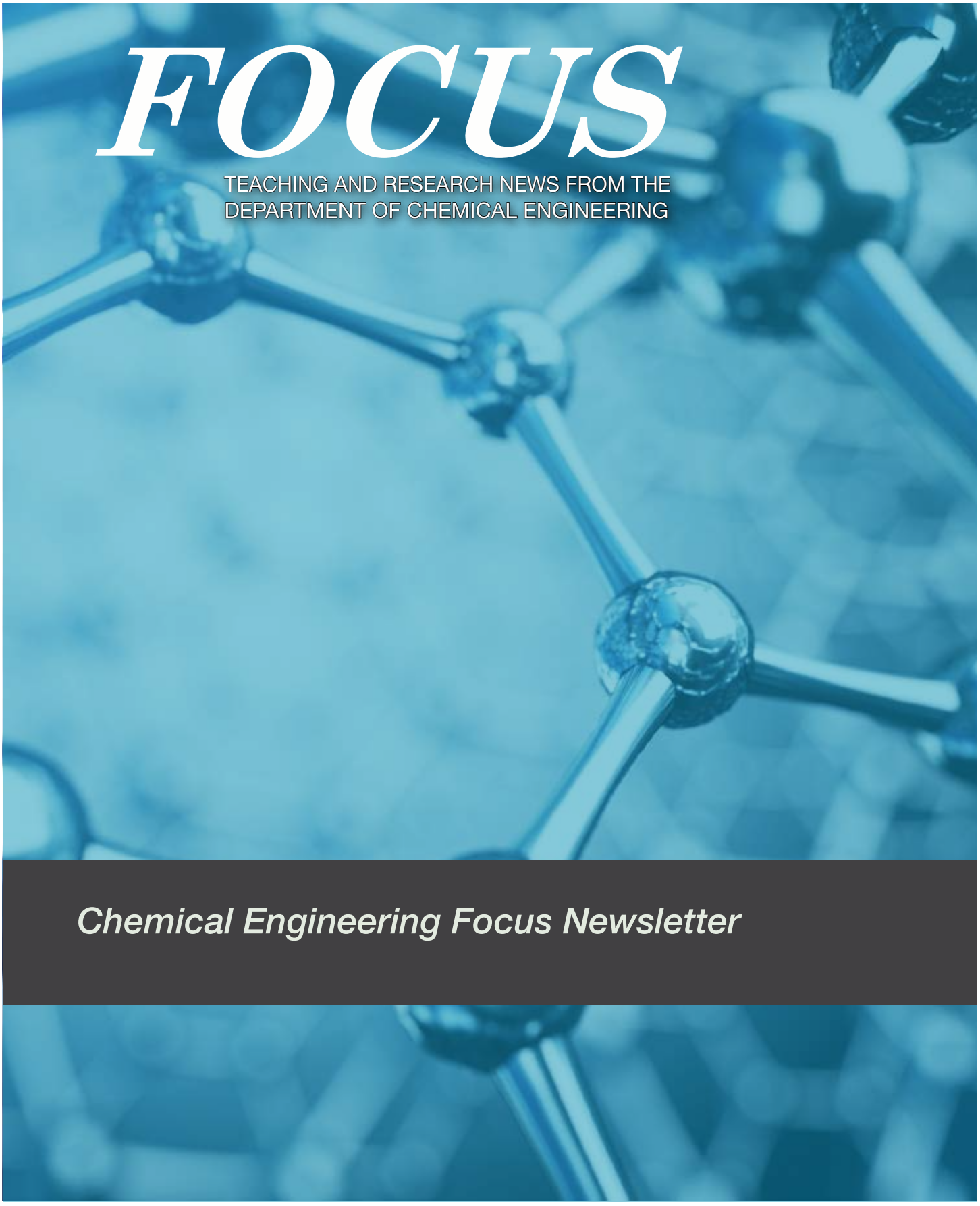


FOCUS

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

Chemical Engineering Focus Newsletter

focus

TEACHING AND RESEARCH NEWS FROM THE DEPARTMENT OF CHEMICAL ENGINEERING

HIGHLIGHTS IN THIS ISSUE

WELCOME FROM THE HEAD OF DEPARTMENT

The year 2017 almost comes to an end as we prepare to farewell a batch of undergraduate students at Sunway and Clayton. I was particularly impressed with the enthusiasm and the depth of knowledge of the final year students during their poster presentation for the Design Project unit. This is the unit where they design a chemical plant using all that they learnt during their time in the department. Many of these students will soon be our eyes and ears to the industry, and on behalf everyone in the department I extend to them our best wishes for their career.

This is also the time to reflect on some of our achievements so far this year in research. We were awarded two Australian Research Council (ARC) Industrial transformation Research Hubs (ITRH). One is on Energy Efficient Separation with applications in mining, power, minerals and water treatment sector among others. The second one is on Processing Lignocellulosics into High Value Products has applications in the renewable fuels and chemicals industry, pulp and paper industry among others. In November, seven staff members were successful in receiving prestigious ARC grants - one DECRA and six discovery grants in multiple areas. This is by far the most successful year of ARC grants in the department's 54 years of existence. We were also successful in attracting significant Australian Renewable Energy Agency grants in photovoltaics. The department also was awarded the Australia China Joint Research Centre (AJCRC) on Dairy Manufacturing. While the ITRH and AJCRC have very strong industry links, my department academics also attracted separate solely industry-funded projects this year than ever before. We also host a third ARC ITRH on Computational Particle Technology. Additionally, the department is involved in two Graduate Research Industry Partnerships - Chemicals and Polymers, Food and Dairy.

The strong industry-linked research funding would not have been possible without our diverse expertise in multiple research areas of both fundamental and applied nature. Our major research expertise areas include – Functional Nanomaterials, Fuels and Energy – both fossil and renewables, Waste Processing, Membrane Technology, Food Technology, Modelling of Particles, Soft Matter, and Industrial Biotechnology.

While on research, I would like to mention about our collaboration with universities outside Australia. While many of you would know of our strong and long-standing research links with reputable universities with China, somewhat less known is our links with North American universities. We currently have joint research projects and/or researcher exchange links with MIT, Yale University, Stanford University, University of California (UC) at San Diego, UC - Davis, UC - Santa Cruz, UC-Berkeley, University of Wisconsin, Madison, South Dakota State University, Penn State University, Ohio State University, New Jersey Institute of Technology, University of Illinois Urbana-Champaign, University of Akron, University of Colorado at Boulder, Georgia Institute of Technology, North Carolina State University, University of Connecticut, the Sandia national Laboratory, and the University of British Columbia. The links include at least two DOE funded joint projects.

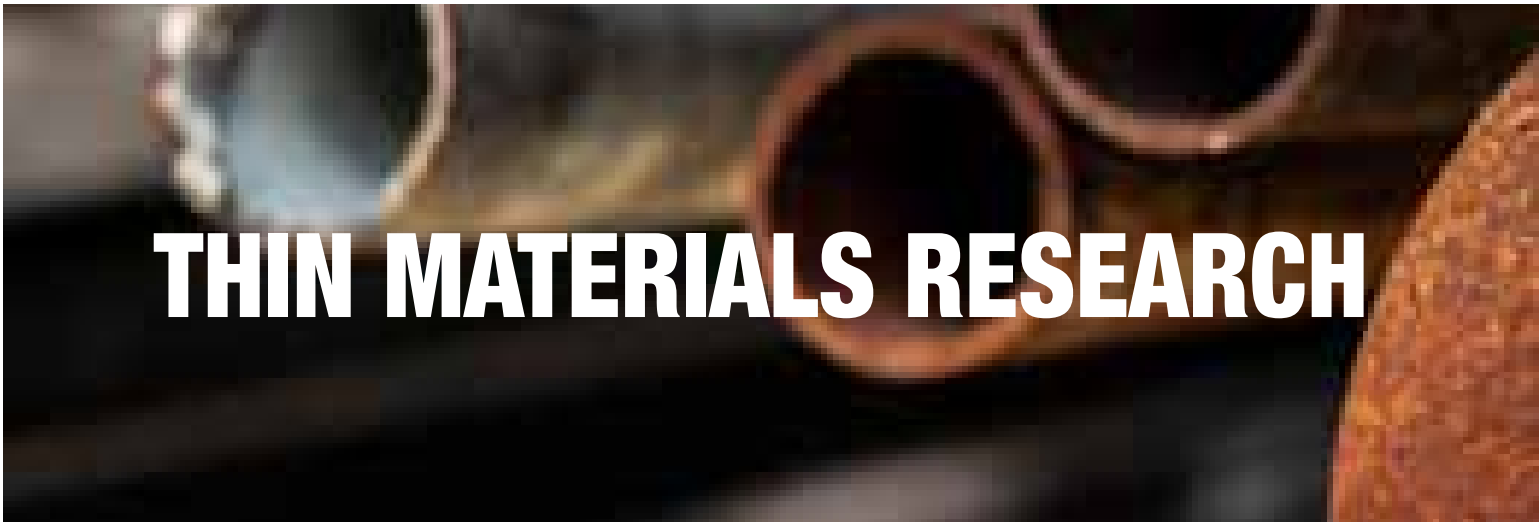
On 5th December, we will hold our second Alumni event for the year. Invitations have gone to all alumni that the marketing department keeps track of, in addition to being advertised through networking sites. We look forward to a larger presence this time that will allow us to show our diverse expertise.

Last month, the Chemical Engineering postgraduate Association (CEPA) organised their 7th conference. I was impressed with the planning and professional running of the day-long event efficiently across three parallel sessions. Equally impressive was the quality of the presentations and the posters which were representative of the diverse nature of research that you all undertake in our department. In a way, the CEPA is a trendsetter in the university; this is the only research conference in the university (and perhaps in the country) organized by the postgraduate students bringing the 190-strong postgraduate students together. While on this matter, I encourage all postgraduates to take advantage of two Professors of Practice that we have – Professor Ross Pilling and Professor Greg Simpson. They remain available at the department once a fortnight at the least. Make the most of this opportunity by talking to them about your research, seek advice on the practical usefulness of your work and career.

In October, Dr Parama Banerjee joined our department. A Monash graduate four years ago, her introduction brings in research expertise in energy storage, electrochemistry and advanced use of carbon materials. Dr Banerjee will also be responsible for teaching at undergraduate and postgraduate levels.

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

Professor Sankar Bhattacharya



THIN MATERIALS RESEARCH

PROFESSOR RAMAN SINGH

Professor Raman Singh holds a joint appointment at the Department of Chemical Engineering and Department of Mechanical and Aerospace Engineering, Monash University. He was the founding Director of the Monash Energy Materials and Systems Institute (MEMSI), as well as being a Research Professor at Centre for Clean Energy Engineering at University of Connecticut (USA). His primary research interests are in the relationship of nano-/microstructure and environment-assisted degradation and fracture, and nanotechnology for advanced mitigation of such degradations. He has also worked extensively on use of advanced materials (e.g., graphene) for corrosion mitigation, stress corrosion cracking, and corrosion and corrosion-mitigation of magnesium alloys (including for the use of magnesium alloys for aerospace, defence and bioimplant applications).

In a current research project, Professor Singh explores corrosion and its impact on infrastructure.

Graphene-coating for corrosion resistance of copper for proton exchange membrane fuel cell applications

Corrosion of engineering alloys and its mitigation measures continue to cost dearly (~4% of GDP of any developed economy which translates to an annual loss of ~$250b to USA). Traditional approaches, such as use of corrosion resistance alloys and coatings have brought about significant mitigation of the age-old problem of corrosion. Corrosion resistant alloy such as stainless steels perform on the principle of their inherent ability to develop a corrosion resistant surface film of oxide of chromium. However, chloride ions (i.e., abundantly present in sea-water) can disrupt this protective oxide film not only in lesser alloys, but even in the case of the alloys with the highest resistance when the corrosive environment is very aggressive.

Hence, the traditional mitigation strategies have not always succeeded in providing durable mitigations. However, a durable corrosion resistance is still a non-trivial challenge in some critical applications, such as where highly corrosive solutions are handled (e.g., concentrated chloride solutions in desalination plants or highly acidic solutions in Proton Exchange Membrane Fuel Cell), or where corrosion resistance is required for very long durations (e.g., nuclear waste containers) or where corrosion can cause serious health problems (such as by degradation of human implants). It is true that circumventing corrosion in such critical applications is technologically challenging, socially fulfilling as well as commercially attractive, but it is equally true that a durable solution calls for a disruptive approach, which in itself is a non-trivial challenge (given the age-old nature of the discipline). On the other hand, given huge economic losses caused by corrosion, the emergence of new materials often triggers an interest in its applicability for corrosion resistance. Most recent examples include ultrathin coatings of graphene and hexa-boron nitride.

Graphene, the thinnest of engineering materials (i.e., just an atomic layer thick) has triggered unprecedented research interest in recent years because of its unique and technologically appealing properties. Graphene also possesses a few unique properties that are specifically required for an effective ultra-thin barrier layer for resistance to aggressive environment. Raman's group demonstrated for the first time that a monolayer or a few atomic layer thick graphene coatings on metals has been shown to improve corrosion resistance by up to two orders of magnitude [1]. However, there is considerable variability in the literature on the degree of improvement. For example, improvement in aqueous corrosion resistance of copper due to graphene coating is reported to vary from insignificant to two orders of magnitude [1-3]. In fact, some of the reports have shown graphene coating to deteriorate long-term corrosion resistance of copper (i.e., graphene-coated copper having much inferior corrosion resistance) [4]. However, the most recent studies of Raman's group has demonstrated durable corrosion resistance due to graphene coating.

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4. M. Schriver, W. Regan, W. J. Gannett, A. M. Zaniewski, M. F. Crommie and A. Zettl, ACS Nano 7 (7), 5763-5768 (2013).
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PROFESSOR XIWANG ZHANG

Xiwang Zhang is a Professor in the Department of Chemical Engineering, Monash University. After obtaining his PhD degree from the Research Centre of Eco-Environmental Sciences, Chinese Academy of Sciences in 2006, he joined Nanyang Technological University, Singapore as a Research Fellow and was then promoted to a Senior Research Fellow in 2009. In 2010, Professor Zhang joined Keppel, a multinational corporation in Singapore, as R&D Manager in Keppel Environmental Technology Centre. Professor Zhang was awarded the prestigious ARC Australian Research Fellowship in 2010 and commenced his ARC fellowship at University of Queensland in 2011.

In a current research project, Professor Zhang and his group explore titanium nanocrystals and their use as a photocatalyst.

Highly dispersed TiO_2 nanocrystals and WO_3 nanorods on reduced graphene oxide: Z-scheme photocatalysis system for accelerated photocatalytic water disinfection.

In a breakthrough study, Professor Zhang and colleagues recently published research reporting a facile hydrolysis-hydrothermal approach, whereby ultradispersed TiO_2 nanocrystals and WO_3 nanorods are concurrently anchored onto reduced graphene oxide (rGO) and formed a novel Z-scheme heterojunction photocatalyst TiO_2/rGO/WO_3 (TRW).

Coupling TiO_2 with WO_3 to develop photocatalytic heterojunctions is one of the most widely used strategies to realize their superior photoactivity. However, the interfacial charge transfer in these heterojunctions is not efficient to achieve an optimized activity.

The researchers employed a variety of techniques to characterise TRW, including Transmission Electron Microscopy (TEM), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), UV–vis diffuse reflectance spectroscopy (UV–vis DRS) and photoluminescence spectra (PL).

Control experiments indicated that, in the synthesis process, glucose and the by-product sodium chloride from the hydrolysis reactions were critical for forming highly dispersed and uniform-sized TiO_2 nanocrystals and WO_3 nanorods.

Compared with TiO_2/WO_3 nanocomposites, TRW showed enhanced activity for bacterial inactivation under simulated solar light. As confirmed by electrochemical characterizations and the reactive oxygen species, rGO in TRW suppresses the recombination of electron-hole pairs and boosts the O2 reduction reactions during photocatalytic process. Z-scheme electron transfer in TRW is proposed based on surface redox reactions and XPS analysis after light irradiation. This study could provide a new clue for designing graphene-based heterojunction photocatalysts for environmental applications.

Highly dispersed TiO_2 nanocrystals and WO3 nanorods on reduced graphene oxide: Z-scheme photocatalysis system for accelerated photocatalytic water disinfection

Xiangkang Zeng, Zhouyou Wang, Gen Wang, Thomas R.Gengenbach, David T.McCarthy, AnaDeletic, Jiaguo Yu, Xiwang Zhang.

Applied Catalysis B: Environmental, Volume 218, 5 December 2017, Pages 163-173

DAIRY INDUSTRY PLACEMENT REWARDED WITH WORK AT BURRA FOODS

Burra Foods graduate process engineer Krystel Li at the Korumburra dairy processing plant. Picture: Dannika Bonser

Working in the dairy industry had been a dream for PhD student Krystel Li.

This month, in her final weeks of completing her doctorate in chemical engineering, she will also begin work full-time with Burra Foods in South Gippsland.

Krystel completed a 12-week placement with the Korumburra milk processor during the summer through the Gardiner Foundation backed by the Monash Industry Team Initiative program.

She has been working part- time as a graduate process engineer, while completing a PhD that looked at ways to improve the properties of milk powders and achieve better formulation and processes.

As part of the MITI program, which places small teams of Monash University students with a dairy manufacturer to solve a specific company research and development challenge, Krystel was tasked with solving a real-life problem in Burra's frozen packing line.

The project included identifying waste streams, and ways to optimise the plant's performance.

"The starting point was to get a good understanding of the process and gather enough information by engaging with people at different levels in the company; from operators to managers," she said.

"Everyone at Burra was more than accommodating and always ready to help us out. Once those waste streams were identified, we proposed sustainable solutions to mitigate those issues."

There was a cost saving for Burra as a result of the project, as less raw material was wasted.

Entering the dairy industry had been on the cards for Krystel and it's why she chose to a dairy-related project for her PhD.

She said Monash University, through the MITI program, was "doing a fantastic job to narrow the skills gap within the dairy industry" and giving students the opportunity to get industry experience.

"Which in many cases can lead to future career opportunities within the industry," she said.

This article first appeared in the Weekly Times (July 2017)

CONGRATULATIONS TO OUR NEW PROFESSORS

We congratulate Professors Chai and Zhang staff who have been promoted to Professor this year. This is a great achievement and acknowledges their significant contributions to teaching, research and engagement.

Professor Siang Piao Chai works at the Malaysian campus and his research interests are in Catalysis & reaction engineering; Photocatalysis; Nanoscience and nanotechnology; Separation processes
Read more about his research (sites.google.com/monash.edu/chaisiangpiao)

Professor Xiwang Zhang works at the Clayton campus and his research interests are in Membrane Technologies, Water Treatment, Nanomaterials, Catalytic oxidation, Photocatalysis, Desalination, Disinfection
Read more about his research (monash.edu/research/explore/en/persons/xiwang-zhang(e0365bcc-88bf-481b-992a-d33259a3864d).html

CORDELIA SELOMULYA WINS THE JUDY RAPER WARD FOR LEADERSHIP

The Judy Raper Award for Leadership in Engineering is offered annually and is open to all female alumnae from the UNSW Faculty of Engineering in recognition of their sustained and significant contribution through demonstrated leadership within the discipline/profession in Australia. Effective leadership is characterised by passion and commitment, setting bold objectives and achieving results, and most importantly, motivating and mobilising the talent of others for the benefit of the discipline/profession and the community at large. The awardee receives a $5,000 prize.

Professor Cordelia Selomulya leads the Monash Biotechnology and Food Engineering group and is Director of both the Australia-China Joint Research Centre for Future Dairy Manufacturing, and the Graduate Industry Research Partnership for the Food and Dairy industry. Professor Selomulya leads the Monash Advanced Particle Engineering Laboratory in interdisciplinary research on the design of nanoparticle vaccines and mesoporous materials. She has designed a more efficient DNA vaccine delivery system for malaria using magnetic nanoparticles, revealed the role of nanoparticle adjuvants for ovarian cancer vaccines, and developed multi-stage vaccines for malaria.

With Prof Judy Raper (DVC Research and Innovation, University of Wollongong) & Prof Mark Hoffman (Dean of Engineering, UNSW)

Save the date

Department of Chemical Engineering
End of year/Christmas party 2017

Thursday 14 December
Alatonero, a Greek restaurant at McCrae on the Mornington Peninsula as our venue for our lunch (www.alatonero.com.au) and we have selected the Greek Feast menu.

This restaurant is opposite the beach, so after lunch we will have a range of activities for you to join in (or just watch). Suggestions - cricket, Frisbees, kite flying, egg and spoon races. You could always get your feet wet too. I will call on some volunteers to help organise the cricket match - captains, players, umpires and spectators needed!!
Jill Crisfield

FONTERRA AWARD WIN AT CHEMECA 2017 CONFERENCE

Further congratulations to Professor Cordelia Selomulya for winning the Engineers Australia Fonterra Award for ground-breaking research in biotechnology and food engineering, presented at the Chemeca 2017 Conference and Awards held in July 2017.

The conference celebrates the pivotal role chemical engineers and industrial chemists play in creating new knowledge and translating it into trailblazing technologies that enhance our quality of life. As one of the largest gatherings of scientists and engineers to be held in Australia, the awards aim to showcase innovative research and technology and provide inspiration for creating new opportunities to address future challenges.

The Fonterra award recognises outstanding contributions in the industrial application of novel technology in the bioprocessing field from a chemical engineer in Australia or New Zealand.

Professor Selomulya and her research team won the award for their ground-breaking research in spray-drying technology that can offer unprecedented detailed insights into the drying process of heat-sensitive dairy powders.

“Winning the award means the work we have been doing at Monash, particularly in spray drying, is being recognised for its impact internationally and to industry” Professor Selomulya said.

There are great challenges in achieving optimum spray drying conditions for powders such as milk protein concentrates and whey powders. Spray-drying is the most energy-intensive process in dairy manufacturing and the dairy industry’s present reliance on costly trial and error approaches when spray-drying new formulations, often results in commodity loss and excessive energy use.

This new technology will help predict the most effective spray-drying conditions to produce powders with improved solubility, emulsification, and heat-stability properties, which means the dairy industry stands to benefit significantly to deliver milk powders with improved quality, functionality, and shelf-life, whilst also avoiding energy expenditure caused by inefficient drying.

There is much potential for this remarkable technology to reach far beyond the scope of the dairy industry, and could be utilised in fields as diverse as pharmaceutical manufacture and production of mesoporous carbon particles for air purification.

Last year, Professor Selomulya was awarded $1M to establish the new Australia-China Joint Research Centre (ACJRC) in Future Dairy Manufacturing, one of only six such centres awarded throughout Australia. In 2017, she also launched Monash’s Graduate Researcher Innovation Program (GRIP) for the Food and Dairy Industry, which is interlinked with the ACJRC. ACJRC and GRIP do not just focus on short-term industry research projects: they have elevated Monash University as a vital international hub for linking industry and academic dairy expertise now and into the future.

Professor Selomulya has created a globally significant industry-research hub at Monash, which will provide ongoing benefit to the dairy and food industry.

CHEMECA CONFERENCE ROUND UP

The Department, which was a Gold sponsor of the event, had a wonderful night at the Chemeca Conference dinner where several of our academics and students were recognised for their contributions to their field.

Congratulations go to Jannatul Azmir, Romesh Wijesiri, Professor Cordelia Selomulya and Dr Nicky Eshtiaghi

Jannatul and Romesh, both 2nd year PhD students in the Department, won their awards for best student papers at this year's conference (see page 10)

Professor Cordelia Selomulya won the 2017 Fonterra Award, which recognises outstanding contributions in the industrial application of novel technology in the bioprocessing field from a chemical engineer in Australia or New Zealand (see article on previous page).

Dr Nicky Eshtiaghi is currently a Senior Lecturer at RMIT University but completed her PhD from the Department in 2010. Dr Eshtiaghi won the Caltex Award, which recognises outstanding achievements in the teaching of chemical engineering.

All four of them were present at our Alumni event held at the Melbourne Convention Centre later that evening.

STUDENT'S PROJECT WORK PUBLISHED

We are proud to have such active and motivated students in the Chemical Engineering Department.

Nicholas Fung and Garen Altinkaya, recently graduated and now working for BP in Health & Safety and Thyssenkrupp, have had their project work from CHE4180 published in a recent paper, *Low temperature hydrogenation of carbon dioxide into formaldehyde in liquid media* in the journal *Catalysis Today*. The project was very innovative because, in a world first, they demonstrated direct hydrogenation of CO_2 into formaldehyde in liquid media reaction. It is also the first time their lecturer, Dr Akshat Tanksale, has had a paper published from CHE4180 projects and it is testament to the high quality work by these two students.

2017 DESIGN PROJECT - VISIT TO DOW CHEMICALS

The 2017 Design Project examined the production of Mono-ethylene Glycol, which is a very important chemical, especially for the production of polyester plastics such as PET.

For the very first time, both the Sunway and Clayton students worked on the same topic and with a very similar project brief. The Clayton class was formed into 16 groups with locations around Australia, New Zealand and Southeast Asia. Groups were allowed a free choice of any of the less-proven technologies, but were allocated to either the Dow or Shell technologies. Half of the class selected Dow and the other half selected the Shell Process. The students were particularly challenged by the need to use different thermodynamic property methods to model different sections of the process using Aspen Plus. A highlight was the opportunity to visit the Dow Chemicals Propylene Glycol Plant in Altona and to meet the plant chemical engineers and maintenance personnel (shown in the photo).

MONASH STUDENT JANNATUL AZMIR WINS THE FELL CONSULTING PRIZE AT CHEMECA 2017

Congratulations to PhD student Jannatul Azmir for winning the Fell Consulting Prize for the best paper presented by a student in CHEMECA 2017 held at the Melbourne Convention and Exhibition Centre in July 2017.

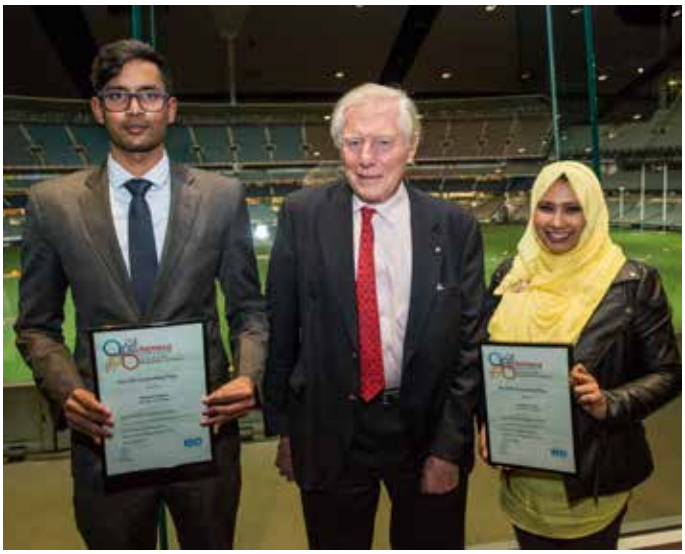
Chemeca 2017 has been held as a partner conference to RACI Centenary Congress which was one of the largest ever gathering of scientists and engineers from around the world. Over the conference, world-class invited speakers were assembled. Young researchers and students were provided the opportunities to present their research.

Jannatul, a PhD candidate working with Professor Aibing Yu and Dr Qinfu Hou in the department of Chemical Engineering at Monash University, presented her recent work on establishing a discrete particle scale model framework for food grain drying. The presentation, titled “A CFD-DEM simulation of food drying process”, was based on a recently accepted paper in Powder Technology (a Q1 or top 25% journal according to Web of Science).

The presentation was focused on the development of a combined computational fluid dynamics (CFD)-discrete element method (DEM) model for a fluid-particle (grains) food drying process. The model is incorporated with a water evaporation model in resemblance to a chemical reaction, thus requiring less model parameters. By such a model, detailed and verified predictions of temperature and moisture content in both fluid and particle phases were generated. It was also demonstrated that the model has the capability to study transient drying behaviours in a fluidised bed and to investigate the effects of some important parameters in food drying such as inlet air temperature and velocity on drying rate and product quality related to moisture distribution. For further detailed information, please refer to the recently accepted paper (J. Azmir, Q.F. Hou, A.B. Yu, Discrete particle simulation of food grain drying in a fluidised bed, Powder Technology, 2017).

Following the initial model development, Jannatul has extended the model capability to consider more complicated and realistic drying phenomena such particle shrinkage related to some food grains in drying. It is expected that the model can also be used to study the effect of irregular grain shapes on drying in different systems.

Jannatul is optimistic that the model will be able to provide detailed information for design and optimisation of drying processes and to make significant contribution to the sustainability in the energy intensive food drying sector.



Jannatul (right) and Romesh (left), both 2nd year PhD students in the Department, won their awards for best student papers at this year’s conference. Pictured here with Emeritus Professor Chris Fell

INTRODUCING THE ACJRC FOR DAIRY MANUFACTURING

The Australian dairy industry is set to reap significant benefits from a new research partnership with China, thanks to a million-dollar grant from the Australia-China Science and Research Fund (ACSRF).

China has become an important market for many Australian agricultural products, and this is especially so for dairy – with 2016 dairy imports accounting for 20% of the Chinese dairy market[1].

To further opportunities for Australian dairy manufacturers, funding was secured from the Australian Government's Department of Industry, Innovation and Science (DIIS) to establish the Australian-China Joint Research Centre (ACJRC) in Future Dairy Manufacturing.

Monash University leads the Australian research push, with Centre Director Professor Cordelia Selomulya leading the strongest dairy research teams in the Asia Pacific region. Professor Selomulya's international research reputation in the manufacture of high value particles for functional foods and the pharmaceutical industry will ensure the Centre will provide the dairy industry with manufacturing process efficiencies and new high-value products, developing a strong link between Australia and the large distribution network in China.

Australian partners include Bega Cheese Limited, Fonterra Australia Pty Ltd, Devondale Murray Goulburn Co-operative Co Limited, Geoffrey Gardiner Dairy Foundation Limited, Monash Food Innovation Centre and The University of Queensland. This Australian collective will join forces with China's Soochow University, in conjunction with China National Cereals, Oils and Foodstuffs Corporation (COFCO) and Mengniu Dairy, the second largest dairy company in China and one of the the top 10 companies in the world. The Chinese consortium has received funding from the Chinese Ministry of Science and Technology (MOST), with Soochow University's Professor Xiao Dong Chen, Director of the China Node.

Professor Selomulya stated that the centre's research will enable the Australian dairy industry to go beyond the traditional production of cheese, butter and skim milk powder to the large-scale manufacture of products such as infant formula, which are in high demand in China.

Bega Cheese's Product Development Manager spoke about the potential of the partnership to facilitate strategic research and development, with a strong focus on the preferences of Chinese consumers. "Bega Cheese Limited foresees that this collaboration will assist with increasing export volumes, thereby supporting Australian employment opportunities in regional dairy communities".

Demand is increasing in China for consumer-ready dairy products, and with the recent signing of the free trade agreement, the Australian dairy industry is well-positioned to grow its current share of the market.

1. *ABC News online "Australian dairy exports encouraged to look at new markets as Chinese growth slows". Clint Jasper 27/06/2017. Part of this material was produced by Monash University*

DEPARTMENT WELCOMES DR PARAMA BANERJEE

We are pleased to welcome Parama Banerjee to our Department as an Early Career Researcher (ECR). Parama brings strong fundamental research expertise in energy storage materials, electrochemistry, and advanced carbon materials with publications in Advanced Energy Materials, ACS Nano and Nature Communications. In addition to receiving seven awards including an ECR award from the CRC Australia, Parama has co-authored 9 industry reports, one invention disclosure, and three significant media releases.

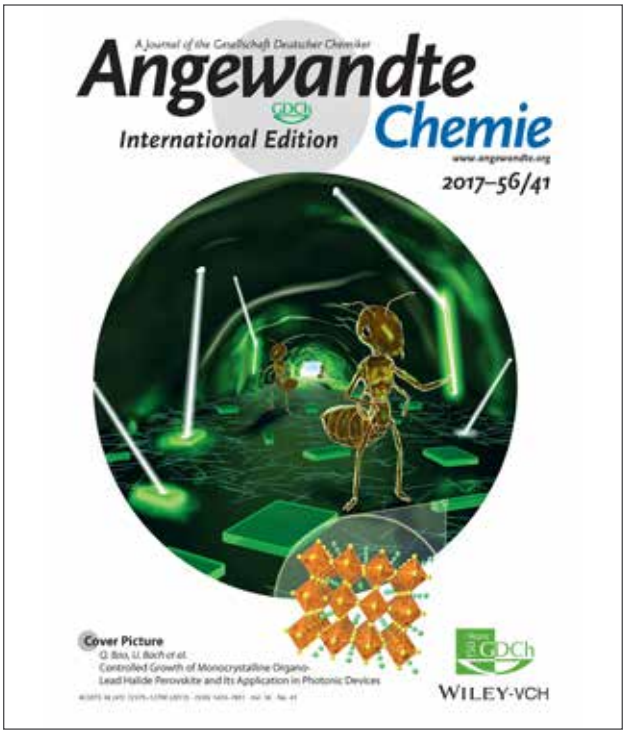
Parama will start with teaching Fluid Mechanics in both semesters in 2018 and assist Dr Meng Woo as the Deputy Director of Teaching, A/Prof Andrew Hoadley on the Design project and Professor Bhattacharya on the undergraduate research project.

Dr Banerjee has always been fascinated by the electrochemical processes, particularly in the areas of energy storage, conversion and corrosion. This fascination led her to pursue a PhD at Monash University, examining the effect of various surface modifications on the electrochemical kinetics of a degrading metal surface. After her PhD, she integrated her knowledge in electrochemistry with carbon-based nanomaterials and ventured into the field of energy storage and conversion. Her current research interest includes electrochemistry of various interfaces, energy storage materials and systems, advanced carbon based materials, corrosion, functional coatings and nanotechnology and nanomaterials.

Research interests

Electron transfer governs the pathway of chemical reactions. However, owing to their speed and size, tracing electron movement is difficult using traditional spectroscopy and synthetic chemistry. Consequently our knowledge of the driving forces for many reactions in nature remains elusive. Electrochemistry offers the potential to investigate these processes directly by the detection of electrons and ions involved. Electrochemistry has significant impact in our society. For example, many physiological processes in the human body involve complex electrochemical reactions at electrified interfaces, energy storage and conversion in batteries, supercapacitors and fuel cells, which are governed by various electrochemical processes. Additionally, understanding and mitigation of corrosion problems, development of biomedical and other chemical sensors requires advanced knowledge of electrochemistry. Thus, Dr Banerjee's research focuses on the interdisciplinary area of electrochemistry with a focus on advanced micro to macro length scale energy storage systems, and advanced polymeric and nanostructured coatings for mitigation of corrosion in metallic systems.

WENXIN MAO COVER AND BEST POSTER



PhD student Wenxin Mao has recently had his research published in the prestigious journal *Angewandte Chemie*, where his paper was selected for the cover picture.

The paper, C*ontrolled Growth of Monocrystalline Organo-Lead Halide Perovskite and Its Application in Photonic Devices,*

(Q. Bao, U. Bach et al). describes a simple solution-based method to produce single-crystalline perovskite platelets from the precursor (MA)[PbBr3]•DMF. Arbitrary perovskite shapes such as arc waveguides were fabricated and employed to build active electro-optical modulators that achieve >98 % modulation intensity of wave-guided light.

Wenxin also presented his research at the *2017 International Symposium on Energy Conversion and Storage Materials* in Brisbane last July, where he received the best poster award at the Brisbane conference. As a satellite symposium of the Centenary RACI, IChemE and Carbon Conference, this symposium aims to bring together a number of top scientists from various countries to discuss the latest advances in functional materials for sustainable energy conversion and storage technologies. The main objective of the symposium is to promote international cooperation and partnership between world leaders in the fields of nanomaterials and nanotechnology for clean energy applications.

NEW GRANT FOR DR HUACHENG ZHANG

Dr Huacheng Zhang, currently a DECRA Research Fellow in the Department of Chemical Engineering, was awarded prestigious DP grant (lead CI, commencing in January 2018) in the most recent ARC round.

Huacheng received her BS degree in applied chemistry (2009) from Xi'an Jiao Tong University. She joined Prof. Lei Jiang's group as a PhD candidate and received her PhD degree in physical chemistry (2014) from Institute of Chemistry, Chinese Academy of Sciences. Then she was employed as an Assistant Professor in Prof. Lei Jiang's group at the Technical Institute of Physics and Chemistry, Chinese Academy of Sciences. In 2015, she obtained a Research Fellow position with Prof. Huanting Wang to work in his group as a full-time researcher in the Department of Chemical Engineering at Monash University. She was then awarded a prestigious DECRA fellowship which commenced in January 2017, also at Monash under the guidance of Prof. Wang.

Her current scientific interests are focused on bio-inspired ion-channel membranes and theoretical modelling of ionic/molecular transport inside artificial nano/sub-nanometer pores/channels.

Her current DECRA project aims to develop an innovative platform strategy for fabricating self-gating nanochannels that undergo autonomous opening-closing changes without any on-off switching of external stimuli. These nanochannels mimic the unique structures and smart functions of biological protein channels, and thus are expected to bring new functions and high-efficiency to applications such as in smart membrane separation, energy conversion, biosensing, and nanofluidic devices. The proposed research has great potential to result in new knowledge of biomimetic design of nanochannels and directly benefit manufacturing industry for Australia.

Huacheng hopes to achieve fabrication of artificial stable ion-channel membranes with specific ion selectivity, high ion conductivity and efficient gating function comparable to biological ion channels. Then she will use these new developed ion-channel membranes to construct efficient separation devices, thus to improve the membrane separation efficiency and reduce energy consuming and pollutions during membrane separation processes.

ERIC SHAQFEH SEMINAR

Professor Shaqfeh from Stanford University will present a spacial seminar at the beginning of December titled Suspended Particles in Complex Fluids: From Fracking Fluids to Swimming Worms.

Professor Eric Shaqfeh is the Lester Levi Carter Professor and Department Chair of Chemical Engineering at Stanford University. He earned a B.S.E. summa cum laude from Princeton University (1981), and a MS (1982) and PhD (1986) from Stanford University all in Chemical Engineering. In 1986, he was a NATO postdoctoral fellow at the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge. From 1987 through 1989 he was employed as a Member of Technical Staff at AT&T Bell Laboratories in Murray Hill, NJ before joining the Stanford Chemical Engineering faculty in early 1990. In 2001 he received a dual appointment and became Professor of Mechanical Engineering. He is most recently (as of 2004) a faculty member in the Institute of Computational and Mathematical Engineering at Stanford. He has authored or co-authored over 180 publications and has been an Associate Editor of the Physics of Fluids since 2006.

Abstract: Rigid or flexible particles suspended in viscoelastic fluids are ubiquitous in the food industry (e.g., pastes), industrial molding applications (all composites and 3-D printed parts), the energy industry (e.g., fracking fluids), and biological fluids (i.e., swimming of bacteria in mucous). The mathematics of the description of these suspensions is in its infancy. For example, the foundational work in Newtonian suspensions was accomplished by Einstein in 1905 as a mathematical prediction of the shear viscosity of a dilute suspension of particles in Newtonian fluid. That same calculation in an elastic fluid was just submitted for publication now over 100 years later! However, while the mathematics of this subject is subtle the real breakthrough in this area has been the development of a computational simulation of such viscoelastic suspensions, with particle level resolution, such that predictions can be made and tested at all volume fraction loadings. This simulation capability is unique and overcomes the major hurdle in understanding the physics of these suspensions – which in many cases are simply qualitatively different than that of Newtonian suspensions. The simplest flows of such suspensions are not understood at a fundamental level, primarily because the collective behavior of particles in an elastic liquid has no foundation – this will change dramatically in the next few years. I will describe three foundational problems that have now been analyzed using these new computational methods – including fracking fluid design and swimming in mucous.

MALAYSIA'S RESEARCH STAR AWARD FOR TWO OF OUR ACADEMICS

Two academics from the Department have received the 2017 Malaysia's Research Star Award, a prestigious honour from the Malaysian government in recognition of their high impact research. Associate Professor Wu is one of the six recipients awarded in the Frontier Researcher category, and Associate Professor Chai is the only recipient awarded in the Young Researcher category.

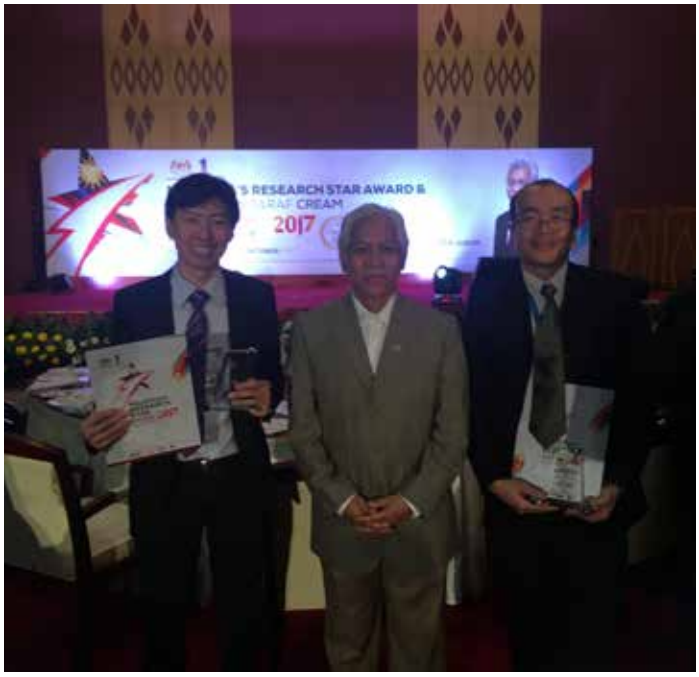
Among the 24 award recipients for 2017, a majority are from public research universities, and Monash Malaysia is the only private and international university that received the award. The Award was administrated by Clarivate Analytics and Elsevier, and criteria were based on the publications in high impact journal and citation statistics.

The Award ceremony was attended by officials from the Ministry of Higher Education. YB Dato' Seri Idris bin Jusoh, Minister of Higher Education, and YBhg. Datin Paduka Ir. Dr Siti Hamisah binti Tapsir, Director General of Higher Education, officiated the award ceremony which was held in Putrajaya on October 2017.

Both Chai and Wu joined the Department as Lecturers in Chemical Engineering in 2008 following completion of their PhDs, and have made excellent progress in their academic careers. Their achievements recognise our efforts to develop a research-intensive School, and further reinforce our commitment to develop a high performing culture and supportive environment in the Schools.

Associate Professor Ta Yeong Wu received his BEng (Hons), MEng and PhD from National University of Malaysia in 2001, 2003 and 2009, respectively. He is currently a Chemical Engineering lecturer and researcher in the School of Engineering, Monash University Malaysia. He is a Graduate Engineer registered under Board of Engineers Malaysia (BEM) and he has been awarded Chartered Chemical Engineer status and elected to Chartered Membership of Institution of Chemical Engineers (IChemE). His current research interests include sustainable solid waste management, biofuel production, and wastewater treatment. He has published a book, a book chapter and more than 70 articles in ISI-Web of Science journals with Scopus h index up to 24. He has been serving as an Associate Editor for the *International Journal of Environmental Science and Technology* (Impact factor: 1.915, Springer) as well as Editorial Board Member for *Electronic Journal of Biotechnology* (Impact factor: 1.527, Elsevier) and the *International Journal of Recycling of Organic Waste in Agriculture* (Scopus indexed journal, Springer).

Assoicate Professor Siang Piao Chai received his PhD degree in Chemical Engineering from Universiti Sains Malaysia. He is currently an Associate Professor and Deputy Head of School (Research) for School of Engineering. He is also the Head of Nano-Analytical Platform at Monash University Malaysia. Dr Chai is an active researcher in the areas of catalysis, photocatalysis, and reaction engineering. His current research interests are centered on the development of advanced hybrid composites for environmental remediation and renewable fuels in photocatalysis. He has published more than 120 papers and accumulated citations of over 4000.



MONASH TAKES AUSTRALIAN TOP SPOT IN PRESTIGIOUS NATURE INDEX

Monash has taken top spot in Australia in the global rankings of the influential Nature Index, which measures universities' contribution to high-quality scientific research papers. This is a shift from the number two spot in 2016.

We ranked first in Australia and 90th globally, according to the latest annual tables from the Nature Index, recently published by the Nature Publishing Group.

The Nature Index is based on an institution's contributions to the publisher's top-tier journals, taking in about 60,000 high-quality papers each year. It counts both the number of articles by Universities and research institutions, and the relative contribution of the authors using the Weighted Fractional count.

The Nature Index Annual Tables are a snapshot of the Nature Index which is updated monthly.

According to the latest results, Australia placed 12th globally for its contribution to scientific research papers. Australia has ten universities and one research group (CSIRO) in the top 500 institutions in the index, which tracks over 8,000 institutions worldwide. The US leads the index, followed by China, Germany, the UK and Japan.

The Nature Index shows Monash researchers contributing to 401 articles in 2016. These articles were primarily in the area of Chemistry where Monash was placed 89th globally. We were also listed in the top 100 globally for our contribution in Earth and Environmental Sciences, where we ranked 61st.

University Provost, Marc Parlange, said Monash's impressive Nature Index ranking highlighted the significant contribution our academics were making to global scientific research.

"Our number one position in Australia is testament to the number of contributions our academics have made to high-quality scientific research papers over the past 12 months and reflects the ongoing commitment of our academics and the impact of their work."

"This is about impact of our research on industry and on the lives of people around the world that has far-reaching and positive effects," Professor Parlange said.

DEPARTMENT RESEARCH PUBLISHED IN *NATURE*

Research from Department academics Xiongfeng Lin, Udo Bach and co-authors was published in *Nature Communications* in September.

Their paper, *Dipole-field-assisted charge extraction in metal-perovskite-metal back-contact solar cells* examines hybrid organic-inorganic halide perovskites and presents a simple gold-perovskite-gold back-contact PSC (bc-PSCs) with a built-in potential and photovoltaic response.

Abstract
Hybrid organic-inorganic halide perovskites are low-cost solution-processable solar cell materials with photovoltaic properties that rival those of crystalline silicon. The perovskite films are typically sandwiched between thin layers of hole and electron transport materials, which efficiently extract photogenerated charges. This affords high-energy conversion efficiencies but results in significant performance and fabrication challenges. Herein we present a simple charge transport layer-free perovskite solar cell, comprising only a perovskite layer with two interdigitated gold back-contacts. Charge extraction is achieved via self-assembled monolayers and their associated dipole fields at the metal-perovskite interface. Photovoltages of ~600 mV generated by self-assembled molecular monolayer modified perovskite solar cells are equivalent to the built-in potential generated by individual dipole layers. Efficient charge extraction results in photocurrents of up to 12.1 mA cm^{-2} under simulated sunlight, despite a large electrode spacing.

Dipole-field-assisted charge extraction in metal-perovskite-metal back-contact solar cells
Xiongfeng Lin, Askhat N. Jumabekov, Niraj N. Lal, Alexander R. Pascoe, Daniel E. Gómez, Noel W. Duffy, Anthony S. R. Chesman, Kallista Sears, Maxime Fournier, Yupeng Zhang, Qiaoliang Bao, Yi-Bing Cheng, Leone Spiccia & Udo Bach
Nature Communications 8, Article number: 613 (2017)
doi:10.1038/s41467-017-00588-3

Associate Professor Victoria Haritos and colleagues also had their research on the engineering of a mesohalophilic carbonic anhydrase published in *Nature Communications*.

Rational engineering of a mesohalophilic carbonic anhydrase to an extreme halotolerant biocatalyst
Andrew C. Warden, Michelle Williams, Thomas S. Peat, Shane A. Seabrook, Janet Newman, Greg Dojchinov & Victoria S. Haritos
Nature Communications 6, Article number: 10278 (2015)
doi:10.1038/ncomms10278

POSTGRADUATE OPPORTUNITIES

PhD

Monash Engineering operates at the forefront of engineering research. All specialised fields of research are at world standard or above and the most recent Excellence in Research for Australia assessment has rated our research results well above world standard. With access to world-class laboratories, workshops and facilities and with highly specialised equipment and software, a PhD in Engineering offers you a stimulating, supportive and professional environment in which to explore engineering challenges and develop solutions for the future.

A PhD in Engineering takes the form of the Monash Doctoral Program – a PhD for the 21st century. The program consists of extensive, independent research of a topic formulated in consultation with academic staff. A minimum of two academic supervisors will support you throughout your study. As part of the program you will also complete a series of professional development activities or coursework units that provide you with the skills required to make an impact in academia, industry, government or the wider community. Your study will result in a research thesis or alternative approved output, which makes a valuable contribution to the current body of knowledge on your chosen topic.

Our research explores a wide range of chemical engineering disciplines, including chemical reactor engineering, coal conversion processes and particle technology. And our researchers are leading the way. Not only are we the number one chemical engineering faculty in Australia – we're among the very best in the world.

Our expertise

Our research here at the Department of Chemical Engineering at Monash is organised into six key areas.
http://www.monash.edu/engineering/departments/chemical/research/department-research-expertise

Why join Monash?
Monash University is ranked as the best university in Australia for engineering and technology by the Times Higher Education, 2016-2017.

What's more, Monash itself is in the top 1 per cent of world universities according to the Times Higher Education World University Rankings 2016-2017, and a member of the prestigious Group of Eight Universities here in Australia.

A full-time funded scholarship is available from outstanding candidates for PhD study in Chemical Engineering.

Chemical Engineering Higher Degree by Research enquiries.
Email us at: chemeng-hdr.enquiries@monash.edu

Masters

Master of Advanced Engineering Coursework (Chemical Engineering) enquiries
https://www.monash.edu/engineering/masters
Email us at: chemeng-pgcoursework.enquiries@monash.edu

SMUCE - SOCIETY OF MONASH UNIVERSITY CHEMICAL ENGINEERS

As is the case with every year, 2017 has flown past our eyes. Over the past semester, a lot has happened with SMUCE. Once again, SMUCE Ball was a great success. With the theme of "All Class", the stars shone and a great time was had by all who attended: students, lecturers, and academics. Held at the glamourous Lincoln of Toorak, it was a night where everyone took a step aside from the hustle and bustle of university to relax, socialise and spend one night away from the computer labs. Another event that SMUCE held was the joint BBQ between SMUCE and CEPA. Providing an insight into what postgraduate studies may entail, the event showed students the different pathways their Chemical Engineering degree can take them. As usual, Industry seminars were held weekly, while GroupUp was created to assist with difficult units. Overall, 2017 saw many things happen under SMUCE. Congratulations to the 2017 committee and good luck to the incoming 2018 committee.

SOCIETY OF MONASH UNIVERSITY CHEMICAL ENGINEERS

Linking students with industry
CONTACT smuce@monashclubs.org
to organise your opportunity to connect with the Chemical Engineering students at Monash University

RENEWAL OF ANFF-VIC TECHNOLOGY FELLOW AMBASSADORSHIP FOR UDO BACH

ANFF VICTORIA

Department academic Professor Udo Bach has had ANFF-VIC Technology Fellow Ambassadorship renewed for 2017-2018.

The fellowship would grant $60k in instrument usage, as well as – and this is new – a potential $5k voucher for usage at ANFF-VIC funded hub capabilities.

RUSSELL SCOTT AT GRADUATION CEREMONY

At the University's invitation, Russell Scott delivered a speech at the Monash Graduation Ceremony on 24 October 2017.

Russell Scott has enjoyed a long and distinguished career in the engineering services industry following a career start in the petrochemical industry. Recently, Russell retired as Chairman of ThyssenKnupp Industrial Solutions (Australia) following several years as CEO of ThyssenKrupp Uhde's global Oil & Gas Business Line. Prior to that appointment, Russell was Managing Director of Uhde Shedden Australia headquartered in Melbourne and Managing Director of Uhde Asia Pacific with responsibility for all the Uhde companies operating in the Asia Pacific region out of offices in Australia, Thailand, China and Mexico.

Russell holds a Bachelor of Engineering (Chemical) Degree from Monash University and is a Fellow of the Institution of Engineers Australia (EA), a Fellow of the Institution of Chemical Engineers (IChemE) and a Fellow of the Royal Australian Chemical Institute (RACI).

Russell was Chair of the Chemeca Conference in 2007, Chair of the IChemE in Australia Board in 2008 and was elected international President of IChemE in May 2012 having served on Council as Vice-President International for several years. Russell is currently immediate Past President of the Asian Pacific Confederation of Chemical Engineering (APCChE) and is a member of the World Chemical Engineering Council.

In 2011 Russell received the Fluor Award of Excellence in Chemical Engineering for exceptional achievement in Management and Leadership and in 2013 was voted the Alumni of the year by Monash University's Engineering Faculty. In 2016 Russell was awarded the Chemeca Medal, the most prestigious award in the chemical engineering profession in Australia and New Zealand.

CONGRATULATIONS TO PROF GIL GARNIER

Professor Gil Garnier has been awarded the L R Benjamin Medal by the Australia and New Zealand Pulp and Paper Industry Technical Association (APPITA)

The Appita L R Benjamin Medal is Appita's highest award, given for outstanding contribution to the scientific and/or technological development of the Australia and New Zealand pulp and paper industry. The contribution must be largely personal, and could be in research, development, engineering or management.

This award was instituted in 1971, and there has been 34 awardees in 46 years since its inception.
Let us congratulate Gil on this well-deserved achievement, not just for him but also for the department and the university.

GIRLS MAKE GAMES

Pre-registration is now live! Link: http://girlsmakegames.com/registration.html

At this time we're offering an early registration discount of AUD 50 (automatically applied when registering).

We also offer need-based financial aid scholarships. Families may apply for scholarships by completing the financial aid application found here: http://girlsmakegames.com/ausreg.html

PLATINUM SEMINAR NOW AVAILABLE ONLINE

Benny Freeman is the Richard B. Curran Centennial Chair in Engineering at The University of Texas at Austin.

He is a professor of Chemical Engineering and has been a faculty member for 28 years. He completed graduate training in Chemical Engineering at the University of California, Berkeley, earning a PhD in 1988. In 1988 and 1989, he was a postdoctoral fellow at the Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (ESPCI), Laboratoire Physico-Chimie Structurale et Macromoléculaire in Paris, France. Dr Freeman was a member of the chemical engineering faculty at NC State University from 1989 – 2002, and he has been a professor of chemical engineering at The University of Texas at Austin since 2002. Dr Freeman's research is in polymer science and engineering and, more specifically, in mass transport of small molecules in solid polymers. He currently directs 12 PhD students, 2 postdoctoral fellows, and 3 visiting scholars performing fundamental research in gas and liquid separations using polymer membranes. His research group focuses on structure/property correlation development for desalination and gas separation membrane materials, new materials for hydrogen separation, natural gas purification, carbon capture, and new materials for improving fouling resistance and permeation performance in liquid separation membranes.

Polymer Membranes for Gas and Liquid Separations

In the past 30+ years, polymer membranes have emerged as a viable and widely used technology to separate gas mixtures and purify water via desalination and filtration of, for example, wastewater. In desalination, for example, reverse osmosis membranes are the dominant technology for desalinating seawater, displacing thermally driven processes in much of the world. In gas separations, polymer membranes are widely used for air separation and hydrogen purification, and they are increasingly being used for natural gas separation.

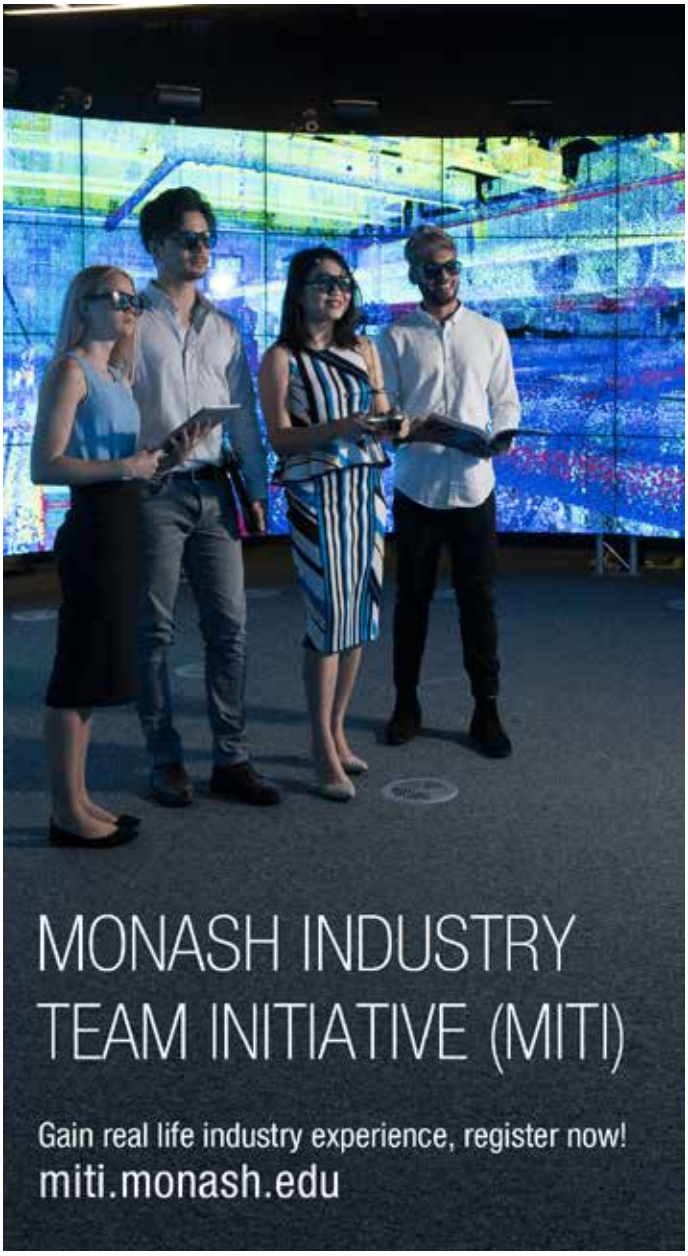
In recent times, focus on grand challenges facing mankind, including development of energy-efficient methods to provide clean water in both the developed and developing world and mitigate carbon dioxide levels in the atmosphere, have driven research into new platforms of membranes in our laboratories. Additionally, the strong and often competing connections between water, energy, and food production, coupled with the shale gas and shale oil revolution currently under way in the United States, are providing new opportunities for low-energy separations.

This presentation will focus on three stories, the first two of which will focus on gas separation membranes and be short summaries of previous studies. In the first, membrane materials were developed with a specific affinity for CO_2, resulting in membranes that are currently used for CO_2 removal from H_2 in H_2 production and in large-scale field tests for post-combustion carbon capture. In the second, careful control of local scale polymer structure was used to design high flux membranes to remove oxygen from air membranes. These membranes are being considered for next-generation inerting of commercial aircraft fuel tanks, among other applications.

Finally, the third (and most extensively discussed topic) focuses on charged polymer membranes, which are widely used for water purification applications involving control of water and ion transport, such as reverse osmosis and electrodialysis. Improving membranes for such processes would benefit from more complete fundamental understanding of the relation between membrane structure and ion sorption, diffusion and transport properties in both cation and anion exchange membrane materials. Ion-exchange membranes often contain strongly acidic or basic functional groups that render the materials hydrophilic, but the presence of such charged groups also has a substantial impact on ion (and water) transport properties through the polymer.

We are exploring the influence of polymer backbone structure, charge density, and water content on ion transport properties. Results from some of these studies will be presented, focusing on transport of salt, primarily NaCl, through various neutral, positively charged and negatively charged membranes via concentration gradient driven transport (i.e., ion permeability) and electric field driven transport (i.e., ionic conductivity). A long-term goal is to develop and validate a common framework to interpret data from both electrically driven and concentration gradient driven mass transport in such polymers and to use it to establish structure/property relations leading to rational design of membranes with improved performance.

The recording of Benny Freeman's seminar can be accessed via this link: https://echo360.org.au/media/873f5168-dfb3-4b33-8ba2-04e19be0a7c1/public



Watch this message from the Director of MITI

THE MITI PROGRAM FOR STUDENTS AND INDUSTRY

The MITI Program Brings Talented students and Industry together. Students can now register their interest for the MITI 2017/18 program.
By registering your interest you will be kept in the loop when new projects open for application over the coming months.

More information is available on the MITI website (miti.monash.edu)

MITI for Students
Be part of a multi-disciplinary team that is solving real business problems
Give yourself an edge in a competitive job market
Gain insights into your future profession
Learn from your peers in other disciplines

MITI for Industry
Benefit from an energetic multi-disciplinary team committed to delivering on time and on budget
Achieve creative and immediate solutions to your business needs
Access diverse ideas through the interaction of disciplines
Get access to dynamic new talent

PROFESSOR HUANTING WANG ELECTED TO AIChE FELLOW

Professor Huanting Wang has been elected by the AIChE Board of Directors to be an AIChE Fellow, the highest rank of membership within AIChE. It is a recognition of his high international standing in the field of chemical engineering and excellence in professional accomplishments and service over an extensive period of time. Huanting is also a Fellow of the Royal Society of Chemistry, another very prestigious election only offered to a select few.

Congratulations Huanting on this wonderful accomplishment for not just himself but also the department and the university.

STUDENT ROMESH WIJESIRI SELECTED TO ATTEND UN CLIMATE CHANGE CONFERENCE

Department PhD student Romesh Wijesiri was selected to attend the UNFCC COP23 (UN Climate Change Conference) in Bonn, Germany earlier in November. At COP23 nations of the world met to advance the aims and ambitions of the Paris Agreement and achieve progress on its implementation guidelines.

Romesh is a PhD student working on developing a novel process for capturing CO_2 (carbon dioxide) directly from air for the mitigation of CO_2 emission induced climate change. He hopes to use the data collected from his laboratory scale studies to construct a pilot scale direct air capture facility, which will be the first of its kind in Australia.

Romesh believes attending COP23 has given him unique first-hand experience into how climate change policies are implemented and the roles that researchers and the industry play in policy-making.

"It was a great opportunity to network with parties involved in technology development, as companies and academics developing climate change mitigation technologies all attended the conference," he said. " I made a couple of valuable contacts in the US and in UK, who were working on direct air capture. Most notable was the 'Center for Carbon Removal', who work on the policy issues concerning deployment of these technologies."

"This may also pave the way for potential future collaborations between Monash University and other academic institutions and/or industry leaders working on CO_2 capture, and allow Monash to develop its international presence in this field."

One of the key discussion topics at the conference was how the nationally determined contributions, which are the emissions reduction targets agreed upon by the countries at COP21 (Paris agreement), fall short of the target of limiting global warming to 1.5 °C by 2050 (we are likely to reach about 3.5 °C).

As Fiji hosted COP23, there was also a big focus on adaptation rather than mitigation. As the Pacific Islands emit very low amounts of CO_2 compared to the rest of the world, completely stopping their emissions would have little impact and yet they would still face the worst of the effects of climate change (rising sea levels, ocean acidification).

Romesh graduated with a Bachelor of Engineering in Chemical Engineering from Monash University in 2015 and is currently completing his PhD under the joint supervision of Andrew Hoadley and Hasina Yeasmin from Department of Chemical Engineering, and Alan Chaffee and Greg Knowles from School of Chemistry. He presented his first conference paper at Chemeca 2017 in July and was awarded "The Fell Consulting Prize" for the best paper presented by a student.

After the conference I also visited Climeworks in Zurich, the first commercial direct air capture project that is currently under way.

In his spare time Romesh is studying for his Chartered Financial Analyst (CFA) Level 1 examinations. "In the long run I hope to bridge my technical background in chemical engineering, and my knowledge in finance gained from the CFA examinations, towards helping the development of sustainable technologies".

"As the constraints for emerging technologies mostly relate to funding rather than the technology, I would love to be in a position where I can carry out fundraising, marketing, etc for these projects".

While in Bonn, Romesh was interviewed by ABC Adelaide for their *The World Today* program (interview available online at (http://www.abc.net.au/radio/adelaide/programs/worldtoday/cop23-climate-change-summit-begins-in-bonn/9126016).

Romesh took advantage of his time in Europe to pursue another of his hobbies. As a wildlife photographer he traveled to Andujar, Spain on a personal trip to photograph the Iberian Lynx, the world's most endangered wild cat species.

CHEMICAL ENGINEERING POSTGRADUATE COMMITTEE WRAP UP

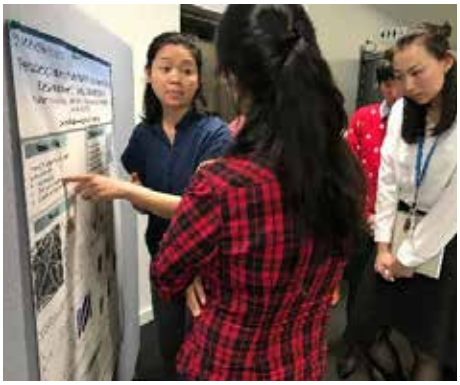
Elected in March, the 2017 CEPA committee has already provided a jam-packed schedule of both social and academic events for Chemical Engineering postgraduate students. The current count of postgraduate students in the department stands at 198, and without events run by CEPA many of these students would never meet their peers in other research groups or learn about their research.

So far this year, we have heard from our very own Dr Joanne Tanner about her experiences of academic life after gaining her PhD, and invited Valentina Mickovski from Monash Careers Connect to talk to the cohort regarding getting the most out of networking. In July, a site visit to the Eastern Treatment plant was organised, where 25 students were given a full comprehensive tour of the site by a previous Monash Graduate Engineer. As well as this, more social events such as the biweekly TGIF, an annual movie night and a joint BBQ with the undergraduate Chemical engineering group (SMUCE) meant that there was lots of communication both between the current PhD students and potential future postgraduates.

Perhaps the most anticipated event of the year was the 2017 CEPA conference. For the past seven years, CEPA has been organising a full-day conference where every postgraduate student has the option to present either an oral or poster presentation to their fellow students and academic staff in the department, with the chance to win some great cash prizes for their efforts. The conference is renown in the department to be a not-to-miss event, and this year's conference held on the 26th October was no exception. This year, 40 students took part in the presenting their work to the rest of the cohort, with the presentation topics reflecting the diverse range of research in the department. At the end of the day, the prizes for best poster, best oral speech, 2nd best oral speech and the people's choice award was handed out in a post-conference networking scenario. Negin Amini and Joel Samsu took out the 1st and 2nd place for the best oral presentation, while My Duyen Ho received an award for the best poster presentation. The audience also had their say on the day, with the prize for the People Choice Best Presentation awarded to Wenxin Mao for his Mid-Candidature presentation. Many thanks are extended to both the Chemical engineering department and the MPA for helping to fund this amazing event, which keeps gaining in strength from year to year.

And that's not all! Although the year is drawing to a close, there are many more scheduled events before the committee hands over the reins to the 2018 cohort. Not only are biweekly TGIFs scheduled until the final TGIC (Thank God it's Christmas) BBQ bash at the end of the year, but the annual Trivia night, a second industry site visit and a talk from a world-class speaker on reducing stress are also being planned! More information on these events will be circulated shortly.

All in all, CEPA has had busy and successful year, which would not have been possible without the full support of the Chemical Engineering Department.



Photos from the CEPA Conference

SPRAY DRYER ON THE MOVE TO THE HOME

We are very grateful to Ross Ellingham, Harry Bouwmeester, Martin Watkins and Kim Phu who transported a big spray dryer (monster) from the Department to the top of Green Chemical Future Building. They took on a task despite many people believing a specialist removal firm would be required.

As the original container wasn't available, and the spray dryer has an unstable platform and irregular shape and size, the team worked together bringing many years expertise and skill and designed and produced a stable and portable platform.

The spray dryer is now located on the top level of the Green Chemical Futures building, as part of the Monash Food Incubator. The spray dryer will be used for research and we also will work with companies who may want to use the spray dryer to produce samples of their products. The membrane rigs are also for research and development.

The food incubator space (which the lab is also a part of) was launched last month.

Monash Chemical Engineering leads Australian Universities in QS World University Rankings

Monash University has maintained its enviable position as Australia's leading chemical engineering faculty. Rankings from the QS World University Rankings, released in September 2016, saw the Department come in at 28th out of the 300 international Chemical Engineering faculties ranked.

Acting Head of Monash Chemical Engineering, Professor Sankar Bhattacharya, congratulated the staff on their commitment to teaching and research which saw Monash continuing in its leading position. "I would also like to show my appreciation to our former Head of Department, Professor Karen Hapgood, who over the five years of her tenure showed great leadership and commitment in shaping the Department".

28/300

Chemical Engineering School Worldwide

DEPARTMENT SUCCESSFUL IN LATEST ROUND OF ARC GRANTS

In the latest round of ARC grants, the Department has enjoyed great success across all three categories with seven successful applications. Together with the two ARC ITRH earlier in the year in Biofuels/Biochemicals and Low-emission separation, the year 2017 is perhaps the most successful year for the department in ARC funding. We congratulate all the recipients and indeed all the applicants this year. Special thanks to the mentors of all DECRA applicants and in particular those of Dr (Ms) Huacheng Zhang.

Details of the successful grants below:

DECRA
Dr Qinfu Hou - new knowledge of mixing and segregation in particle science and technology - with application in minerals/mining/metallurgy

Discovery Projects
Dr Huacheng Zhang - Engineered Ion Channels for Selective and Switchable Ion Conduction - with application among others for biomimetic design of artificial ion-channel membranes
A/Prof Matthew Hill - Direct Air Oxygen Capture - with application among others for design of efficient portable batteries for industrial and medical use
Prof Xiwang Zhang - Photocatalysis for water treatment
Prof Wenlong Cheng - Durable and wearable electronic skin sensors - medical applications
Prof Sankar Bhattacharya - UNSW led - Transforming complex waste to value-added products - application for processing automotive wastes

LIEF
Professor Udo Bach - Facility for electric and magnetic probes of materials - led by Prof Michael Fuhrer of Physics

AKSHAT TANKSALE FINALIST AT THE CHEMECA ACADEMIC SHARP BRAIN CONFERENCE

Dr Akshat Tanksale was selected as one of the finalist at the Academic Sharp Brain conference, a pitch deck competition held during Chemeca 2017.

The project, titled *Production of Diesel Additive Fuel Directly from Syngas,* which Akshat presented on behalf of his coworkers, examined (Poly)Oxymethylene Ethers (OMEn, n≥1), a class of second generation fuel components that can be blended with diesel in large volume fractions (>20%) to minimize soot emission, making transportation fuels more sustainable.

The group invented a two-step process in which they can convert renewable biomass feedstock into OME1, without the need to produce formaldehyde separately – as is the case in the traditional four step process.

In their invention both the reaction steps are carried over nanomaterial catalysts at low temperatures which significantly reduces the energy consumption in the production of OME1. The intermediate step of formaldehyde production, which happens in-situ in the liquid media, was also separately invented in their lab.

Academic Sharp Brain provides Chemeca participants the opportunity to pitch their innovative scientific- and technology-based ideas to the invitee experts and investors and to attract tangible (funds) and intangible (in kind support, mentorship) support developing business opportunities.

More information is available at the following sites:

Academic Sharp Brain - http://www.racicongress.com/Chemeca2017/academic-sharp-brain.php
https://www.youtube.com/watch?v=ZS_vQ0ObqaY

2018 INTERNATIONAL CONFERENCE ON BIO-INSPIRED MATERIALS AND MEMBRANES

The 2018 International Conference on Bio-inspired Materials and Membranes (IBMM2018) will be hosted in Melbourne between the 23 and 27 of January 2018.

The key objective of the conference is to bring researchers in the fields of materials and membrane together for potential interdisciplinary collaborations. Many leading researchers in the fields from Australia, UK, China, South Korea, Singapore and etc, have confirmed their attendances.

With an expected 150 delegates the conference will be a great opportunity to showcase the research strengths of the Department.

More information on the conference website (https://www.arc-eesep.com/ibmm2018)

www.arc-eesep.com/ibmm2018

CALL FOR ABSTRACTS

Draft Program

Tue 23 Jan 2018 7:00 pm: Welcome Reception
Wed 24 Jan 2018 9:00 am to 5:00 pm: Full Day Conference
Thu 25 Jan 2018 9:00 am to 5:00 pm: Full Day Conference
Thu 25 Jan 2018 6:30 pm: Conference Dinner
Fri 26 Jan 2018: Australia Day
Sat 27 Jan 2018: Day Tour and Campus Tour

Deadline for Abstracts
1 December 2017

Themes of the conference

- Synthetic, Biomimetic and Bioinspired Membranes
- Bioinspired Nanostructured Materials
- Bioinspired Interfacial Materials
- Design and Synthesis of Biomaterials
- Self-assembly and Bioprinting of Biomaterials
- Innovative Energy-efficient Separation Science and Technology
- Water and Wastewater Treatment
- Environmental Science and Technology
- Bioinspired Catalysts for Energy and Fuels
- Biosensor and Biomechanics

Confirmed Speakers

- **Dr Anita Hill (CSIRO)**
- **Prof Tony Fane (UNSW)**
- **Prof Lei Jiang (ICCAS)**
- **Prof Dongyuan Zhao (Fudan Uni)**
- **Prof Dan Li (Melbourne Uni)**
- **Prof Dan Wang (IPECAS)**
- **Prof Joe Da Costa (UQ)**
- **Prof Weishen Yang (DICPCAS)**
- **Prof Shaomin Liu (Curtin Uni)**
- **Prof Zongping Shao (Curtin Uni)**
- **Prof Mikel Duke (VU)**
- **Prof Lingxue Kong (IFM)**
- **Prof Liang-Yin Chu (Sichuan Uni)**
- **Prof Yanlin Song (ICCAS)**
- **and more: please refer to our conference website**

Venue

Pullman Melbourne Albert Park
65 Queens Rd, Melbourne VIC 3004

16 October 2017	**14 December 2017**	**23 January 2018**
Registration Open	Notification of Abstract Acceptance	Welcome Reception

MONASH University

ALUMNI NETWORKING NIGHT

The Head of Department, Professor Sankar Bhattacharya and current staff members invite you to an Alumni Networking night.

Tuesday, December 5, 2017

Department of Chemical Engineering Tour - 5pm to 6pm
tours will depart from the foyer of the Green Chemical Future Building and include:

1. Monash Food Incubator
2. The Society of Monash University Chemical Engineers (SMUCE) Office
3. New Horizons Building (82)
4. Chemical engineering lab tour building 37 (G09, G12 and G13
5. Drinks and canapes will be served from 6pm to 8pm

Drinks and canapes will be served from 6pm to 8pm
Level 4, Collaborative lounge, Green Chemical Future Building,
13 Rainforest Walk, Monash University Clayton

RSVP by Friday 3 December 2017
Please advise of any dietary requirements to Lilyanne Price lilyanne.price@monash.edu

Free Parking in Red and Blue parking bays after 5pm in North 1 multi-level car park

http://www.monash.edu/__data/assets/pdf_file/0010/71686/3-Claytoncolour.pdf

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