

ChemEng *focus*

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Inside this issue:

New Engineering leadership program launched at Sunway	5
Sunway students emerge 1st in Design	5
Meet our students	6
SMUCE update	7
Excellence in the PhD Award	11
Welcome to the Department	17

Monash welcomes new engineering Dean

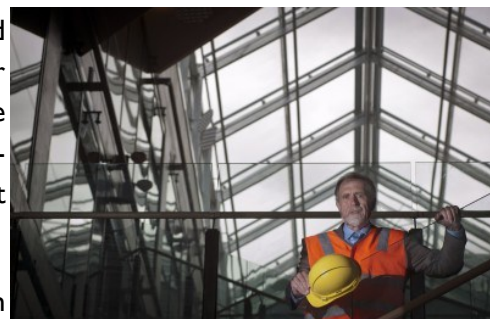
Respected engineering researcher and university administrator Professor Frieder Seible commences work as the new Dean of the Faculties of Engineering and Information Technology at Monash University.

Professor Seible comes to Monash from the University of California San Diego, where he held the roles of Dean, Irwin and Joan Jacobs School of Engineering; Distinguished Professor, Department of Structural Engineering; Eric and Johanna Reissner Chair of Applied Mechanics and Structural Engineering; and Walter J Zable Professor. Professor Seible is an Elected Fellow of the US Academy of Engineering and a Foreign Fellow of the Chinese Academy of Engineering.

Professor Seible has also been appointed as an Academic Vice-President of the University.

Vice-Chancellor and President Professor Ed Byrne welcomed Professor Seible to his new role.

“On behalf of the broader Monash community, I welcome Professor Seible to the University and the exciting challenges that lie ahead. Together,



Professor Frieder Seible inspects Monash University's new research facility New Horizons.
Photo credit: Coretext Brad Collis

we look forward to continuing to build on our academic success, developing our global presence and promoting Monash as a key participant in international education. I believe Professor Seible has a key role to play in transforming Monash into one of the world's very best universities,” Professor Byrne said.

Provost and Senior Vice-President Professor Edwina Cornish said she welcomed the appointment of such an experienced and well-regarded academic and administrator to Monash.

“I am delighted that Professor Seible has accepted the role of Dean of the Faculties of Engineering and Information Technology,” Professor Cornish said.

Continued from previous page.....

“Professor Seible is a distinguished academic leader and administrator and brings to Monash an impressive record of industry engagement and international experience, with a particular focus on China. His impressive academic background and excellent grounding in graduate research promises to further strengthen the reputation of both the faculties of Engineering and Information Technology and the University.”

Professor Seible said he was excited by the academic challenges he would face in his new role, particularly those concerning the way the next generation of engineers should be educated in response to global shifts in economic, technological and sociological influences.

“The challenge for engineering educators is to broaden the capabilities of new engineers so they can work collaboratively with researchers from other academic disciplines, and also as global citizens who can positively respond to the needs of industry both here in Australia and overseas,” Professor Seible said.

“Australia is uniquely positioned within the South-West Pacific region, which is fast becoming the economic centre of the world and researchers at the University are involved in exciting research opportunities.”

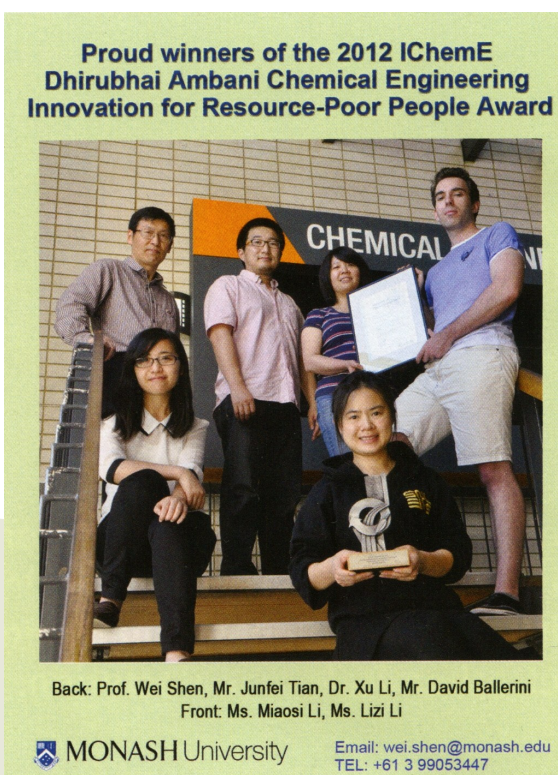
Professor Seible is particularly delighted to be overseeing the University’s new research facility New Horizons, which will bring together world-class researchers from the University and CSIRO to tackle substantial challenges

in fields of research such as renewable energy, materials science and biomedicine.

Professor Seible is an international expert in the field of structural engineering, and his research interests include the evaluation and protection of critical infrastructure systems; earthquake-resistant design of reinforced concrete and concrete masonry structures; the development of new large-scale structural testing techniques; and the application of polymer matrix composites in civil structures.

Under his leadership, the Irwin and Joan Jacobs School of Engineering rose to be ranked as one of the top 10 engineering schools in the world. Professor Seible has also been appointed as an Academic Vice-President of the University, in which role he will be responsible for a range of external and international engagement initiatives.

Professor Seible succeeds the current Dean of Engineering, Sir John Monash Distinguished Professor Tam Sri-dhar, who will continue in his Academic Vice-President role at Monash, leading the University’s significant academic initiatives in China and India. Professor Seible will also fill the position of Dean of Information Technology.



New scholarship fund established to recognise Dr Marie-Faith Fiawoo

“The Monash community was deeply saddened to hear that Dr Marie-Faith Fiawoo, a Monash staff member (postdoc Research Fellow) in the Faculty of Engineering was tragically killed in the wall collapse in Carlton in late March. Dr Fiawoo was 33 years old and in Melbourne on a work visa from France. A scholarship fund to support students in Engineering and University-wide has been established in memory of Dr Fiawoo and to recognise her contribution to the University. Funds raised will support a range of student scholarships and initiatives in the Faculty of Engineering including the Leadership program, and Women in Engineering bursaries. Donations will also support student participation in international opportunities including travel scholarships.

Visit the [Alumni donation page](#) to find out more about how to contribute.

New Horizons: State of the art research facilities for Monash researchers — Stefan Smith

The New Horizons building, as part of Monash University's mission for world leading research and progress toward a sustainable future, has recently been completed and offers a new research facility for 400 staff and students.

New Horizons features a striking diagonal design profile and numerous sustainable innovations which makes it the first research building of its size to receive a 6 Green Star energy design rating. In addition, the interior spaces have been designed to optimize collaboration between departments through open plan workspace, laboratories and a wide variety of shared spaces, including break-out zones, meeting rooms, and a large staff lounge and outdoor space.

Monash University Department of Chemical Engineering has had 6 of its research groups move into the state of the art facility, headed by Dr. Lei Jiang, Prof Huanting Wang, Assoc Prof Bradley Ladewig, Assoc Prof Wenlong Cheng, Dr. Lizhong He, Prof Ravi Jagadeeshan, along with over two dozen HDR students and research staff under their direction. Research topics of this group follow the future-manufacturing theme and include Membrane development, Desalination, Gas Separation, Clean Energy, Environmental and Nanoparticle technologies

CSIRO (Commonwealth Scientific and Industrial Research Organization) has also joined the New Horizons team and staff from its Division of Materials Science and Engineering will be taking up residence in the New Horizons building, strengthening its partnership with Monash University and Department of Chemical Engineering to improve synergies on common research topics.



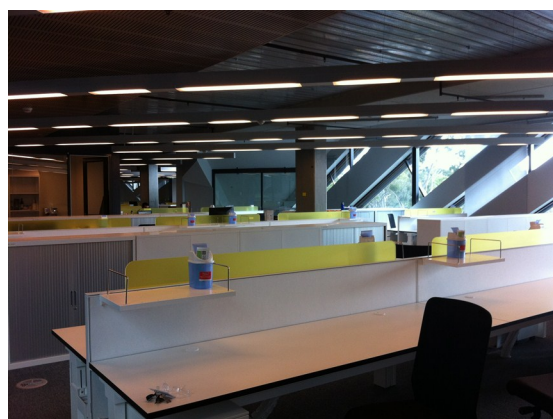
Internal stairs



One of many break-out areas available to students



Membrane development, Desalination, Gas Separation, Clean Energy, Environmental and Nanoparticle technologies Laboratory



Student workstations

New Equipment in the Department

New Undergraduate Lab equipment for CHE2162 Mass and Energy Balances - a new Air conditioning unit for mass and energy balance calculations



The Department has invested in a new Air Conditioning Laboratory Unit made by P.A. Hilton Ltd which will be used during the laboratory classes of the CHE2162 student engineers.

This equipment will be used in training of the methodology of air conditioning plant and the processes occurring between air inlet and its discharge to the conditioned space. The new Hilton Air Conditioning Laboratory Unit will also enable students to investigate the basic air conditioning processes of heating, cooling, humidification, de-humidification and air movement that are of fundamental importance to undergraduate engineers. The units allow students to investigate air re-circulation and mixing, computer monitoring, dynamic humidity and temperature control as well as being able to perform the below experimental capabilities;

- Demonstration of the processes and components used in heating, cooling, humidification, de-humidification of an air-stream.
- Measurement of air psychrometric condition before and after humidification, heating, de-humidification /cooling using pairs of precision wet and dry bulb sensors.
- Determination of a heat and mass balance across each process resulting in heating, cooling and humidity change using the instrumentation fitted.
- Construction of a complete refrigeration cycle diagram for the air-cooling plant plus an energy balance between the refrigeration circuit and the change in air enthalpy and its mass flow across the evaporator.
- Investigation of the volumetric efficiency of the refrigeration compressor under varying load.
- Determination of the specific heat capacity of air, by measurement of the change in psychrometric condition across a heating or cooling process.

Research New Xray Diffraction unit (Rigaku Miniflex 600) for determining crystal form.



The Department has recently purchased a desktop X-ray Diffractometer (XRD) which can be used for a wide variety of teaching and research activities. XRD is a commonly used technique for identification of the crystal phases in materials, however there are many more advanced applications within the Department including identifying components (such as impurities) within samples, verifying the crystalline phase of newly-developed materials such as membranes, adsorbents, coal, biomass and catalysts, and even measuring the degree of crystallinity in food and pharmaceutical compounds.

The particular unit that was purchased is called a Rigaku Miniflex 600 and contains a powerful 600W X-ray source, coupled with a six-sample auto changer which allows for multiple samples to be loaded into the unit and automatically rotated into position for measurement - including with spinning of the sample if required. Since commissioning several months ago, a large number of postgraduate students and researchers have been trained in the safe operation of the unit. It is currently used extensively, approximately six days per week, mostly for research projects but also for industrial project work and for undergraduate research projects.

The benefits to the department from the purchase of this unit are many and extensive - it allows for routine analysis of materials that previously had to be done in another department or external to the University. More importantly, it means that our own research students can be trained in this technique, enhancing their skills and expertise. Furthermore, it allows us to offer a more complete research service to our research and industry partners.

Monash University has launched the Engineering Leadership Program (ELP) at the Sunway Campus

The Engineering Leadership Program (ELP) at the Sunway Campus is a first of its kind. The program is aimed at prime top students and leaders in Engineering.

High-performing undergraduate engineering students will be identified and invited to join the one-year course. Participants will learn the soft skills necessary to develop future careers in industrial leadership, including team-building, communication skills and interpersonal skills.

The programme is designed to stimulate and inspire these future leaders, taking them out of their comfort zone whilst providing a supportive learning environment. The 2013 ELP participants are all second-year engineering students from the Chemical, Mechanical, and Electrical and Computer Systems Engineering disciplines. To make the cut, the students underwent a competitive selection process requiring excellent academic results, a written application and a panel interview to assess their communication skills and leadership potential.

Shell Malaysia Retail General Manager Mr Leslie Ng, the program's mentor representative, offered sound advice to the other industry professional mentors and their mentees. Shell and Engineers Australia are sponsoring the program in 2013.

Monash Sunway emerged first in a national level Chemical Engineering Design competition

The Institution of Engineers Malaysia organized the 1st Chemical Engineering Design Competition themed "Design of Biogas plant- Production and Utilization" in 2012.

A total of 22 teams from different universities across the country participated in the competition.

The preliminary rounds of the competition involved submissions of two progress reports and a final report.

Eight teams were shortlisted for poster presentation in the finals of which two teams were from Monash Sunway.

Shell is the major sponsor of the 2013 programme and has contributed three mentors.

There are a total of 11 mentors who volunteer their time on the ELP course and will share their knowledge and experience with the group.

Chemical Engineering student **Helen Lim Yau Wei** says "Malaysia's oil and gas industry is going quiet well and billions of ringgits are being invested in this industry. This shows Malaysia has the potential to be the regional hub of the oil and gas industry. I hope that this ELP programme can help me to become a part of this industry in the future." Fellow Chemical Engineering student **Jason Yau Wai Xian** adds that the ELP is a "golden opportunity for the students to gain an insight into the industry."

The ELP is designed with the local industry and today's students' needs in mind. It also provides an opportunity for Monash alumni and partner organisations to support the [program](#).



Mr Leslie Ng of Shell Malaysia speaks on behalf of the mentors.

The team led by Chee Beng Siang (with team-mates Aaron Ng TzeHeng, Voon Seen Yee, Sarah Yeoh Ee Lyn and Madura Ananda Kumar) emerged as the overall winner of this competition while the team led by Cheang Khai Hong (with team -mates Lee Pui Ee, Low Yen Yen Tan Kian Tiong and Teh Hock Xiong) was placed fourth.

"The positive attitude of the students and contributions from all chemical engineering staff have led to the students' victory in this competition" says Dr. Ramanan who is the advisor to the teams.

Meet our students

Blaise Murraylee

Bachelor of Engineering in the field of Chemical Engineering and Bachelor of Science

Blaise Murraylee was unsure whether he wanted to study engineering or science, all he knew is that he loved maths and science and he wanted to pursue a career in both. When he found out Monash University offered both in a double degree, Blaise no longer had to make a decision. "Engineering, with the combination of using knowledge from maths, physics and chemistry to solve problems dealt with in the real world, on an industrial scale felt like something I would not only be able to do well, but enjoy doing." Blaise chose chemical engineering as his discipline. Analysing processes that create products from their raw materials, while considering the energy usage, efficiencies and cost is one of the many areas studied in chemical engineering.

Blaise is also involved in many co-curricular activities that the faculty and Monash have to offer, including the Leadership in a Technological Environment program and industry placement.

"In the LITE program, "I was given the opportunity to go on a one week placement at GlaxoSmithKline where I got to meet a number of engineers including recent graduates from Monash in different areas of the company. I also got to complete two small projects in my short time there. It was a great way to see what engineers do

on a day to day basis and see what I could potentially be doing in the future while only in the 2nd year of my course."

"The atmosphere at Monash is amazing too. The people are fantastic and there's always something happening which makes coming into uni really enjoyable, even when assignments begin to pile up."



Engineering, with the combination of using knowledge from maths, physics and chemistry to solve problems dealt with in the real world, on an industrial scale felt like something I would not only be able to do well, but enjoy doing.

Alison Slater

Bachelor of Biomedical Science and Bachelor of Engineering in the field of Chemical Engineering



Alison Slater chose to study a double degree in engineering and biomedical science at Monash University because of its excellent reputation for research and teaching. The wide range of clubs and societies also caught her eye, most notably, Engineers without Borders.

"Being involved with Engineers Without Borders was definitely a highlight of my undergraduate program. I met a lot of interesting and amazing people and got the chance to contribute to a number of great causes."

Alison is now a process engineer at a Rio Tinto alumina refinery, where she works towards making the plant easier and safer to operate, as well as more energy efficient.

"My role is to monitor key parameters and bottlenecks in a section of the plant and to recommend a course of action to overcome these and to make improvements. It's great because I get exposure to completely different aspects of the plant operation and I learn new things everyday."

"The thing I most enjoy about my job is that I learn something new each day, whether that be while spending time outside in the plant, at my desk crunching numbers or simply chatting with a colleague."

"I'd like to become fully competent in this role, and then eventually spend some time working overseas."

Society of Monash University Chemical Engineers (SMUCE) President—Rhett Richardson

SMUCE Semester 1—RoundUp



Semester One was a highly productive 12 weeks for SMUCE with over 150 members signed up to the club! As always SMUCE ran a variety of successful events including combined lectures, barbeques and our first ever Trivia Night at Sir John's Bar!

Fresh off the press this semester was the 2013 Careers guide with over 250 copies distributed to undergraduate and postgraduate students to aid them with their job search. The guide featured over 20 companies detailing both their vacation and graduate programs.

Academically SMUCE continued its tradition of weekly industry seminars. Featured companies this semester were ExxonMobil, PwC, Orica, GSK, Lion, KPMG, Uhde Shedden, WorleyParsons, Australian Paper and DIAL. As normal, unit feedback evaluations were completed for all chemical engineering units to improve the learning experience for students.

Semester 2 is gearing up to be bigger and better than ever! Namely because of the

SMUCE ACADEMIC DINNER 2013

Date: Thursday, 26th September, 2013

Time: 7pm - 11pm

Where: Lakeside, Albert Park

Cost: \$75 members/ \$85 non-members

Theme: TBC

Tickets on sale in early Semester 2!

annual Academic Dinner to be held in September!

SMUCE would like to wish you all the best for the exam period and have a happy and safe winter break.

See you all next semester!

Regards, The SMUCE Team

SMUCE
***"Linking students
with Industry"***

Jerard Koon

Academic Vice President [2013]

SMUCE

Society of Monash University Chemical Engineers

C/O Department of Chemical Engineering,

Building 35, Room 226

Monash University, Clayton Campus 3800

Student Affairs by Laura Aston — from Lot's Wife Edition 4, 2013

In the wake of university funding shortcomings, clubs have the potential to pick up some slack with their diverse methods of engaging students. The Society of Chemical Engineers, better known as SMUCE is exemplary in providing such an outreach. SMUCE's activities centre on linking students to the professional world at large with strong industry, alumni and academic partnerships.

SMUCE has more than a few reasons to boast. Their awesome moose logo is a start, not to mention the enviable office they occupy in the engineering precinct, as well as an unparalleled industry rapport. However, boasting is certainly not something the hard-working SMUCE committee will be found doing. Not least of all because they are too busy working on running a proactive academic club with an ever-growing calendar of regular activities to organize for members, with new ideas constantly in the pipeline. For a club of fewer than 150 members, the overwhelming majority of whom are chemical engineering students, their presence on campus is disproportionately larger than their membership base might suggest.

SMUCE committee members share a genuine compassion for fellow students' plight to fulfill vacation work requirement and successfully obtain work after study. SMUCE committee members are driven by genuine compassion for the collective plight of students to successfully transition to life after study. In reality, such a feat is not automatic even with as taxing a degree as chemical engineering under one's belt. To accomplish this objective, SMUCE reaches out to industry, forging partnerships that offer returns to students, companies and Monash University alike. For several years, the SMUCE industry seminar series has been gaining momentum, offering students the chance to listen to and meet representatives from diverse employers in fields relevant to their studies. This year, a full suite of weekly industry representatives were locked in as far as 6-months in advance. The willingness of industry representatives to engage with students through SMUCE is evidence of the esteem with which it is regarded by the professional world. 2013 also saw the publication of the SMUCE careers guide. The careers guide, which provides information

about transitioning into the professional world, is an invaluable supplement to academic life, and the pride of hardworking SMUCE committee members who devoted their summer to sourcing content from industry partners.

SMUCE also works closely with the Department of Chemical Engineering. The relatively new concept of mid-semester unit evaluation was the brain-child of the 2009 committee. Unlike end-of-year evaluations, mid-semester evaluations offer tangible returns to the students reviewing the subject, since they equate to improvements in the current term of study. The concept has caught on so well that SMUCE reps aren't able to obtain feedback fast enough to satisfy academics, who are hungry for feedback on the quality of their teaching.

The social element of club life is not lost on SMUCE either. A little thinking outside the box has seen the addition of annual lawn bowls, sustainable laboratory beer tasting, BBQ's, the September academic dinner (which is heavily attended by faculty staff) and more recently a trivia night at Sir John's bar.

How does one club achieve such proactivity? Undoubtedly, this culture has been inherited. But it continues to attract innovative students who enjoy putting their organizational skills to use in improving the quality of study and career prospects for their fellow students, while working with a

team of equally motivated individuals with support and recognition coming from many levels of the university institution.

Of course, academic clubs are by no means more relevant in supplementing the university experience than recreational, cultural or welfare clubs. Each offer their own valuable opportunities for students to engage with each other and the world at large; with the advantage of university recognition meaning clubs can benefit from funding, venue hire and support to foster such activities.

So, after learning a little about SMUCE, let's just see if their membership base continues to be biased towards ChemEngers....

SMUCE committee members are driven by genuine compassion for the collective plight of students to successfully transition to life after study. In reality, such a feat is not automatic even with as taxing a degree as chemical engineering under one's belt.

Company participation?

Would your company like to offer any of the following?

- **Vacation Work Experience to our undergraduate students**
- **Graduate Positions (Undergraduate and Postgraduate)**
- **Speak to undergraduate students at a lunch time seminar about your company**
- **Become a corporate sponsor or donate a student prize**

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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Faculty of Engineering Annual Engineering Awards An evening of celebration

The Faculty of Engineering has recognised the outstanding achievements of both students and staff at the Annual Engineering Awards held on 12th June 2013 in the Alexander Theatre at Monash University.

Dr Kris Ryan congratulated award recipients and spoke about the excellence achieved by Monash Engineering students. "Monash Engineering attracts some of the brightest students, where we strive to create a high quality learning environment. Our goal is to attract the best minds of each generation and educate the future leaders of our profession. It is through our students that we ensure that our legacy reaches much beyond our lifetime." The Awards ceremony was followed by cocktails which gave the award recipients and their guests an opportunity to network with the distinguished industry guests.

The Department of Chemical Engineering congratulates the students and staff for their achievements.

ExxonMobil Awards for Excellence was received by **Jerard Koon** and **Sofia Lee** [Presenter: Kimberly Hribar] The ExxonMobil Awards for Excellence are presented to three (3) undergraduate students in their penultimate year in any engineering discipline who display outstanding all-round performance

Jenkins Family 'follow your dream' Bursary was received by **My Ngan (Natalie) Hoang** [Presenter: David Jenkins]. When his father passed away David Jenkins 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." This bursary is awarded to a third year Chemical Engineering student based on academic and equity criteria.

The Owen Potter Award for Chemical Engineering Excellence was received by **Jun Qu** [Presenter: Karen Hapgood]. This award was instituted in 1991 in recognition of the contribution made by the foundation Professor, Owen Potter, not only to the Department of Chemical Engineering but to the chemical engineering profession in Australia generally. A prize and a medallion is presented annually to the top first class honours graduate.

The Yong Cher Biau Memorial Award was received by **Hawra Ali Abdul Abbas** [Presenter: Carlos Tiu]. Datuk Yong Ah Pwi, Malaysia, offers this prize in memory of his late son, Yong Cher Biau, who passed away having completed almost three quarters of a successful BE (Chemical) degree. The prize is awarded annually to the top student in level three in the Department of Chemical Engineering achieving a first class honours standard.

Dean's Award for Excellence in Teaching [2012] was received by **Associate Professor Bradley Ladewig** [Presenter: Professor Frieder Seible]. Bradley Ladewig pioneered a number of innovative learning and teaching approaches, including high-definition weekly wrap-up videos, interactive Facebook groups, rapid student feedback by marking, scanning and returning all tests to students as PDF documents within 48h, and guest appearances from engineers at their workplace through live Skype video-conferencing to lecture theatres.

Department of Chemical Engineering staff members are recognised as social inclusion champions

On 17 April 2013, Professor David Copolov had great pleasure in hosting the annual Vice-Chancellor's Social Inclusion Awards, attended by more than 100 staff and students.

CEO of Oxfam Australia, Dr Helen Szoke, provided the keynote presentation.

"There is acknowledgment that many in the University work hard to build a culture where they feel they can participate. This is the heart of social inclusion and indeed, from my perspective, it is the heart to human rights approach," Dr Szoke said.

"Diversity is the one thing we have in common and we should celebrate it every day and that is what today is about."

The Social Inclusion Awards recognise the efforts of staff and students who contribute significantly to the University's commitment to social justice and human rights.

The Chancellor, Dr Alan Finkel, congratulated all nominees.

"Since 2009, the ultimate responsibility for improving our performance in social inclusion has rested at the very highest levels of the university with the Vice-Chancellor and the senior management team," Dr Finkel said.

"But, as you all well know, universities are people, strong-willed individuals. So, the direction from the senior management can easily remain a dead letter unless committed, talented staff are there to breathe life into it. It is exactly those kinds of people that we will be honouring today."

The Department of Chemical Engineering Awards were presented to:

Associate Professor Karen Hapgood, Ms Chloe Priebee, and Ms Lilyanne Price who collaborated to provide over and above support to a Chemical Engineering student during their PhD studies at Monash University.



Photo by [Greg Ford Photography](#)

Dr Fateme Rezaei**Recognition for Excellence in PhD Dissertation**

Dual PhD degree

Monash University/Lulea University of Technology, Sweden



Dr Fateme Rezaei, a former Her PhD thesis, entitled “Optimization of Structured Adsorbents for Gas Separation Process-graduate student of the Department of Chemical Engineering has recently been chosen by the "International Adsorption Society (IAS)" and experimentally. Given the ease of using the results of her work, Dr. Rezaei's research not

Award for Excellence in the PhD Dissertation.

The Award consists of a certificate citing the accomplishments of the recipient, an honorarium of \$1,000 and travel allowance. The certificate was presented at the 11th international conference on the Fundamentals of Adsorption (FOA) in May 2013 in Baltimore, USA. Dr Rezaei also presented a plenary talk on the summary of her research work during conference.

This award provides recognition to exceptional young scientists or engineers, who have performed original doctoral thesis work of outstanding quality, achievement and impact in the area of adsorption.

Dr Rezaei obtained her Dual-Award PhD degree from Monash University, Australia and Lulea University of Technology, Sweden in 2011 under supervision of Professor Paul Webley.

only offers a good base for selecting the structure of adsorbents for a particular process but also sheds lights to retard the progress of global warming through development of efficient and cost-effective technologies using structured adsorbents.

Since completing her degree at Monash Fateme has gained a post-doctoral fellow position at Georgia Tech, Atlanta, USA where she is expanding her expertise in gas separation by designing next generation materials and processes. In particular, her current research at Georgia Tech is focused on evaluating a new approach to the capture of CO₂ from pulverized coal power plant flue gas by synthesis, characterization and evaluation of novel materials and contactors as well as numerical modeling of swing adsorption systems.

Synthesis of Liquid Fuel following Gasification of Victorian Brown Coal By Bayzid Kabir Kazi, Energy, Fuels and Reaction Engineering Group



Victorian brown coal continues to be important as the cheapest energy source for the Victorian economy. However, due to the high propensity towards spontaneous combustion after drying, dried brown coal cannot be readily exported, and is therefore used locally, mostly for power generation. Upgrading and refining Victorian brown coal to liquid fuels, which can be used locally or exported, is one way of utilising this vast resource.

When considering liquid fuels production through gasification, Fischer-Tropsch liquids, methanol and Dimethyl ether (DME) are the major candidates. Fischer-Tropsch processes are widely used but have low energy efficiency and produce more greenhouse gases than methanol or DME.

My PhD project, supervised by A/P Sankar Bhattacharya at the Department of Chemical Engineering at Monash University, focuses on production of DME from Victorian brown coal through gasification without the use of Fischer-Tropsch. This would significantly reduce the production of greenhouse gases compared to standard techniques.

DME is a non-toxic, non-carcinogenic and non-corrosive compound that has been used as an aerosol propellant, refrigerant and precursor to many important chemicals. DME has similar properties to LPG, and is being promoted in Asia as a 'synthetic

natural gas' for domestic use. It can also be used as a diesel substitute and in gas turbines for power generation.

While DME can in principle be synthesised from coal-derived fuel gas (consisting of CO and H₂ including others), the majori-

ty of plants worldwide use natural gas as feedstock. Experimental investigation of DME production using fuel gas from gasification of Victorian brown coal has not been attempted. The fuel gas from brown coal will contain several contaminants, such as hydrogen chloride (HCl), ammonia (NH₃), hydrogen cyanide (HCN) and even hydrogen sulphide (H₂S) at various levels. The effect of these contaminants on the performance of the catalysts, and on the yield and selectivity of the DME from synthesis of brown coal derived fuel gas is unknown.

For assessing the possibility of DME production from Victorian brown coal, the following questions need to be answered:

- What is the appropriate brown coal gasification scheme for the DME production? Can we do catalytic gasification at lower temperature to improve process efficiency?
- Is there any gas cleaning requirement prior to DME production?
- What will be the DME production pathway? Will it be once-through or recycled system? Will it be a poly-generation system?
- Can we use commercially available catalysts for syngas to DME production? If not, what modifications are needed?
- What are the appropriate process parameters (eg. temperature, pressure) for optimum production of DME?
- Can we use commercially available catalysts for syngas to DME production? If not, what modifications are needed?
- What are the appropriate process parameters (eg. temperature, pressure) for optimum production of DME?



High pressure DME synthesis reactor and ancillaries

continued next page

The aim of my project is to provide answers to these questions. It is the first known project assessing DME synthesis following brown coal gasification.

The scope of my project can be categorised into three broad groups:

- Gasification of Victorian brown coal in bench and lab-scale equipment to obtain syngas composition and gasification kinetics. Kinetic study in a small scale thermobalance was used to assess the feasibility of catalytic gasification schemes, and a lab-scale entrained-flow reactor was used to obtain coal/char conversion and syngas composition at conditions similar to industrial ones. The initial findings from the study have been submitted to a peer-reviewed journal.
- Assessment of commercially available catalysts for syngas to DME synthesis was performed using various analytical techniques; alongside conventional lab-based techniques using FTIR, XRF, XPS, TPD and XRD. The synchrotron-radiation based facility at Australian Synchrotron was also used for catalyst characterisation. An article based on the assessment is currently under preparation for submission to a peer-reviewed journal.

mission to a peer-reviewed journal.

The experiments are carried out in a high-pressure continuous flow synthesis reactor to find the DME yield and selectivity. The reactor used for the study is shown above.

Current findings shed light onto the modification of catalysts required for syngas to DME synthesis, and formulate and test an appropriate catalyst to achieve high yield and selectivity of DME.

- Thirdly, a process model was developed using Aspen Plus integrating brown coal drying, gasification, gas-cleaning, DME synthesis and product purification. The work has been published in a peer-reviewed journal (Kabir et al, Computers & Chemical Engineering 48 (2013) 96-104). This model identifies the optimum conditions for processing gasification and the subsequent synthesis of the syngas to DME.

A review paper on brown coal gasification and DME synthesis technologies is currently under review in a high impact factor journal.

The Australia-China Workshop on Novel Carbon Capture Technologies 2013 by Sankar Bhattacharya

The Australia-China workshop on Novel Carbon Capture Technologies was recently held in Melbourne from 20-22 March. Co-sponsored by BCIA and funded by the Australian Government under the Australia-China Joint Coordination Group on Clean Coal Technology, the workshop was well attended by over 50 participants. The workshop was a collaborative effort between Monash University, Melbourne, Australia and Tsinghua University, Beijing, China, to present a diverse range of insights centering on the development of low emission coal technologies. The wide-ranging program succeeded in highlighting many unique developments in emerging coal utilisation fields in both Australia and China.

Over two days there were five plenary speeches plus 22 presentations by researchers from six universities; Tsinghua University, Monash University, The University of Stuttgart, Germany, Southeast University, China, University of Science and Technology Liaoning, China and Melbourne University, Australia. The presentations included recent developments in a range of different low emission coal technologies, including chemical looping, CO₂ cap-

ture, coal and biomass gasification, coal drying, oxy-fuel combustion in PF and CFB modes, direct carbon fuel cells, and CO₂ mineralization.



Above: International visitors view the AGL Loy Yang brown coal open cut mine.

Representatives from a range of governmental departments as well as research and industrial institutions were present including BCIA, ATSE, Department of Primary Industries (DPI), AGL Loy Yang, Commonwealth Scientific and Industrial Research Organisation (CSIRO) and EnergyAustralia.

All BCIA sponsored PhD scholarship recipients were invited to present at

the workshop.

The last day of the workshop was dedicated to a site visit in the Latrobe Valley with international guests and Monash University representatives visiting AGL Loy Yang's power station and mine.

Several project proposals for brown coal research are expected to follow from the discussions that took place at the sidelines of the workshop.

Recent publication for 2013

Peer-reviewed books

- Functional Nanostructured Materials and Membranes for Water Treatment, Duke, M., Zhao, D., Semiat, R.
- Ordered Mesoporous Materials, Zhao, D., Wan, Y., Zhou, W.
- Sustainable Process Engineering: Concepts, Strategies, Evaluation and Implementation, Brennan, D. J.

Peer-reviewed book chapters

- Food powders rehydration, Handbook of food powders: Processes and properties, Fang, Y., Selomulya, C.
- Mesoporous materials for water treatment, Functional Nanostructured Materials and Membranes for Water Treatment, Deng, Y., Zhao, D.
- Target areas for nanotechnology development for water treatment and desalination, Functional Nanostructured Materials and Membranes for Water Treatment, Duke, M., Semiat, R., Zhao, D.
- Nanoparticles, Immunomodulation and Vaccine Delivery, Frontiers in Nanobiomedical Research: Volume I Handbook of Immunological Properties of Engineered Nanomaterials, Xiang, S. D., Fuchsberger, M., Karlson, T., Hardy, C. L., Selomulya, C., Plebanski, M.
- Fermentable sugars from lignocellulosic biomass: Technical challenges, Biofuel Technologies - Recent Developments, Potumarthi, R., Baadhe, R. R., Bhattacharya, S.
- Production of Lactobacilli Proteinases for the Manufacture of Bioactive Peptides: Part II-Downstream Processes Marine Proteins and Peptides: Biological Activities and Applications, Agyei, D., Potumarthi, R., Danquah, M. K.
- Production of Lactobacilli Proteinases for the Manufacture of Bioactive Peptides: Part I-Upstream Processes Marine Proteins and Peptides: Biological Activities and Applications, Agyei, D., Potumarthi, R., Danquah, M. K.
- Recent advances in ion exchange membranes for desalination applications, Functional Nanostructured Materials and Membranes for Water Treatment, Klaysom, C., Ladewig, B. P., Lu, G. Q., Wang, L.
- Thin film nanocomposite membranes for water desalination, Functional Nanostructured Materials and Membranes for Water Treatment, Li, D., Wang, H.
- Functional zeolitic framework membranes for water treatment and desalination, Functional Nanostructured Materials and Membranes for Water Treatment, Zhu, B., Li, B., Zou, L., Hill, A., Zhao, D., Lin, J. Y., Duke, M.
- CO₂ emissions targeting for petroleum refinery optimization, Multi-Objective Optimization in Chemical Engineering: Developments and Applications, Al-Mayyahi, A., Hoadley, A. F. A., Rangaiah, G. P.

Journal articles

- Optical-electronic properties of carbon-nanotubes based transparent conducting films, Advances in Chemical Engineering and Science, Chen, K., Yeh, H., Chen, H., Liu, T., Huang, S., Wu, P., Tiu, C.
- Comments on "A new solution approach for simultaneous heat and mass transfer during convective drying of mango" by E Barati and J A Esfahani, Journal of Food Engineering, 102 (2011) 302-309; "A novel approach to evaluate the temperature....", Journal of Food Engineering, Chen, X. D., Putranto, A.
- CFD-DEM investigation of particle separations using a sinusoidal jiggling profile, Advanced Powder Technology, Viduka, S. M., Feng, Y., Hapgood, K., Schwarz, P.
- Mapping of regimes for the key processes in wet granulation: Foam vs. spray, Aiche Journal, Tan, M., Hapgood, K.
- Rheology of Slurries and Environmental Impacts in the Mining Industry, Chemical and Biomolecular Engineering, Boger, D. V.
- Bioanalytical evaluation of Lactobacillus delbrueckii subsp. lactis 313 cell-envelope proteinase extraction, Chemical Engineering Sciences, Agyei, D., Lim, W., Zass, M. C., Tan, D. A., Danquah, M. K.
- Zeolite monoliths with hierarchical designed pore network structure: Synthesis and performance, Chemical Engineering Journal, Hasan, F., Xiao, P. Y., Singh, R. K., Webley, P. A.
- Spatial reaction engineering approach as an alternative for nonequilibrium multiphase mass-transfer model for drying of food and biological materials, Aiche Journal, Putranto, A., Chen, X. D.

Recent publication continued

Journal articles

- On designing particulate carriers for encapsulation and controlled release applications, *Powder Technology*, Liu, W., Wu, D., Selomulya, C., Chen, X. D.
- Chemical looping combustion (CLC) of two Victorian brown coals - Part I: Assessment of interaction between CuO and minerals inherent in coals during single cycle experiment, *Fuel*, Saha, C., Zhang, S., Hein, K. R., Xiao, R., Bhattacharya, S.
- Direct synthesis of zeolitic imidazolate framework-8/chitosan composites in chitosan hydrogels, *Microporous and Mesoporous Materials*, Yao, J., Wang, K., Wang, H.
- Pool boiling characteristics of microalgae suspension for biofuels production, *Applied Thermal Engineering*, Zeng, X., Quek, C. X., Danquah, M. K., Woo, M. W., Chen, X. D., Lu, Y.
- Direct measurement of alkaline phosphatase kinetics on bioactive paper, *Chemical Engineering Sciences*, Khan, M., Garnier, G.
- Infiltration of precursors into a porous alumina support for ZIF-8 membrane synthesis, *Microporous and Mesoporous Materials*, Li, L., Yao, J., Chen, R., He, L., Wang, K., Wang, H.
- Forward osmosis desalination using polymer hydrogels as a draw agent: Influence of draw agent, feed solution and membrane on process performance, *Water Research*, Li, D., Zhang, X., Simon, G. P., Wang, H.
- Effect of cationic polyacrylamides on the aggregation and SERS performance of gold nanoparticles-treated paper, *Journal of Colloid and Interface Science*, Ngo, Y. H., Li, D., Simon, G. P., Garnier, G.
- Effect of cationic polyacrylamide dissolution on the adsorption state of gold nanoparticles on paper and their Surface Enhanced Raman Scattering properties, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, Ngo, Y. H., Li, D., Simon, G. P., Garnier, G.
- Effect of inorganic particulates on the condensation behavior of lead and zinc vapors upon flue gas cooling, *Proceedings of the Combustion Institute*, Jiao, F., Zhang, L., Song, W., Meng, Y., Yamada, N., Sato, A., Ninomiya, Y.
- Application of the unified compaction curve to link wet granulation and tablet compaction behavior, *Powder Technology* [P, Nguyen, T. H., Morton, D. A., Hapgood, K.
- Nanoparticle-modified electrode with size- and shape-dependent electrocatalytic activities, *Langmuir*, Tang, Y., Cheng, W.
- Lightweight, flexible, nanorod electrode with high electrocatalytic activity, *Electrochemistry Communications*, Tang, Y., Ng, K. C., Cheng, W.
- On the efficacy of malaria DNA vaccination with magnetic gene vectors, *Journal of Controlled Release*, Al-deen, F. M., Ma, C. W., Xiang, S. D., Selomulya, C., Plebanski, M., Coppel, R. L.
- Application of the self-heat recuperation technology for energy saving in biomass drying system, *Fuel Processing Technology*, Liu, Y., Aziz, M., Kansha, Y., Bhattacharya, S., Tsutsumi, A.
- Synthesis and evolution of zirconium carbide via Sol-Gel route: Features of nanoparticle oxide-carbon reactions, *Journal of the American Ceramic Society*, Ang, C. K., Seeber, A. J., Wang, H., Cheng, Y.
- A printable graphene enhanced composite counter electrode for flexible dye-sensitized solar cells, *Nano Energy*, Peng, Y., Zhong, J., Wang, K., Xue, B., Cheng, Y.
- Effect of number density on optimal design of gold nanoshells for plasmonic photothermal therapy, *Biomedical Optics Express*, Sikdar, D., Rukhlenko, I., Cheng, W., Premaratne, M. H.
- A novel graphical approach to target CO₂ emissions for energy resource planning and utility system optimization, *Applied Energy*, Al Mayyahi, M., Hoadley, A. F., Rangaiah, G. P.
- An overview of the synthesis of ordered mesoporous materials, *Chemical Communications*, Li, W., Zhao, D.
- Extension of the stober method to construct mesoporous SiO₂ and TiO₂ shells for uniform multifunctional core-shell structures, *Advanced Materials*, Li, W., Zhao, D.

Recent publications continued

Journal articles

- Successive layer-by-layer strategy for multi-shell epitaxial growth: Shell thickness and doping position dependence in upconverting optical properties, *Chemistry Of Materials*, Li, X., Shen, D., Yang, J., Yao, C., Che, R. C., Zhang, F., Zhao, D.
- Generalized synthesis of core-shell structured nano-zeolite@ordered mesoporous silica composites, *Catalysis Today*, Lv, Y., Qian, X., Tu, B., Zhao, D.
- Two-dimensional mesoporous carbon nanosheets and their derived graphene Nanosheets: Synthesis and efficient lithium ion storage, *Journal Of The American Chemical Society*, Fang, Y., Lv, Y., Che, R. C., Wu, H., Zhang, X., Gu, D., Zheng, G., Zhao, D.
- Multi-layered mesoporous TiO₂ thin films with large pores and highly crystalline frameworks for efficient photoelectrochemical conversion, *Journal of Materials Chemistry A*, Feng, D., Luo, W., Zhang, J., Xu, M., Zhang, R., Wu, H., Lv, Y., Asiri, A. M., Khan, S. B., Rahman, M. M., Zheng, G., Zhao, D.
- Designed synthesis of LiMn₂O₄ microspheres with adjustable hollow structures for lithium-ion battery applications, *Journal of Materials Chemistry A*, Zhou, L., Zhou, X., Huang, X., Liu, Z., Zhao, D., Yao, X., Yu, C.
- Highly ordered mesoporous crystalline MoSe₂ material with efficient visible-light-driven photocatalytic activity and enhanced lithium storage performance, *Advanced Functional Materials*, Shi, Y., Hua, C., Li, B., Fang, X., Yao, C., Zhang, Y., Hu, Y., Wang, Z., Chen, L., Zhao, D., Stucky, G. D.
- Large-pore ordered mesoporous materials templated from non-Pluronic amphiphilic block copolymers, *Chemical Society Reviews*, Deng, Y., Wei, J., Sun, Z., Zhao, D.
- An overview of the synthesis of ordered mesoporous materials, *Chemical Communications*, Li, W., Zhao, D.
- In-situ crystallization route to nanorod-aggregated functional ZSM-5 microspheres, *Journal Of The American Chemical Society*, Li, B., Sun, B., Qian, X., Li, W., Wu, Z., Sun, Z., Qiao, M., Duke, M., Zhao, D.
- Core-shell composites of USY@Mesosilica: Synthesis and application in cracking heavy molecules with high liquid yield, *Microporous and Mesoporous Materials*, Jia, L., Sun, X., Ye, X., Zou, C., Gu, H., Huang, Y., Niu, G., Zhao, D.
- A controllable synthesis of rich nitrogen-doped ordered mesoporous carbon for CO₂ capture and supercapacitors, *Advanced Functional Materials*, Wei, J., Zhou, D., Sun, Z., Deng, Y., Xia, Y., Zhao, D.

Department of Chemical Engineering at Monash ranked 25th in the world; QS University Subject Rankings 2013

The Department of Chemical Engineering climbed from 40th place [2012] to an impressive 25th place in the QS University subject rankings for 2013.

Vice-Chancellor Professor Ed Byrne said he was delighted with the University's strong performance across such a wide range of disciplines.

"This year's results are an extraordinary achievement and are indicative of the overall quality of the University's teaching and learning, and its research," Professor Byrne said.

"They are further proof that our students are receiving a world-class education."

The QS subject rankings are determined by a combination of academic peer-review, employer attitudes and research output and impact; the rankings are intended to help students decide the best university at which to study.

Monash is currently ranked 61st overall in the QS World Rankings. QS Top Universities has ranked international tertiary educators since 2004.

More information on the QS University Subject Rankings is available at the [QS Top Universities website](#).

The Department welcomes the following new HDR students starting their degree [March-June 2013]

PhD:

- **Ms Paurami Chandran** [Supervisors: Cordelia Selomulya, Zhangxiong Wu] **Research Topic:** Novel mesoporous carbonaceous spheres with uniform size as effective adsorbents in water treatment
- **Mr Rong Cao** [Supervisors: Wei Shen, Mengwai Woo] **Research Topic:** Cellulosic / Paper-based Sensing Platform for Blood Analysis with "in Writing" Read-Out
- **Ramya Chandrasekaran** [Supervisors: Wenlong Cheng, David Jans, (Biochemistry & Molecular Biology) Kylie Wagstaff (Biochemistry & Molecular Biology)] **Research Topic:** High quality plasmonic nanoparticles
- **Mr Hong Lee Lim** [Supervisors: Karen Hapgood, Samuel Cook (GlaxoSmithKline)] **Research Topic:** Understanding and preventing agglomeration during filter drying.
- **Ms Janelle Zhiyun Khoo** [Sankar Bhattacharya, Nawshad Haque (CSIRO)] **Research Topic:** Synthesis of Metal-Organic Framework for Carbon Dioxide Capture
- **Miss Sepideh Motamed** [Lizhong He, Wei Shen] **Research Topic:** Engineering advanced biocatalysts by combining directed evolution & nanoparticle immobilization
- **Ms Natasha Xin Ci Yeow** [Gil Garnier, Wei Shen] **Research Topic:** Mechanism of filtration in paper diagnostics
- **Mr Ezzatollah Shamsaei** [Huanting Wang, Zhe Liu] **Research Topic:** Preparation and characterization of phosphoric acid composite fuel cell membrane by radiation induce
- **Mr Naveen Noah Jason** [Wenlong Cheng, Lizhong He] **Research Topic:** Paint On Composite Solar Cell
- **Mr Shahrouz Taranejoo** [Lizhong He, Kerry Hourigan (Biological Engineering)] **Research Topic:** A Novel Smart Drug Delivery System Based on Functionalized Mesoporous Silica Nanoparticles
- **Miss Zahra Abbasi** [Sankar Bhattacharya, Huanting Wang] **Research Topic:** Removal of Toxic Organics (dyes) from Industrial Wastewater by Clay Adsorbents
- **Mr Zhengyang Zhao** [Lizhong He, Tom Peat (CSIRO), Wei Shen] **Research Topic:** Develop high efficient and high stable biocatalyst nano-reactors
- **Ms Bhuvana Kasargod** [Lizhong He, James Swarbrick (Department of Medicinal Chemistry, Faculty of Pharmacy and Pharmaceutical Sciences)] **Research Topic:** Bioremediation of Heavy metal effluent using diatom biofilms

Masters:

- **Mr Sean Jun Liang Chew** [Dong Chen, Mengwai Woo, Karen Hapgood] **Research Topic:** Spray Dryers as Micro-particulate Reactors

Congratulations to the following HDR students completing their degree [March-June 2013]

PhD:

- **Dr Ying Hui Ngo**, Thesis Title: "Nanoparticles functionalized paper for biodiagnostic applications" [Supervisors: Gil Garnier, George Simon (Materials Engineering), Dan Li (Materials Engineering)]
- **Dr Wenjie Liu**, Thesis Title: "Spray drying assembly of uniform microparticles for microencapsulation and controlled release" [Supervisors: Cordelia Selomulya, Xiao Dong Chen]

News in brief.....

Congratulations to **David Barling** was selected to attend the BASF International Summer School in Germany in August 2013. BASF selected ~30 postgrad students from around the world to attend and learn about BASF and their research. BASF covers all travel costs for the trip.

Congratulations to **Naveen Noah Jason** who was awarded the 2013 Victoria International Research Scholarship (VIRS).