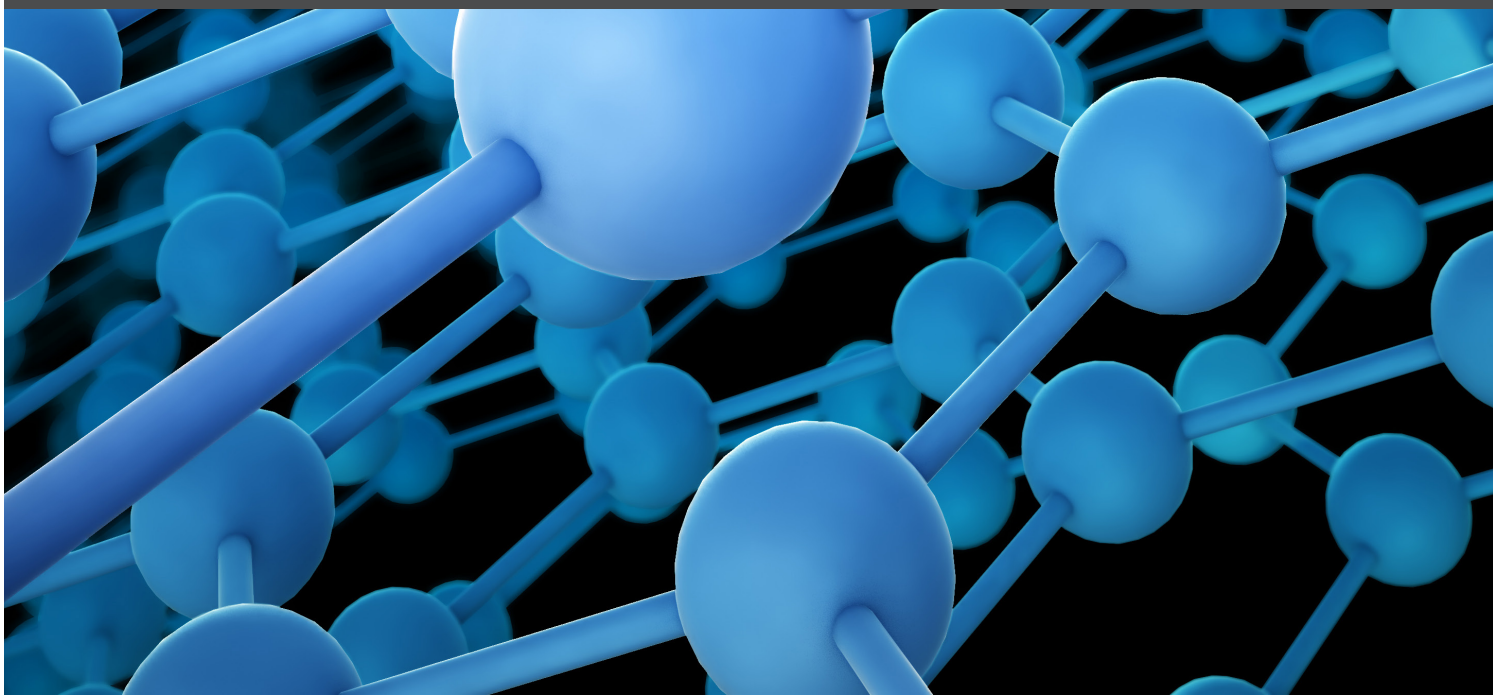
DEPARTMENT OF
CHEMICAL ENGINEERING
MONASH UNIVERSITY

focus

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

Chemical Engineering Focus Newsletter



NOVEMBER 2016
VOLUME 9, ISSUE 3

MONASH University
Engineering

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HIGHLIGHTS IN THIS ISSUE

NOVEMBER 2016
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ROSS PILLING HAS JOINED CHEMICAL ENGINEERING AS A PROFESSOR OF PRACTICE

We are pleased to announce that Ross Pilling has joined the Department as a Professor of Practice. Ross has recently stepped down as Chairman and Managing Director of BASF Australia and New Zealand, and is now a regular around Monash University with his involvement in the BASF Kids Lab (in GCF every year) and research functions including the Chemicals and Plastics Manufacturing GRIP. He is also a regular speaker at industry and research conferences and forums nationwide.

Professor Pilling is a national Councilor and Deputy President of the Australian Industry Group, and a board member of the CRC Polymers and PACIA.

The Professor of Practice recognises Professor Pilling's extensive contributions to chemistry and chemical engineering. He will be based in the department around one day a fortnight (18 Alliance Lane, Room 229, Building 36) and is keen to meet our staff and students (both postgraduate and undergraduate). He is particularly interested in organisations facing challenges (such as universities with changes to education and research), building leadership capacity and social responsibility, advanced manufacturing and helping build productive industry-university collaborations, where all parties gain from the arrangement. He will also be a terrific ambassador for Monash, the Department and our closely-related friends in materials and chemistry (and others) as he provides high-level input to strategic industry and government bodies around the country.

At a recent welcome event held for Ross Pilling, Prof Karen Hapgood (HOD) said "we are making initial plans for an alumni function with Ross as guest speaker. Ross is also likely to be a regular visitor at future departmental strategic retreats, and is looking forward to meeting people from across Monash on the days he is on campus".

About Ross Pilling

Ross Pilling's executive career has been built upon a strong belief in the importance of an advanced manufacturing industry for a balanced and healthy economy, and consequently the broader community.

Having extensive experience in highly regulated chemicals, manufacturing and services industries across Australia, Malaysia, Singapore and the UK, Ross is familiar with a wide range of industrial sectors, including agriculture, paints and coatings, construction, mining, personal care, home care, health and nutrition.

Ross recently retired as Chairman and Managing Director ANZ at BASF, and a member of the Asia Pacific Leadership Team (since 2008), where he designed and implemented a successful major transformation program. He also led the integration of four global acquisitions, driving operational synergies and cultural change while doubling revenues and increasing sites from three to 18.

Previously, Ross was Chairman and MD of BASF Asia Pac Service Centre in Malaysia, providing shared services to over 10,000 employees at 60 companies in 16 countries. During his earlier career, Ross worked in Australia and the UK, leading various businesses and corporate functions such as supply chain, strategic procurement and marketing.

Among many roles, Ross has been Deputy National President of the Australian Industry Group, a member of an Industry Advisory Committee at RMIT University, and a Member of the Prime Minister's Business Advisory Forum to COAG. He is a Fellow of the Australian Academy of Technological Sciences and Engineering, a Graduate of the AICD's Mastering the Boardroom Course and has a Master of Science from Cranfield, a Bachelor of Engineering with Honours and a CIM Diploma in Marketing.

He believes that business leaders have a responsibility to speak out on important issues and is a regular contributor to conferences and business forums on the topics of manufacturing, chemistry, sustainability, STEM education and youth engagement.

RESEARCHERS SUCCESSFULLY PRODUCE HYBRID NANO-SANDWICHES: A PLATFORM FOR HIGH-EFFICIENCY ELECTROCATALYSTS AND MOLECULAR SIEVING MEMBRANES

Monash Chemical Engineering PhD student Ms Yaoxin Hu and Research Fellow Dr Jing Wei in the Nanomaterials and Membranes Laboratory have successfully integrated graphene nanosheets with metal organic frameworks to produce hybrid nano-sandwiches.

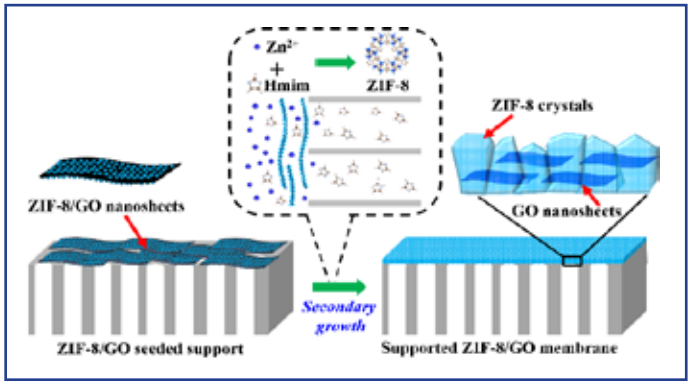
These hybrid nano-sandwiches can also act as a platform material to address the challenges in the scalable fabrication of defect-free, ultrathin metal organic framework membranes for molecular sieving separation, and in the development of high-efficiency electrocatalysts for advanced energy application.

In this research, ZIF-8 and ZIF-67, two types of metal organic frameworks, and graphene oxide (GO) were chosen to demonstrate the synthesis of 2D nano-sandwiches. The continuous ZIF layer of the nano-sandwiches effectively prevented the agglomeration of graphene during high-temperature treatment, while being converted to the N-doped nanoporous carbon layer with a high density of active sites for electrocatalysis. The resultant carbon nano-sandwiches had a high specific surface area, nanoporous structure and good electrical conductivity, all of which assisted fast mass transport and electron transfer in electrocatalysis.

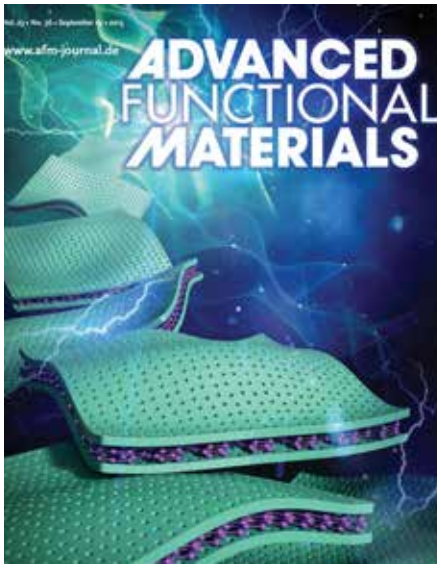
Importantly, such nanoporous carbon/graphene nano-sandwiches exhibited higher long-term stability and better methanol tolerance than commercial Pt/C materials in acidic media, and showed great potential to be used as high-efficiency electrocatalyst in fuel cells, supercapacitors, batteries, and for water splitting. This work was published in *Advanced Functional Materials* (2015, 25, 5768; highlighted on the back cover) and highlighted by Materials Views China.

2D nano-sandwiches were also used as nano-hybrid seeds for the preparation of ultrathin, defect-free ZIF membranes. ZIF-8/GO membrane with a thickness of as thin as 100 nm was fabricated using 2D ZIF-8/GO nanosheets as seeds and secondary growth on various porous substrates including ceramics and polymers.

This 2D nano-hybrid seeding strategy is simple and versatile for scalable fabrication of ultrathin, defect-free metal organic framework membranes for molecular sieving separation (*Angewandte Chemie International Edition*, 2016, 55, 2048).



READ MORE ABOUT PROFESSOR HUANTING'S GROUP



Professor Huanting Wang delivered a plenary talk at SCPPE 2016

Prof Huanting Wang was recently invited to give a plenary presentation entitled *New Strategies for Synthesis of Zeolitic Imidazolate Framework Molecular Sieving Membranes* at The 4th International Conference on Sustainable Chemical Production and Process Engineering. This was the 4th conference in its series since 2007, and it provided a unique forum for researchers and engineers around the world to assess and critique the current status and future directions of collaborative research and development in Sustainable Design of Materials and Process Innovations, and Energy-Water Sustainability.

MONASH STUDENT WINS PRIZE AT PERMEA & MELPRO CONFERENCE

We congratulate PhD student, Mr Ezzatollah Shamsaei who won the Best Oral Presentation award (voted by the Student Award Evaluation Committee) at PERMEA & MELPRO held in Prague (Czech Republic), during May 2016.

The international conference PERMEA & MELPRO takes place in one of the Visegrád group countries (Czech Republic, Hungary, Poland, Slovakia) every three years, with a focus on the preparation and production of membranes, and the assessment and utilisation of their separation properties.

The conference was visited by 265 participants from 33 countries, with over 240 presentations given (94 oral and 149 poster presentations). The winning presentations received awards from the European Membrane House, European Membrane Society and Czech Membrane Platform supported by the Visegrád Fund.

In his presentation, Ezzat highlighted his recently published works in ChemComm and *ACS Appl. Mater. Interfaces* on the development of metal organic framework (MOF) composite membranes for improved gas separation properties.

Ezzat believes that MOFs will be exploited in more and more practical applications in the future and although there are some obstacles to overcome, MOF membranes certainly bring a bright prospective for the large-scale separation applications. Ezzat thanks Monash University for the travel grant and his supervisor Prof. Huaunting Wang for his expert advice and outstanding support.

RECLAIMING COPPER FROM WASTEWATER: MONASH ALUMUS PART OF AWARD WINING TEAM

Congratulations to our Almnus Thapa Khagendra (completed his studies in 2009) who has had his project recognised with the top award at the Manufacturers Monthly Endeavour awards as winner Environmental Solution of The Year (Sponsored by Atlas Copco).This work, which he completed while workng for Bosch Australia, has also been published on the EPA's VIC website.

The Manufacturers' Monthly's 13th annual Endeavour Awards were held in May at the Novotel Sydney Olympic Park.

Bosch Australia saw a significant opportunity in waste treatment processes at its Clayton site to reclaim precious copper. The project involved a wastewater treatment process, enabling reclamation of dissolved copper from manufacturing wastewater. Reclaimed copper is recycled and treated wastewater used as a pH correcting reagent within the treatment plant onsite. Bosch has been able to prevent 40 tonnes of prescribed waste going to hazardous waste landfill and reclaim 1.2 tonnes of high-grade solid copper per annum from the wastewater. Through recycling and reclaiming the wastewater produced from their diode manufacturing process, the company has reduced its industrial monthly waste by 31%.

The full report is available on the EPA's website.

DEPARTMENT PROFESSOR SPEAKING AT THE EMS ENERGY INSTITUTE IN THE USA

EMS Energy Institute was pleased to host its Special Fall 2016 Energy Exchange Seminar Series, including two talks by our own Professor Sankar Bhattacharya

Sankar Bhattacharya
Professor & Deputy Head, Department of Chemical Engineering
Monash University, Melbourne, Australia

Thursday, September 8
Research on Gasification of Brown Coal and Biomass Using Fluidized Bed and Entrained Flow Reactors

Monday, September 19
Sankar Bhattacharya
Chemical Looping Application for Coal Combustion and Chemicals Production


energyXchange

SPECIAL FALL 2016 SEMINARS

Professor Sankar Bhattacharya
Deputy Head, Department of Chemical Engineering, Monash University, Melbourne, Australia

Professor Bhattacharya joined academia in 2009 after having worked for twenty-one years in industry - at the International Energy Agency in France, Anglo Coal Australia and CRC for Lignite in Australia, and Development Consultants in India. He commissioned the first Circulating Fluidized bed Combustion pilot plant in Australia, led the first Oxygen-blown pressurized Fluidized Bed and Transport Reactor gasification trials of Victorian brown coal, and worked on commissioning of coal-fired plants in India. He currently leads a group of 16 PhD students working on coal and biomass gasification, biofuels and chemical looping applications. Professor Bhattacharya holds a BEng degree in Mechanical Engineering from Jadavpur University-India, MS in Energy Technology from the Asian Institute of Technology –Thailand, PhD in Chemical Engineering from the University of Newcastle-Australia and Diploma in Management from the Melbourne Business School.

Seminar 10:30 - 11:30 am
Refreshments 10:00 - 10:30 am
C213 Coal Utilization Laboratory • EMS Energy Institute

Thursday, September 8 — **Research on Gasification of Brown Coal and Biomass using Fluidized Bed and Entrained Flow Reactors**

This presentation will first provide an overview of the fuels research at Monash University in oxy-fuel combustion, biofuels, and fuel cell areas. This will be followed by the presentation of outcomes from the gasification trials at bench to pilot plant scale – first using HTW gasifier and Transport reactors, and currently using entrained low reactors.

Monday, September 19 — **Chemical Looping Application for Coal Combustion and Chemicals Production**

Chemical looping is a rapidly developing process for CO_2 capture from coal combustion at potentially low energy and cost penalty. However, the principle is also being tried for a variety of applications. In This presentation will provide some of the key research outcome from the industry-funded chemical looping research aiming at CO_2 capture, and acid and hydrogen production.

This seminars are sponsored by:
PennState College of Earth and Mineral Sciences
Energy Institute

PIONEERING RESEARCH: NOVEL FORMALDEHYDE PRODUCTION METHOD FROM BIOMASS FEEDSTOCK

Pioneering work from Dr Tanksale and co-workers has proven that the aqueous phase method of hydrogenation of carbon monoxide into formaldehyde - one of the worlds most important bulk chemicals - addresses the current limitations and inefficiencies of current production methods.

Formaldehyde (HCHO) is one of the most important bulk chemicals in the world and is used as a feedstock in over 50 industries including resins (with urea, phenol, melamine, etc.), adhesives, plastics, foam, polyurethane paints, and disinfectants. Total global formaldehyde production is ~30 million tonnes per year and has been growing at a rate of 5.4% per annum worldwide. However, current methods of formaldehyde production from natural gas lead to ~57% exergy loss and therefore high CO_2 emissions.

An alternative is to produce formaldehyde via hydrogenation of CO and CO_2, but little attention has been paid to this method because it suffers from thermodynamic limitation in the gas phase. Moreover, their preliminary research shows that the same method can be used for carbon dioxide conversion into formaldehyde. Syngas (mixture of CO, CO_2 and H_2) can be produced from many sources, including natural gas, coal, and biomass. Lignocellulose biomass is especially considered as a vital resource for chemical production to achieve the low carbon emissions targets committed by the world in COP21, Paris.

Lignocellulose Biomass Conversion into Clean Syngas

Lignocellulose biomass gasification is a promising technology for delivering renewable energy. However, tar formation during gasification remains a challenge. This research provided an alternative method for lignocellulose biomass gasification over in-situ nickel based catalysts using a novel method known as reactive flash volatilization (RFV).

Several novel catalysts such as supported Ni, Pt-Ni, Ru-Ni, Re-Ni and Rh-Ni were investigated in this study. Microcrystalline cellulose (MCC) was chosen as the feedstock because of its highly crystalline structure. It was shown that up to 100% conversion of MCC can be achieved using Ru-Ni, Re-Ni and Rh-Ni catalysts at temperature of around 750°C with co-feed of oxygen and steam with negligible quantity of char and tar produced under the right conditions. The flow rate of MCC and the feed gases could be adjusted to control the ratio of H_2/CO in the product gas from 1 to 2. This is a clear advantage over the conventional gasification routes because this ratio is extremely important for downstream conversion processes.

For example, for methanol synthesis H_2/CO ratio of 2 is desirable, whereas for dimethyl ether and formaldehyde production the ratio should be close to 1. Subsequently, the kinetic parameters of RFV were determined for various feedstock, including MCC, xylan, lignin and lignocellulose biomass. It was determined that the RFV has three kinetic zones – (1) pyrolytic decomposition, (2) reforming, and (3) char gasification. Only reforming zone was found to be affected by the catalysts, whereas the other two were largely affected by the temperature and feed ratios only.

This insight was the first of its kind and it enabled further research into RFV of lignocellulose biomass such as pinewood and eucalyptus sawdust. Pinewood (softwood) and Eucalyptus (hardwood) are two very different types of wood because of their molecular structure and composition. They also contained different levels of ash. This research established the catalytic role of inorganic compounds found in the ash of these feedstock. Eucalyptus, which contained higher ash content, was significantly easier to gasify, achieving 100% conversion into clean syngas with tunable H_2/CO ratio.

Direct Conversion of Syngas into Formaldehyde

Industrially HCHO is produced in three stages – (a) Steam reforming of natural gas to produce syngas, (b) Methanol Synthesis and (c) partial oxidation of methanol to produce formaldehyde. Alternatively, HCHO is industrially produced via dehydrogenation of methanol. However, these are all high temperature and high pressure reactions and the products of each stage require large separation units for purification, which is the root cause of energy losses.

Dr Tanksale and co-workers have shown that the commercial method of HCHO production suffers from ~57% loss in exergy (i.e. energy quality). Given the large amount of formaldehyde (HCHO) produced in the world, when combined with the high losses in exergy, leads >60% energy loss and high CO_2 emissions, globally. Many researchers have proposed HCHO production directly from natural gas via partial oxidation. However, this method is unviable due to low yield of HCHO. The rate of HCHO decomposition into CO and H_2 is much greater than the rate of partial oxidation of methane, resulting in low HCHO selectivity at CH_4 conversions over 5%.

A more efficient and effective option is starting from syngas which contains H_2, CO and CO_2 and which can be obtained from renewable sources. Therefore, there is an urgent need to develop a method for producing HCHO from syngas as a feedstock. One of the main reasons why syngas to HCHO method was not investigated before is because this reaction is thermodynamically limited in the gas phase. The Gibbs free energy change (ΔG°) of this reaction is positive at 25°C and it increases with increasing temperature.

Therefore, this reaction is non-spontaneous and the equilibrium of this reaction favours the decomposition of HCHO.

Novel Formaldehyde Production Method from Biomass Feedstock, cont.

Recently Dr Tanksale and his team discovered an alternative method for the conversion of CO and H_2 directly into formaldehyde in aqueous medium. In the aqueous phase, the Gibbs free energy change of the reaction is negative at temperatures below 110°C (ΔG^{o}=-7.1 kJ/mol) and the equilibrium constant is several orders of magnitude higher than gas phase ($K_{25°C}$=17.33 mol^{-1}), which shows that formaldehyde formation is favourable in the aqueous phase.

Another advantage of the aqueous phase method is that commercially HCHO is sold in an aqueous solution. When HCHO is dissolved in water it reacts within 70 ms to form methylene glycol ($CH_2(OH)_2$). In the solution, HCHO and $CH_2(OH)_2$ co-exists in dynamic equilibrium with a HCHO/$CH_2(OH)_2$ ratio of 1:2499 at STP and pH = 7, which means 99.96% of HCHO is converted to CH2(OH)$_2$. Methanol is also used in the commercial solution to stabilise the hydrated formaldehyde. Therefore, HCHO produced in this project was instantly absorbed in water and stabilised by methanol, shifting the reaction equilibrium in the forward direction.

Furthermore, the team found out the reaction mechanism of this method, which showed that CO and H_2 soluble in the liquid phase directly react on the catalyst surface to produce HCHO. Therefore, increasing the solubility of feed gases and the stability of product in the liquid phase is important. The latest results showed that the yield of formaldehyde can be increased by a factor for four by using pure methanol as the solvent.

A STUDY EXCHANGE TO SOUTH DAKOTA UNIVERSITY

Monash Chemical Engineering PhD student Krystal Li recently spent time at the South Dakota State University (SDSU). Here she writes about her experience in the USA

The partnership between Monash University and South Dakota State University (SDSU) via the Australia Research Council (ARC) and Dairy Management Inc. grant, has allowed me to live 'the American Dream', at least for three months. Travelling over 15,000 km brought me to the relatively small town of Brookings, South Dakota (net population of 23,000), where SDSU is located. My research work was carried out at the Institute for Dairy Ingredient Processing Dairy Science Department with Professor Lloyd Metzger and Dr Hasmukh Patel (Land O'Lakes), utilising technologies such as cavitation and carbon dioxide injection to reduce the viscosity of high protein concentrates prior to spray drying. A reduced viscosity of the concentrate ultimately signifies huge savings in cost and energy requirement as drying can occur at higher solid content. This exchange programme has allowed me to gain valuable hands-on experience in industrial manufacturing processes such as membrane filtration, large-scale spray drying, and evaporation. It will immensely help my subsequent research in optimising the spray drying operation, while maintaining excellent functional properties of the final powders.

In addition to my research, the opportunity has provided me with an amazing platform for immense personal growth and development. Saying that the people of Brookings are friendly and nice is an understatement! They are so amicable and open that it made the transition from Melbourne to South Dakota very smooth. I forged friendships with many of the locals in Brookings. It was an unparalleled experience spending time at the pubs playing pool Downtown, playing 'Frisbee Golf', shooting at target range (I can assure you no animal was killed), fishing, experiencing the 4th of July fireworks and many more experiences. The fauna and flora are simply magnificent, with acres of green pastures, lakes, forests and native animals such buffalos, pheasants, jackrabbits (the SDSU mascot) and prairie dogs.

The opportunity to represent Monash in this programme was an absolute honour and enriching experience, and that would not have been possible without my astounding supervisor, Professor Cordelia Selomulya. I am finally back in Melbourne and I now feel refreshed and fully motivated to continue and complete my research.

ALUMNUS CHIRANJIB SAHA PURSUING A CAREER IN CLEAN POWER GENERATION

Monash alumnis Dr. Chiranjib Saha feels that his major focus during his career is that scientific research should be for practical application. He completed his PhD in 2013 in energy and fuel research under the supervision of Dr Sankar Bhattacharya. During his PhD he developed a fundamental understanding of Chemical Looping Combustion (CLC), a promising technology pathway for easier ecosnomcal CO2 capture from the combustion of Victorian Brown Coals and other low-rank coals for thermal power generation. His research was the first-ever study of CLC using brown coals. During his time at Monash, Dr Saha received several accolades including the Young Research Scientist Prize from Royal Society of Victoria and the Best Energy Project at the Australian Institute of Energy's annual conference.

Immediately after completing his PhD in 2013, Dr Saha gained employment at the CanmetENERGY Technology Center, Ottawa Division in the Clean Electric Power Generation (CEPG) group.

The experience of working at CanmetENERGY helped Dr Saha quickly understand the great challenge of clean power and CO_2 capture research at an industrial scale. To progress towards meeting this challenge, Dr Saha joined the Southern Research (SR) and the National Carbon Capture Center (NCCC).

At NCCC, Dr Saha continues to pursue a career in clean power generation research and CO_2 capture technology development. Dr Saha currently leads and technically manages research projects in the demonstration of various types of CO_2 capture technologies.

NCCC, which is sponsored by the U.S. Department of Energy (DOE) and managed and operated by Southern Company, is one of the largest facilities of its kind in the world dedicated to the development of cost-effective CO_2 capture technologies for coal-fired power generation. As part of SR at NCCC, Dr Saha has served several CO_2 capture technology developers at large bench scale, pilot or higher scales. Some of the major clients served, but not limited to, are General Electric (Global Research Center), Cansolv (Shell) Technologies, Linde (R&D), Air Liquide, Mississippi Power's Kemper County Energy Facility, Electric Power Research Institute (EPRI), etc. Dr. Saha is the member of Industrial Advisory Board (IAB) under DOE and National Energy Technology Laboratory's (NETL's) Carbon Clean Simulation Initiative (CCSI) tool set development program representing SR and NCCC.

STUDENT GRACE TALBOT-WALSH AT THE YOUNG WOMEN SCIENTIST CAMP AND SMART SISTER WORKSHOP

Monash Chemical Engineering Student Ms Grace Talbot-Walsh has recently returned from the 2016 Young Women Scientist Camp and Smart Sister Workshop in Korea. Here Grace reports on the conference and her highlights.

On the 20th of October, I was granted the opportunity of flying to Korea to attend the 2016 Young Women Scientist Camp and Smart Sister Workshop, courtesy of the association of Korean Women Scientists and Engineers (KWSE). The event was held in the City of Daejeon, a hub of scientific research and the home of the renowned Korea Advanced Institute of Science and Technology (KAIST) University lending to the city being widely known as 'the Silicon Valley of Korea'.

Over 150 young women from 24 countries attended the 2-day event on the 22nd-23rd October, with myself and Ms Brianna Ganly from the University of New South Wales chosen to represent Australia for the duration of the camp. The aim of the event: to provide a strong networking platform for young female scientists and engineers from around the Asia-Pacific region, and to discuss ways in which to reduce the disparity of females in these fields.

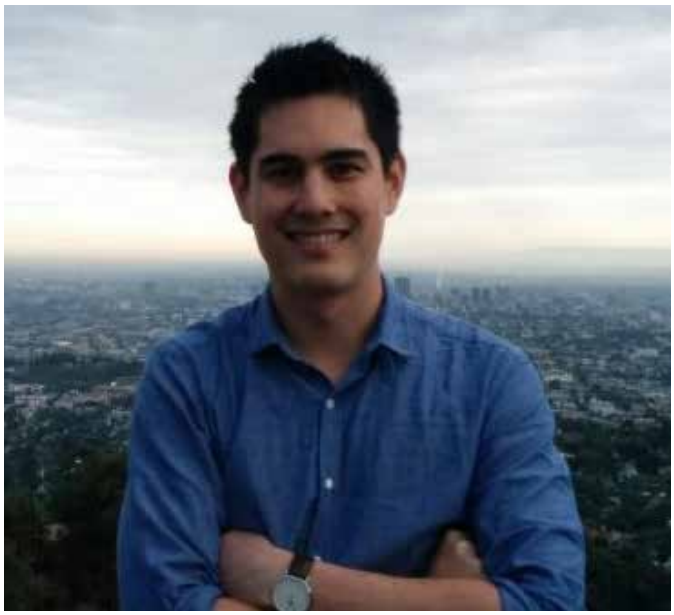
After registration and welcome talks, the camp was initiated through the opening of each countries respective 'stalls'- a chance for each country to display photos and artefact's representative of the candidates country, and provide a relaxing environment for initial introductions. After a traditional lunch, we were updated on regional KWSE events and programs aimed at providing strong networks for Korean female scientists and engineers, followed by individual participant oral and poster presentations, where each candidate was given the opportunity to share their academic research. All participants were then invited to attend the welcome dinner dressed in their country's traditional native dress, with spare Korean national outfits available for the countries without their own formal dress wear. The dinner was then opened by a breath-taking live Tae-Kwon-Do performance by the black-belt students at the local university.

Much of the second day was spent in listening to distinguished speakers addressing the issue facing Korean Women in the STEM fields, and the changing demographic of employed females in the sector. The afternoon was dedicated to thought-provoking discussions and sharing of ideas through small mentor-lead consultations, followed by the formation of a panel debate in which one person from each country was chosen to represent their thoughts on multiple global issues. Although many topics were deliberated, the underlying theme of future female contribution and increasing gender equity was considered key to advancing the future of STEM research. After the serious nature of these topics, everyone was invited to warm up and unwind with a quick K-Pop dance session!

All too soon, the closing dinner was over, and the event was formally closed. However, the connections made at the camp were not as quick to end, with future networking opportunities and meetings being discussed throughout the room. The aim of the camp was evidently achieved and undoubtedly successful- as the connections made at the camp between so many like-minded young women are sure to stay with us for years to come.

HOW TO BUILD SUCCESS

Alistair Michener founder and CEO of Drawboard, an IT company specialising in collaborative drawing markup for engineering and construction professionals, caught up with Matt Hamilton from Alumni Recognition and Engagement to talk about how Monash University shaped the young entrepreneur.



You studied a Bachelor of Chemical Engineering and a Bachelor of Commerce at Monash. What did you learn at Monash that helped set you up in your career?

I learnt that unlike high school, there's no such thing as direct analytical answers. When it comes to Chemical Engineering, you need to find the answer with limited resources. It forces you to work with others and tackle problems from different angles.

You manage a team of developers at Drawboard. What is the most important management skill that someone in your position should possess?

Everyone is different and you need to accommodate that. Developers are the most important resource a software company has and they have different needs to sales, product, or finance people. They may refer to themselves as scientists (they do study computer science after all) and can be very meticulous with how they operate. The range of different requirements from developer to developer is large and so trying to be tolerant and flexible is important.

What is the one piece of advice that you would offer to current students who are considering starting their own company after graduation?

My advice would be that they should have a great and well thought out idea, and be prepared to go the extra mile to achieve it. It's a lot of hard (but rewarding) work. I say it needs to be a great idea because I have come across quite a few 'wantrepreneurs' who aren't idea-led.

You do a lot of international travel in your role. What tips or tricks allow you to conduct business effectively overseas?

Make sure you are punctual and come with an agenda. Be prepared with material and let them know what you want to discuss. The most important thing you can do is to make sure you follow up with notes/minutes of the meeting and chase up tasks if there are any - as soon as possible.

VIDEO: A DAY IN THE LIFE OF A C&P INNOVATION NETWORK GRIP: PHD RESEARCHER AT MONASH UNIVERSITY

Video produced by C&P Innovation Network PhD researcher Vu Dao.

'The Chemicals and Plastics Innovation Network and Training Program' is led by Monash University and the Plastics and Chemicals Industries Association (PACIA) and underpinned by support from the Victorian Government and 20 industry members that are a combination of multinationals and SMEs.

There are 17 industry partner driven PhD innovation projects where the PhD researchers have an internship with industry. The PhD researchers have 60 additional training modules jointly delivered in partnership with industry on technical and business topics. The C&P Network also has combined events with industry including training, site visits, networking events and innovation showcases.

CHEMICALS AND PLASTICS 'INNOVATION SHOWCASE AND SYMPOSIUM'

Monash University and the Plastics and Chemicals Industries Association (PACIA) held the inaugural C&P 'Innovation Showcase and Symposium' in the Green Chemical Futures Building at Monash University on 2 June 2016. The event was an opportunity for all stakeholders to view progress after one year and gave an opportunity for potential future PhD students, supervisors and companies to find out more about 'Manufacturing Innovation' and this collaborative innovation program with industry.

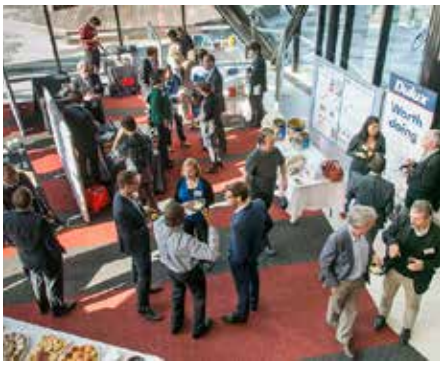
'The Chemicals and Plastics Innovation Network and Training Program' is led by Monash University and the Plastics and Chemicals Industries Association (PACIA) and underpinned by support from the Victorian Government and 20 industry members that are a combination of multinationals and SMEs. There are 17 industry partner driven PhD innovation projects where the PhD researchers have an internship with industry. The PhD researchers have 60 additional training modules jointly delivered in partnership with industry on technical and business topics. The C&P Network also has combined events with industry including training, site visits, networking events and innovation showcases.

Jeff Malone the General Manager Australia of SRX Global gave an enlightening presentation on 'Manufacturing Innovation'. He explained SRX's operational re-alignment where they have had a total shift and created a new market that did not previously exist. They have dedicated capacity and staffing solely to prototypes, embraced full product build and test, improved service flexibility to work efficiently with innovators, partnered strategically with innovative companies to provide them an end to end solution, and established long term collaborative relationships with Industry Networks, Clients and suppliers. He also explained the SRX innovation process.

Dr Tim Davey the Research Manager at Dulux Australia discussed the 'Industry perspective of being in the C&P Innovation Network program'. He explained the benefits he saw with Dulux having a PhD researcher with the C&P Manufacturing Innovation Network and Training program.

The C&P PhD researchers gave 3 minute presentations summarising their Innovation Demonstration Projects. They also ran a session 'A day in the life of a C&P Innovation Network GRIP PhD researcher' at Monash University where after showing a video of their experiences in the C&P program they separated into three groups to have interactive sessions on the 'C&P Graduate Research Interdisciplinary Program experience', 'Our potential impact on worldwide mega trends' and 'Potential industry outcomes from our research'.

The C&P PhD researchers each had an Innovation Demonstration Project showcase with posters and displays together with their industry company. These Network industry companies include 3M Australia, Agilent Technologies, Axieo, BASF Australia, Dulux, Haymes, Nufarm, PerkinElmer, PPG Industries, P&G, KPMG, CSIRO and EPA Victoria. There were over 60 attendees at the C&P 'Innovation Showcase and Symposium' this included staff from the Network industry Companies and other companies considering joining the network in the next round.



MONASH HELPS SHAPE AN INDIGENOUS FUTURE IN ENGINEERING

During September a group of year 11 and 12 Indigenous students selected from across Australia visited the Faculty of Engineering to find out more about what it is like to study and work in this field.

Monash, The University of Melbourne, Swinburne and RMIT Universities hosted the inaugural Victorian Indigenous Engineering Winter School (VIEWS) as part of their commitment to greater representation of Indigenous Australians in the field of engineering.

With only 53 Indigenous students graduating in Engineering Australia-wide in 2014 (and 179 in the four years from 2010 to 2014, according to Department of Education and Training), Indigenous communities are largely under-represented in this field. Obstacles include the mathematics requirements and high ATAR. Programs such as VIEWS aim to address this.

Participants in the winter school, which ran across the four universities for five days, had the opportunity to learn about different pathways into engineering and hear first-hand from current Indigenous engineers and engineering students. Students gained an appreciation of what an engineer does and the value they add to improving the lives of people across the globe. The program forms part of Monash University's Reconciliation Action Plan aimed at advancing the education, research and employment aspirations of Aboriginal and Torres Strait Islander people. Professor Frieder Seible, Deputy Vice-Chancellor and Vice President (Enterprise) and Dean, Faculty of Engineering and Faculty of Information Technology welcomed the initiative.

"This was an exciting opportunity for year 11 and 12 Indigenous students to experience some of what the world of engineering has to offer here at Monash. Fostering a diverse and inclusive culture is at the heart of what we do here and part of this is our commitment to advancing the education and research aspirations of Aboriginal and Torres Strait Islander students in the field of Engineering," Professor Seible said.

Jordan Carter (pictured above) is in his final year of Chemical Engineering at Monash University. As an Indigenous student who has taken the pathway, Jordan now encourages high school students to pursue a career in Engineering.

"This winter school program opens students' eyes to the types of courses available in Engineering and career opportunities. It's also important for Indigenous students who don't achieve a high enough ATAR, so they understand there are other pathways into Engineering."

Jordan received the Jenkins "Follow your dream" bursary a couple of years ago - an annual award from one of our alumni David Jenkins, which supports underrepresented groups in engineering including indigenous students as 1st priority, followed by students from a rural or remote background.

In 2015, the National Indigenous Engineering Summit brought together the engineering industry, professional bodies, educational providers and policy leaders to exchange ideas and develop strategies to increase the number of Indigenous Engineers. The Summit concluded with a National statement of intent; a commitment to the future. VIEWS directly came out of the recommendations of the Summit.

The 'Follow your dream' bursary

David Jenkins (BE – Chemical Engineering 1970) was raised in a family who valued education. Both of David's parents grew up during the Great Depression where many parts of Australian society experienced various hardships, challenges and missed opportunities – and for David's parents this meant foregoing their educational opportunities and instead needing to commence work at an early age. David's mother had won a scholarship to complete her later years of high school but circumstances did not permit her to accept. The experiences of his parents helped shape the person that David was to become.

When his father passed away David decided to donate the proceeds from his estate to the Faculty of Engineering at Monash in the form of an annual scholarship. David says that he made this decision "To recognise the education opportunities that my parents did not have and to benefit others in the same circumstances. I also hope that this donation may inspire others, not necessarily to give to Monash University but to give to other philanthropic organisations".

OPTIMIZATION OF MILK POWDER PRODUCTION PROJECT WINS AT IFT16 CONFERENCE

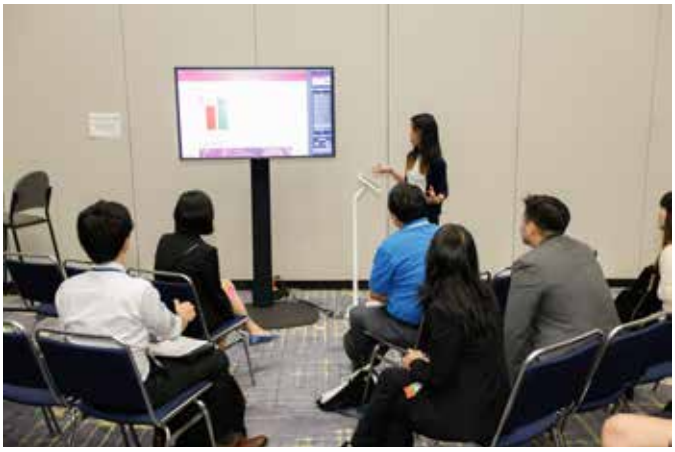
Our congratulations go to Department PhD student Martin Foerster on his recent success at the IFT16 conference held in Chicago, Illinios.

The annual conference is the biggest event of its kind for the global food science community, with over 23,000 food science and technology experts from more than 90 countries. Martin, supervised by Professor Cordelia Selomulya and Dr Meng Wai Woo, won the first prize in the Graduate Research Paper Competition of the IFT Dairy Division. The two-stage competition process comprised of preselection of finalists from more than 700 submissions and an oral presentation in front of an expert panel. Martin was the only participant among the five finalists that qualified from outside the USA.

The award recognised his achievements in gaining a better understanding about the segregation process of milk's components during spray-drying of dairy powders.

The new knowledge is expected to contribute to improved powder quality for the end user and an increase in industrial efficiency during manufacturing due to a reduction of product losses and the elimination of additional processing steps.

The next day, the Monash flag was flying high once more with Martin bringing home the third place at IFT's charity run. More than 500 runners watched the sunrise over Chicago's skyline as they gathered at 5.30 a.m before taking on the 5 km course. This year's event raised more than $120,000 in support of IFT's Feeding Tomorrow foundation.



IN PROFILE: PHD STUDENT SHAHROUZ TARANEJOO

Shahrouz Taranejoo is a current PhD student at Monash University, whose research is aimed at developing smart and advanced delivery platforms for pharmaceutical application, particularly for cancer treatment. Owing to his research background and publications, Shahrouz was given the opportunity to work in the Tissue Engineering Lab at Harvard-MIT (division of Health Sciences and Technology). This Lab is one of the pioneering centres in the United States for studying Biomedical Engineering. During his time at Harvard-MIT, Shahrouz was working on microfluidic systems, bioprinter and microneedle technologies designed for biomedical applications e.g. drug delivery systems. More specifically, he worked on developing hierarchical drug delivery systems, based on hydrogel-nanoparticle conjugate, for controlled and prolonged drug release of chemotherapeutic agents.

Could you tell us about your research topic?

My field of research is developing smart and advanced delivery platforms for pharmaceutical applications especially for cancer treatment. This topic is including at least but not last microfluidic devices adjusted and engineered for fabrication fine-tuned nanoparticulate drug carrier, stimuli-responsive therapeutic delivery systems and biomechanical effects of the drug-carrier complexes.

What made you interested in this field?

I chose this field to be involved in research for developing novel treatment approaches for people affected by cancer. Significant side effects that are typically associated with chemotherapy, including short life expectancy, loss of appetite, hair loss and etc. may be addressed with employing smart targeted delivery platform.

What was your Undergraduate / Postgraduate / study prior to your PhD?

I was studying polymer engineering in Tehran University, Iran.

Why did you decide to do a PhD?

Pursuing my interest in pharmaceutical and material sciences required more specific research work and obtaining more knowledge that can be achieved when I do a PhD.

Why did you choose Monash?

Monash University is a globally recognized university especially in engineering and pharmaceutical sciences, ranked amongst top 25 and 5 universities, respectively. Although I had several options for pursuing my studies in USA and Australia, however top-notch research works that are performed in Monash University along with the rate of success for PhD graduated Monash students attracted my interest to study in Monash University.

Can you tell us about how the opportunity to take your research to Harvard University and MIT came about – and what was this experience like?

Owing to my research background and publication, I got the opportunity to work in Tissue Engineering Lab at Harvard-MIT division of health sciences and technology, one of the pioneer centres in United States for studying biomedical engineering.

What was the highlight of your placement in the US?

I was working on microfluidic systems, bioprinter and microneedle technologies designed for biomedical applications e.g. drug delivery systems. Moreover, I worked on developing hierarchical drug delivery systems based on hydrogel-nanoparticle conjugate for controlled and prolonged drug release of chemotherapeutic agents.

Can you tell us a little about your supervisor(s) and how they support you in your research?

My supervisor, Professor Kerry Hourigan, not only gave me vital scientific advice for doing my PhD work but also kindly provided me enough space for pursuing my ideas without unnecessary micromanaging. When I was in USA he financially supported my research work as well.

IN PROFILE: PHD STUDENT Shahrouz Taranejoo, cont.

What was the best piece of advice you received that still has an impact on you?

Do not discard your raw ideas even when they seem very crude. I learned that none of my raw ideas is trivial and it is time-worthy to think about and develop them.

What advice would you give to future graduate researchers who are beginning a PhD in your field?

Never stop, even if you fail several times. It is the nature of research works especially when you are working with living creatures, I promise that the result will be stupendous.

What has been the biggest break-through in your research?

In my own research work, we developed a novel route of nanofabrication through microfluidic systems to create fine-tuned pH-stimuli drug carrier with significant improvement compared to normal bulk synthesized nanocarriers. A microfluidics approach to synthesize core-shell nanocarriers with high pH tunability is developed. The sacrificial shell protects the core layer with the drugs and prevents their release in the severe pH conditions of the gastrointestinal tract, while allowing for drug release in the proximity of a tumor. The proposed nanoparticulate drug-delivery system is designed for the oral administration of cancer therapeutics.

What are your goals moving forward (career aspirations, what's next)?

After finishing my PhD, I am looking forward to continuing my research work in this field through working with globally recognized scientific groups . I had the opportunity to learn about new generation of delivery systems for therapeutic agents which is a combination of stem-cells and nanoparticulate carriers. I would like to employ my learning and experience in biology, microfluidic systems and material science for developing this new topic. Moreover, it will be excellent and worthwhile if I can establish my own lab as an academic staff to be able to train new research students in the field of biomedical engineering.

CONGRATULATIONS TO OUR RECENT ARC GRANT RECIPIENTS

Dr Akshat Tanksale; Professor Alan Chaffee; Dr Samir Mushrif, Associate Professor Andrew Hoadley, Dr Jinghua Guo: ***High purity formaldehyde production from carbon oxides.*** This project aims to investigate the detailed reaction mechanism of a green chemistry route of producing formaldehyde by reducing carbon monoxide and carbon dioxide in liquid phase. Formaldehyde is a widely used feedstock for chemical industries, but is not considered a green chemical because it is produced using natural gas as the feed, which loses over 61 per cent of energy. This project will maximise the yield and purity of the product, making it commercially viable. This project's method for producing formaldehyde is expected to reduce the capital cost and energy losses.

Professor Wenlong Cheng, Professor San Thang: ***Programming soft plasmene nanosheets with living RAFT functional polymers.*** This project aims to use recently discovered plasmene to demonstrate programmable materials properties using living RAFT polymeric ligands. Plasmene is free-standing, one-particle-thick, superlattice sheets of plasmonic nanoparticles. It represents a conceptually new class of two-dimensional metamaterials with broad applications in energy, environment, sensors and optoelectronic devices. This project expects to generate new knowledge and patentable technologies, and advance Australian worldwide standing in the field of nanotechnology and polymer science.

Professor Huanting Wang, Professor George Simon, Professor Dr Shu-Hong Yu: ***Structurally-bridged crystalline molecular sieve-polymer membranes.*** This project aims to produce a membrane platform technology for efficient and cost-effective separation in natural gas processing and petrochemicals, using crystalline sieve materials. It will address the mismatch of mechanical properties between crystalline molecular sieve materials (zeolites and metal organic frameworks) and polymers, and coating flaws which limit their use as gas separation membranes. It will create nano-reinforcement in the coating and polymer substrate, with nano-bridges between them. The resulting membranes will be mechanically tough and separate better than existing membranes. Advanced membranes are expected to benefit fuel industries by reducing separation cost and energy consumption

CHEMICAL ENGINEERING AT MONASH OPEN DAY

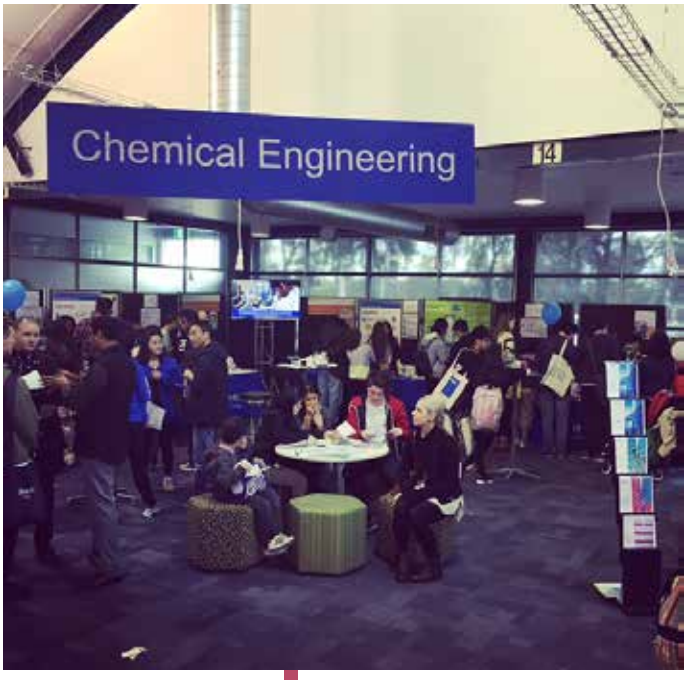
We thank everyone who helped and contributed to the Chemical Engineering section of open day this year. The day was very successful, between the displays, activities, lab tours and “Gen S” campaign.

This year’s Open Day saw a bigger crown than in recent years, with over 4300 visitors to the Faculty of Engineering, >3800 attending the information sessions and some 900 joining the many tours through the facilities. Everyone was kept very busy keeping up with the demand for brochures, questions and queries.

We also received some very positive feedback from Prof Julia Lamborn, the Assoc Dean for Education in the faculty.

She attended one of the Chemical Engineering Laboratory tours and was extremely impressed at the organisation, flow, the station/stand stops, and the great job that the presenters were doing at each station.

Monash University holds an open every year around August.



IChemE GLOBAL AWARD FINALIST

Congratulations to Dr Lizhong He, Assoc Prof. Victoria Haritos and Bhuvana Kasargod (PhD student) on being listed as finalists for the IChemE Global awards 2016.

Their project, 'Self-assembled enzyme nanoparticles as reusable biocatalysts' was short-listed for IChemE Global Biotechnology Award, along with nine other finalists from the UK, US, Singapore, Brazil. The awards were announced and presented at a Gala Dinner in Manchester, UK on the 3rd November. While our team did not take home the prize this time, they enjoyed the night celebrating with their fellow finalists.

The Biotechnology Award recognises achievement and discoveries in the fields of biochemical, biomedical, bioprocessing, bioengineering, bioenergy, biocatalysis, bioreactor and nantechnology.

The Monash team developed an innovative approach to advance enzymes to be economically competitive as sustainable biocatalysts for the chemical industry.

Their work has also been featured in the latest AusBiotech Magazine October issue.

From left: Assoc Prof. Victoria Haritos, Dr Lizhong He, and PhD student Bhuvana Kasargod

Monash Chemical Engineering in worlds top 51- 75 according to AWRU/Shanghai subject rankings

A new ranking system - the AWRU (Shanghai JiaoTong) has placed Monash Chemical Engineering as 2nd in Australia in the 51-75 band out of 300 Chemical Engineering departments that were ranked. View the full rankings HERE.

Broadly this is consistent with the trend in other rankings - which place importance on citations, papers with international coauthors, and papers with industry co-authors.

TOP 51-75
Chemical Engineering School Worldwide

MONASH UNIVERSITY ALUMNI AND FRIENDS RECEPTION

We are pleased to invite you to be our guest at the Monash Engineering and Information Technology Alumni and Friends reception in Melbourne. The event will be hosted by Professor Frieder Seible, Deputy Vice-Chancellor (Enterprise), Academic Vice-President (Industry Engagement), Dean of Engineering and Dean of Information Technology at Monash University.

This is a wonderful opportunity to catch up with other Monash alumni and friends. Renew old acquaintances, make new connections, reminisce about past experiences and reflect on your time at Monash. Share your professional news, achievements and opportunities with alumni from the Faculty of Engineering and the Faculty of Information Technology as well as the resources and information technology industries.

Tuesday, 15 November 2016
6:00 - 8:00pm (registration from 5:30pm)
Bourke Room 2, Level 2, RACV City Club
501 Bourke Street, Melbourne

TO REGISTER PLEASE VISIT THIS WEBSITE: https://campaigns.it.monash.edu/alumni-melbourne

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

CONTACT MONASH CHEMICAL ENGINEERING

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- **Vacation Work Experience to our undergraduate students**
- **Graduate Positions (Undergraduate and Postgraduate)**
- **Speak to undergraduate students at a lunch time seminar about your company**
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Would you like to receive future issues of ChemEng Focus? If so, please email lilyanne.price@monash.edu and we will add you to our newsletter mailing list.

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