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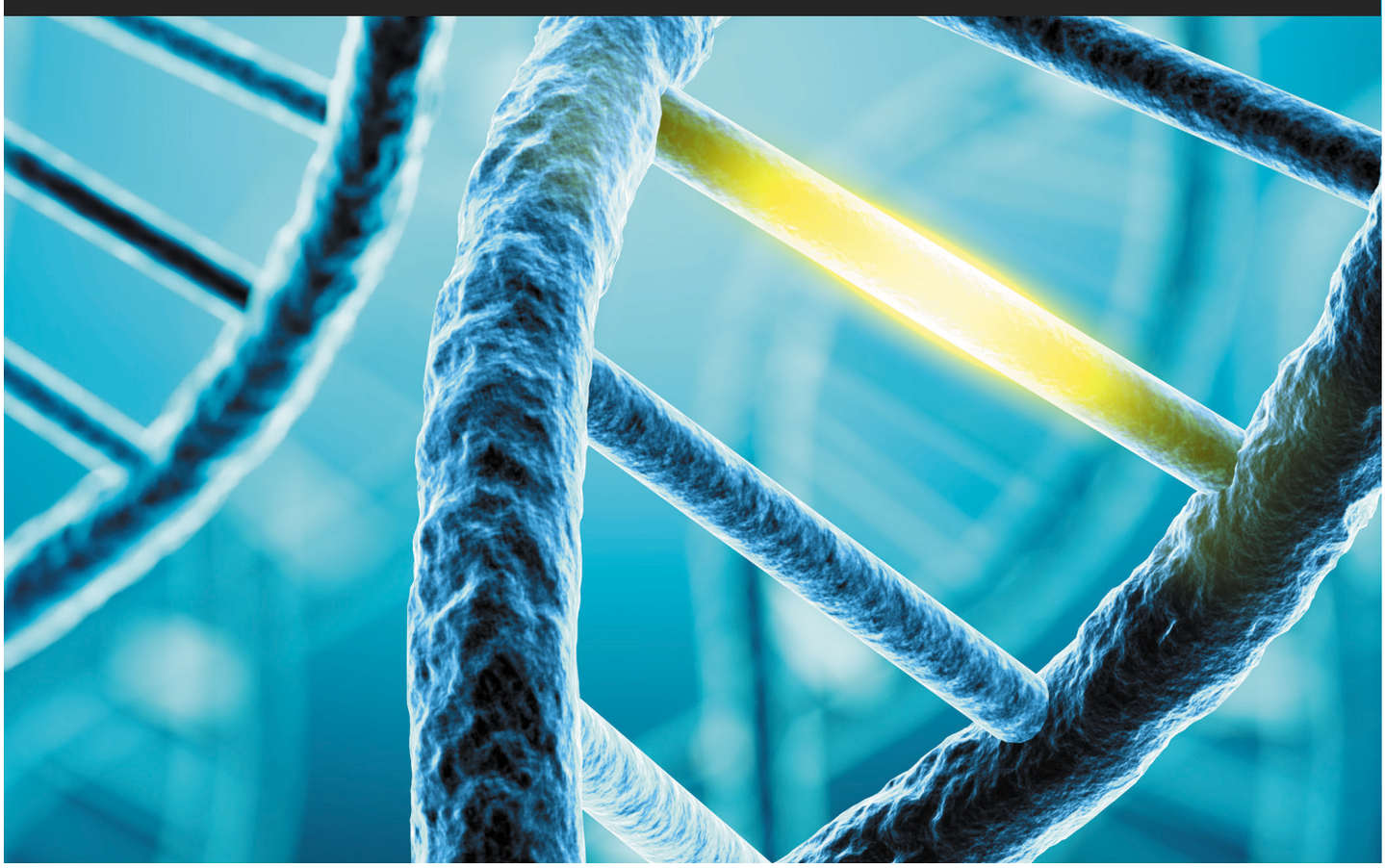
FOCUS

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

Chemical Engineering Focus Newsletter



focus

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

HIGHLIGHTS IN THIS ISSUE

WELCOME FROM THE HEAD OF DEPARTMENT

It is my pleasure to welcome the undergraduate students back to the department as they start their semester one of 2017, the year that the department starts its 54 years of existence. We now have over one hundred students at each year of the undergraduate level, while the postgraduate students number almost 160.

The year 2017 also started with good news. Our department is ranked first among all Chemical engineering departments in Australia, and twenty-eighth in the world, according to the QS world university ranking. This ranking is based on six major indicators - academic peer review, employer review, citations per faculty, student-faculty ratio and international faculty and student ratios.

To all our undergraduate students, I encourage you to question everything that you are taught. It is through questioning and the discussions in and outside the classroom with academics and your fellow students that enhance understanding and the uptake of knowledge and prepares you better for employment following your graduation. If you have any concerns or suggestions, I am always available to hear from you.

To all our postgraduate students - we provide one of the best multicultural research environment amongst the universities in the country with students coming from all continents of the world. Therefore, make every effort to enrich your cultural experience during your stay at Monash. This is an important experience for your career in a rapidly globalising world. Also, the nature of research work that you do is very diverse, reflecting the wide experience of our academics and research staff and the support that we receive from a wide range of industries. Therefore, I encourage you to attend as many milestone presentations as possible; these take place every week in the conference room. Listen carefully and ask questions. Your questions will broaden your knowledge, beyond your area of research work. This experience will stand you in good stead as most of you will work outside of academia after receiving your PhD. In the department, we have two professors of practice, Professor Ross Pilling and Professor Kerry Pratt. Professor Pilling came from a distinguished industry background, and Professor Pratt had a distinguished career in industry and academia. They remain available at the department once a fortnight at the least. Make the most of this opportunity by talking to them about your research, seek advice on the practical usefulness of your work. As with the undergraduate students, I am always available if you have any issues to discuss.

GUEST SEMINAR – PROFESSOR INGO PINNAU, KING ABDULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SAUDI ARABIA

Monash Chemical Engineering welcomed Professor Ingo Pinnau to present a guest lecture in December 2016. Professor Pinnau is Centre Director, Chemical and Biological Engineering Program Faculty, at Saudi Arabia's King Abdullah University of Science and Technology.

Addressing the audience on the topic functionalised polymers of intrinsic microporosity for highly energy-intensive gas separations, Professor Pinnau spoke about his research emphasising that Membrane-based gas separation is a rapidly emerging technology that has been well established in the purification hydrogen streams, nitrogen production from air, and is showing an increasingly larger role in natural gas sweetening and vapour/gas separations. One strategy actively pursued to generate new polymeric membrane materials with combinations of high permeability and high selectivity is the introduction of microporosity (pores < 20 Å) in the polymer matrix.

It has been shown that rigid ladder-type chains comprising fused rings joined by sites of contortion pack inefficiently in the solid state to produce polymers of intrinsic microporosity (PIMs). Recently, a successful integration of monomers contorted by spirobisindane, ethanoanthracene, Tröger's base and triptycene moieties into polyimide structures has generated highly permeable intrinsically microporous polyimides (PIM-PIs). Some of these PIM-PIs exhibited significantly enhanced performance for O_2/N_2, H_2/N_2 and H_2/CH_4 separations with properties defining the most recent 2015 permeability/selectivity upper bounds. Several series of novel PIM-PIs and ladder PIMs will be presented based on rigid and bicyclic moieties, which are solution processable to form mechanically robust films with high internal surface areas (up to 1000 m^2/g). Gas permeation and physisorption data indicate the development of an ultramicroporous structure that is tuneable for different gas separation applications. Specific emphasis will be placed on the potential use of hydroxyl- and carboxyl functionalised PIMs for highly energy demanding applications for natural gas treatment and olefin/paraffin separation.

BEST PRESENTATION AWARD AT THE ICSPT 2017

Congratulations to PhD student Ms Hui Zhu who was presented with the Best Presentation Award at the ICSPT 2017: 19th International Conference on Separation and Purification Technology, which was held in Barcelona Spain in February 2017

Hui's talk examined 'CFD-DEM Modelling and Analysis of the Continuous Separation of Sized Particles Using Inertial Microfluidics', in which she discussed the inertial difference induced by the microfluidics inside a curved micro-channel has great potential to provide a fast, inexpensive, and portable solution to the separation of micro- and sub-micro particles in many applications such as aerosol collections, airborne bacteria and virus detections, as well as particle sortation.

In this work, the separation behaviours of different sized particles inside a reported curved micro-channel have been studied by a combined approach of computational fluid dynamics for gas and discrete element model for particles (CFD-DEM). The micro-channel is operated by controlling the gas flow rates at all of its branches respectively used to load particles, introduce gas streams, and collect particles of various sizes.

The validity of the model has been examined by comparing the calculated separation efficiency of different sized particles against the measurement. On this basis, the separation mechanisms of the inertial microfluidic separator are elucidated in terms of the interactions between particles, between particle and fluid, and between particle and wall.

The model is then used to study the effect of feed solids concentration on the separation accuracy and efficiency. The results obtained from the present study demonstrate that the CFD-DEM approach can provide a convenient way to study the particle separation behaviors in micro-channels of various types.

FAREWELL FROM HEAD OF DEPARTMENT, PROFESSOR KAREN HAPGOOD

Professor Karen Hapgood, Monash Chemical Engineering's Head of Department between 2012-2016 is being farewelled and congratulated as she commences her new career as Head, School of Engineering, Deakin University. From all within the Department of Chemical Engineering at Monash, we wish Karen good luck and invited her to pen her Monash story. Enjoy.

I joined the Department of Chemical Engineering at Monash University in January 2006, as a Senior Lecturer, after 5 years in the pharmaceutical industry in the US and Australia. Cordelia Selomulya joined at the same time and we were the first female academic staff to join the department. At the time, I had come straight from the pharmaceutical industry and so joining Monash and coming up to speed on teaching and research was a big deal for me. As my very first job as an engineering graduate had been with Honeywell, a control engineering company, I was naturally assigned to teach process control. I turned up to my first lecture, armed with a USB stick, only to find that there was no PC in the room, so I had to give the whole thing verbally. This however was better than my next lecture for a 1st year course, where a student lost consciousness in the middle of the lecture and I had to dial the emergency number to get medical assistance! (the student was OK). Despite such tumultuous start to my lecturing career, I very much enjoyed teaching and working with students. After 11 years of teaching I continue to maintain contact with many alumni, including alumni from my first classes.

As Cordelia and I both did research in the general area of particle technology, we co-founded the "Monash Advanced Particle Engineering Laboratory" or "MAPEL". I have had the pleasure of supervising many PhD and Masters students who were mostly looking at granulation of powders, and pharmaceutical manufacturing. All of the research projects were related to industrial powder processing problems, and some have gone on to attract follow-on research world-wide, including liquid marbles (Nicky Eshtiaghi, Thanh Nguyen and Sally Yue), drop penetration (Thanh Nguyen), distribution nucleation (Rachel Smith, Wav Kariuki), powder blending (David Barling and Kahlil Desai), foam granulation (Melvin Tan), agglomeration in filter driers (Hong Lim), and 3D printing of "perfect particles" (Ruihuan Ge). Most projects have had strong support from industry partners, allowing students to spend significant time at industry partner sites, particularly at the GSK Boronia and Port Fairy sites.

Monash Engineering has been a terrific place to build my career and in 2012 I was appointed Head of Department, the first female to hold this position, as well as being the youngest to date. I loved this role – it offered the perfect blend of corporate and academic. Over the last 5 years, the Department has grown and changed enormously. In 2006 there was about 60 student in my control class, but this has grown to ~140 students, plus a new Masters program. We have invested in upgraded teaching facilities and technology, and gradually overhauled our student lab equipment. I am particularly proud of the "cheap and cheerful" renovations in the old 3rd and 4th year rooms, which finally eliminated the dusty old blackboard. These rooms were renamed the Potter and Lawson rooms, in honour of the first two heads of department, and these names have stuck and helped ensure modern students hear a little bit about the key Professors who were instrumental in getting Monash Chemical Engineering off to a flying start.

Our research contingent has grown also. Our postgraduate student numbers have grown from around 70 to over 150 PhD and Masters students, providing a never-ending challenge to Jill Crisfield (Department Manager) and Lilyanne Price (Academic Programs Manager) on where

to fit them all. As the postgrad students have grown, our facilities have grown also. Researchers now have access to new analytical equipment that makes their research easier, including a SEM unit in the Departmental for routine analysis and surface analysis equipment. Our staff numbers have grown as has our footprint - a quarter of our staff are based in the New Horizons building, which promotes broad research collaboration – mostly via the good coffee available on the ground floor. We have had a few great departmental get-togethers and short retreats – some to work on strategy ideas, some to concentrate on grants, and some to say farewell to some great staff.

As a Department, I think my main contribution has been to support larger and more ambitious collaborative team research. The Department now has extensive collaborations with other staff in the New Horizons and the Green Chemical Futures buildings, and with large industry consortia in the energy and paper industries. Chemical Engineering now hosts two major ARC Research Hubs, each involving many researchers and industrial partnerships. The department is currently at the top of Australia in a number of external benchmarks – most notably we are equal 1st in Australia for Chemical Engineering based on the Excellence in Research Australia analysis and #28 in the world in QS discipline rankings (up from #45 in 2012). We are now flooded with undergraduate and postgraduate student inquiries and our staff are regularly recognised by awards, research contracts and patents. In practice, this means we don't have to start each presentation or meeting with a long explanation about Monash – we are now "on the map" for Chemical Engineering.

In addition to all the Department changes and milestones, there are some great moments that stand out. One is the Department roadtrip to the 2010 Chemeca conference in Adelaide, efficiently organised as usual by Jill Crisfield. She herded seventy staff and postgrads on a bus, with our trip including an overnight stop on the return where we took our international students out to a local country pub – complete with resident kelpie. The SMUCE dinner is another highlight- a chance to walk into a room of students you see almost every day but recognise barely anyone as they look completely different dressed up. (I think the experience is the same but in reverse for the students.) An annual highlight was to travel across the state to visit final year students in the Industry Placement unit and see the amazing project outcomes they achieved after 4 or 5 months on site. Being involved in the final year research and design projects each year is always a terrific chance to work closely with the students. I always feel proud to overhear final year students, passionately debating design options as they walk past my office door. And a list of highlights would be incomplete without mentioning the long running #trucksrule joke in control and the hilarious student exam art it produced year after year.

I have thoroughly enjoyed my time at Monash, and after spending 11 years of building a great career from scratch in the Department, I am sad to say farewell to you all. I send my best wishes to all staff, students and alumni who I have had the pleasure to work with over the years, and I look forward to keeping up with all the Department news in future issues of the newsletter.

Karen Hapgood
December 2016

PREDICTING THE CONFIGURATIONS OF DNA MOLECULES IN A FLOW FIELD - RESEARCH ON THE COVER

The results of a collaborative study between Professor Ravi Jagadeeshan and colleagues in the USA have been published in two back-to-back papers in the January 2017 issue of the Journal of Rheology [4,5]. The significant advances in experimental and computational methodologies, and the impressive agreement between experimental results and simulation predictions have led to one of the papers [4] being chosen as the featured article in the issue, and both papers have been highlighted on the front cover of the issue.

The success of the simulations in predicting the experimental observations implies that we now have a quantitative understanding of the dynamics of semidilute polymer solutions, which will prove to be immensely useful in a diverse range of technological applications.

The properties of many modern products manufactured in the cosmetic, pharmaceutical, and plastics industries are crucially dependent on the spatial arrangement of the molecular constituents that make up these products, and on the nature of their mutual interactions. The 'holy grail' of research and development of these products is to be able to design the topology and conformation of individual molecules, their packing on a molecular scale, and the way in which they interact with each other through various intermolecular forces, in order to achieve a desired product property. For instance, the alignment of polymer chains in the production of polymer films is a desirable trait for many applications since it results in superior mechanical and thermal properties. Another instance is the self-assembly of DNA and other similar nucleotide-based polymers for constructing multifunctional, nanometre-scale therapeutic agents with specific mechanisms of action. An essential step towards achieving this still distant goal is to be able to observe the non-equilibrium dynamics on the molecular scale, and to map the resulting understanding of the microscale physics to the macroscopic or emergent properties of such materials.

A major advance in this direction has been the development of single molecule techniques that enable the confinement, manipulation and observation of single particles and molecules using methods such as optical traps, magnetic tweezers and hydrodynamic fields. Of particular interest in the present context is the development of the 'Stokes trap' by Professor Charles Schroeder and his group in the Department of Chemical and Biomolecular Engineering at the University of Illinois at Urbana-Champaign, which is a significant step forward with the potential to impact broad fields ranging from biophysics to materials science. It is essentially a new method to confine and manipulate multiple nanoparticles or molecules using only fluid flow, without the need for electrical or optical fields [1]. Using single molecule fluorescence microscopy, the Stokes trap enables the observation of the dynamics of single molecules stained with fluorescent dyes over sustained periods of time, when subjected to a flow field. This capability proved to be especially important for the PhD thesis research of Dr Chandi Sasmal (who recently graduated from the Department of Chemical Engineering supervised by Professor Ravi Prakash Jagadeeshan), on the flow behaviour of polymer solutions.

The 'intermediate' range of concentration in polymer solutions, between the limits of dilute and concentrated solutions, is extremely relevant in a number of industrial applications such as ink jet printing and the spinning of nanofibers, and in biological processes such as the diffusion of proteins in the crowded environment of a single cell. This so called 'semidilute' regime of concentration has proven particularly difficult to characterise because of strong intermolecular interactions between the different polymers in the solution, which prevents a simple theoretical treatment based on the behaviour of individual polymer chains. In an important breakthrough, Professor Jagadeeshan's former PhD student Aashish Jain developed molecular theories and computational algorithms capable of accurately capturing the equilibrium behaviour of polymer solutions in this regime of concentration [2]. Chandi Sasmal built on this theoretical foundation to develop a highly advanced mesoscopic simulation algorithm that can describe far from equilibrium semidilute polymer solutions [3], and subsequently applied his methodology to compute the non-equilibrium dynamics of individual molecules in the flow field generated in a Stokes trap. Realising that the validity of these theoretical developments could be evaluated by directly comparing simulation predictions with experimental measurements in the Stokes trap, a research collaboration was initiated between the Schroeder and Jagadeeshan groups, whereby Professor Schroeder's PhD student Hsiao Kai-Wen would perform experiments under conditions that matched the simulations of Chandi Sasmal.

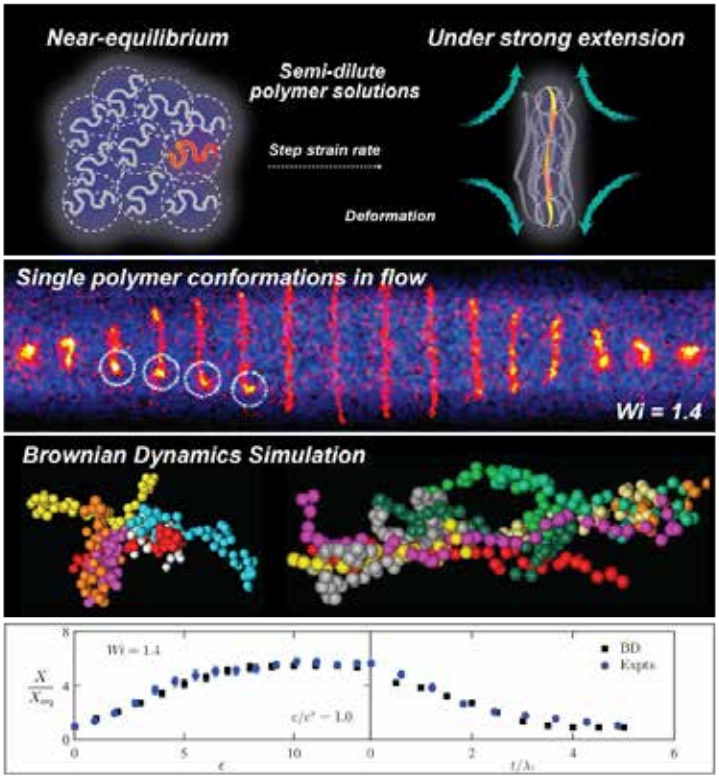
DNA molecules in solution have proven to be model polymer solutions for the purpose of evaluating molecular theories, since they can be produced with identical molecular weights, and can be stained with a fluorescent dye for visual observation. Using a double-strand linear DNA from the lambda-phage bacteriophage, which has roughly 48,000 base pairs, Kai-Wen carried out experiments in which individual molecules in the semidilute solution were trapped in the centre of the Stokes trap, and observed as the flow field was suddenly switched on, and subsequently stopped. Since the flow of the fluid past the segments of

a DNA chain exerts a drag force, the DNA chain unravels in the flow field and stretches out. However, not all molecules behave identically because they have different initial configurations, and they are subjected to thermal fluctuations due to the bombardment by fluid molecules. As a result, the experiments revealed a fascinating and rich diversity in behaviour of DNA chains as they stretched out due to flow and then relaxed back to their equilibrium configurations when the flow was switched off. Since Sasmal's simulations take into account the presence of fluid drag and thermal fluctuations, a systematic comparison of theoretical predictions and experiments could be carried out.

The success of the simulations in predicting the experimental observations implies that we now have a quantitative understanding of the dynamics of semidilute polymer solutions, which will prove to be immensely useful in a diverse range of technological applications.

Dr Chandi Sasmal is currently a Postdoctoral fellow in the Department of Chemical Engineering, University of California, Santa Barbara, USA, with Professors Gary Leal and Glenn Fredrickson.

[1] Shenoy, A.; Rao, C. V.; Schroeder, C. M., "Stokes trap for multiplexed particle manipulation and assembly using fluidics", Proc. Nat. Acad. Sci. USA, 113, 3976–3981, 2016.
[2] A. Jain, B. Duenweg, and J. R. Prakash, "Dynamic crossover scaling in polymer solutions", Phys. Rev. Lett., 109, 088302 (2012).
[3] A. Jain, C. Sasmal, R. Hartkamp, B.D. Todd, J. R. Prakash, "Brownian dynamics simulations of planar mixed flows of polymer solutions at finite concentrations", Chem. Eng. Sci., 121, 245–257, (2015).
[4] Hsiao, K.; Samsal, C.; Prakash, J. R.; Schroeder, C. M., "Direct observation of DNA dynamics in semidilute solutions in extensional flow", J. Rheol., 61, 151–167, 2017.
[5] Sasmal, C.; Hsiao, K.; Schroeder, C. M.; Prakash, J. R., "Parameter-free prediction of DNA dynamics in planar extensional flow of semidilute solutions", J. Rheol., 61, 169–186, 2017.



Artwork appearing on the front cover of the January 2017 issue of the Journal of Rheology. The top panel is a schematic representation of polymer molecules in a semidilute solution assuming coiled and stretched configurations at equilibrium and in flow, respectively.

The second panel displays images from a fluorescent microscope of stained DNA molecules stretching at the onset of flow and relaxing when the flow is switched off. The third panel is a snapshot of various configurations adopted by the coarse-grained models used to represent polymers in the simulations.

The bottom panel depicts the superb comparison between experiments and simulations (BD) of the mean stretch of the polymer molecules in the flow direction as a function of time.

IN PROFILE: PROFESSOR AIBING YU

Particles are all around. In fact, particles are the second most commonly handled material – after water – in the world. However, our understanding of particulate systems and the interaction forces that occur between particles and surrounding fluids, as well as between particles and walls, is limited. This gap in knowledge is largely due to the difficulties associated with determining the forces that govern the packing and flow behaviour of particles experimentally.

Aibing Yu is hoping to change all that. He has established the Laboratory for Simulation and Modelling of Particulate Systems (or SIMPAS) at Monash University, Australia, as a world-leading research facility in particle science and technology.

As well as heading up SIMPAS, Aibing is Vice-Chancellor's Professorial Fellow, Pro Vice-Chancellor and President (Suzhou) at Monash University. He has published over 900 articles in particle/powder technology and process engineering and is an Executive Editor of Powder Technology, as well as being on the editorial board of around 20 other journals. Aibing has received various prestigious fellowships and awards including an ARC Federation Fellowship, the Ian Wark Medal and Lecture, and Top 100 Most Influential Engineers in Australia. He is an elected Fellow of Australian Academy of Science, and Australian Academy of Technological Sciences and Engineering.

Aibing talked to *Materials Today* about his research and future plans…

How long has your team been running?

SIMPAS was established after I joined University of New South Wales (UNSW) in 1992 and largely represents my own research team. Based on this, I established a multidisciplinary research centre at the university in 2000. SIMPAS played a lead role in establishing various initiatives at the national level. For example, I was Deputy Director of the ARC Centre of Excellence for Functional Nanomaterials (2003-2010), Founding Director of Australia-China Joint Research Centre for Minerals, Metallurgy and Materials (2013-2015), and ARC Industrial Transformation Research Hub for Computational Particle Technology (2016-). Recently, sponsored by Jiangsu Industrial Technology Research Institute (JITRI) and local government, we have also established a Specialised Research Institute for Process Modelling and Optimisation in Suzhou, China. SIMPAS moved with me to Monash University in 2014.

How many staff makes up your team?

SIMPAS is currently composed of 15 academic and research staff, along with 35 PhD students. Since its foundation, SIMPAS has graduated over 35 postdoctoral fellows, 70 PhDs and 20 master students.

What are the major themes of research in your lab?

Simulation and modelling of particulate systems is our major research theme. Our aim is to understand the fundamentals governing particulate flow and packing through rigorous simulation and modelling of the particle-particle and particle-fluid interactions at different time and length scales, with application oriented to the mineral/metallurgical/material industries.

The research in SIMPAS lies in five inter-related areas at three levels, as shown in the schematic (Fig. 1), including the development of simulation and modelling techniques (level 1), fundamental studies of particle packing and flow, and the transport properties of static/dynamic particle systems (level 2), and industrial applications (level 3). The three-level classification represents, on one hand, the flow path from R&D capability to industrial application, while on the other highlights the needs from different industries that are the driving force for our research.

How and why did you come to work in these areas?

The challenge of understanding particulate systems first sparked my interest back in the late 1980s when I was doing my PhD on the packing of particles. There is an urgent need to develop innovative techniques to overcome the difficulties of investigating particulate systems. Simulation and modelling, developed on the basis of well-established laws in physics, offers an effective method to do so. With this realisation, I established my team in this area when I started my academic career at UNSW.

What has been your highest impact/most influential work to date?

In terms of research, I have developed a sustained particle- and multi-scaled way to study granular/particulate matter at various time and length scales. This breakthrough has played an important role in developing a step change – and to a large degree, revolutionary– advancement in process modelling and analysis.

In terms of applications, my research impact is significant, having led to multimillion-dollar savings per annum in

various industries. In terms of education and training, SIMPAS has trained more than 150 researchers, many of whom are now playing a lead role in academia or industrial R&D.

SIMPAS has conducted over 60 projects supported by the Australian Research Council (ARC), bringing more than A$70M in research funds to UNSW and Monash University.

What facilities and equipment does your lab have?

SIMPAS has developed a sustained and systematic way to study particulate/granular matter at various time and length scales including, for example, the determination of contact forces between particles at an atomic or sub-particle scale, dynamics of a particle system at a particle scale, and performance of an operational unit at a process equipment scale. Our research is mainly computational, so in addition to the use of relatively well known techniques such as Molecular Dynamics (MD) simulation, Lattice Boltzmann Method (LBM), Finite Element Method (FEM), and Computational Fluid Dynamics (CFD), we have also developed a wide range of numerical tools to study particulate systems at the particle scale, mainly based on the so-called Discrete Element Method (DEM) and CFD-DEM (sometimes referred to as Combined Continuum-Discrete Method or CCDM). The tools and research outcomes have been widely used in the design, control and optimisation of industrial processes.

Our work is mainly computational, and intellectually challenging but we are also well equipped with advanced computing facilities (e.g. high performance CPU- and GPU-based computers) at UNSW and Monash. In addition, we have access to computational facilities at the national level (e.g. National Computational Infrastructure in Australia). In the past, we have also built-up experimental facilities of various types, mainly for material characterisation and lab-scale experiments for model development and validation.

The same idea can be applied in the study of other 'particle' systems. One such example, focused on nanocomposite materials, is shown in Fig. 3. The so-called particles in a nanocomposite experience different governing forces because of the difference in time and length scales. Consequently, different simulation techniques are used for such systems in SIMPAS.

Do you have a favourite piece of kit or equipment?

I am particularly proud of our CFD-DEM approach in which we employ a traditional CFD model and an innovative DEM model to describe coupled particle-fluid flows at the individual particle scale. This modelling technique is now widely accepted as one of the most effective ways to study the fundamentals of the particle-fluid flows that are widely found in industries. The method has now been further developed to include heat and mass transfer so that particle-scale modelling of complicated industrial multiphase processes is feasible.

What is the key to running a successful lab?

There are different answers from different people with different backgrounds. For me, the answer is simple: a leader must have a big vision, be able to identify important areas for development, and motivate his/her group to work hard toward the goal(s) set.

How do you plan to develop your lab in the future?

Particle science and technology is multidisciplinary and relatively new. According to Professor Pierre-Gilles de Gennes, the 1991 Nobel Prize laureate in Physics, "Granular matter in 1998 is at the level of solid-state physics in 1930". At present, solid-state physics is still one of the most active research areas, so granular or particle research is probably still in its infancy. There remains a lot to learn, so it is difficult to predict its future. But one thing is sure: there will be many new developments in theories, physically meaningful models, and advanced research techniques – and particle-scale studies will represent a major trend.

With support of the newly established National Research Facilities - the ARC Research Hub for Computational Particle Technology in Australia and JITRI Research Institute for Process Modelling and Optimisation in China, SIMPAS will grow further. In the coming years, SIMPAS will focus on the quantification of particle-particle and particle-fluid interaction forces under different conditions, the development of a theory to link discrete to continuum modelling, and the development of more robust models and efficient computer codes for designing and optimising particulate and multiphase processes that are widely used in industries. In the meantime, SIMPAS will put more and more effort to the commercialisation of its research techniques and outcomes, aiming to generate an impact not only in research but also in industrial applications.

Article originally published on 'Materials today' http://www.materialstoday.com/lab-profile-aibing-yu-simpas-monash-university

INTERNSHIPS WITH AUSTRALIAN DAIRIES

Krystel Li, a PhD candidate within the Department of Chemical Engineering, undertook a summer internship at Australian dairy companies Devondale Murray Goulburn (2015/2016) and Burra Foods Australia (2016/2017) as part of the Monash Industry Team Initiative (MITI). Krystel, who is in the last year of her PhD, is examining the improvement of functional properties of dairy powders, under the supervision of Professor Cordelia Selomulya.

Krystel valued the experience to take time out of her PhD to gain valuable industry experience, especially in the dairy industry.

"The difference between doing a PhD and working in the dairy industry is tremendous," said Krystel. "While doing a postgraduate degree by research involves mainly working on your own, in industry, you need to be able to communicate with all the different departments in the company, so having good communication skills is vital, and that is something postgraduates might lack as we communicate mainly by written word rather than spoken word."

The two projects that were offered to Krystal by the companies were completely different. However, they both offered broad industry skills. At Devondale Murray Gouldburn, she worked on using novel technologies to improve the taste of UHT milk. "UHT milk products (long shelf life milk) are not overly popular in Australia given people prefer to drink fresh pasteurised milk. UHT has a 'cooked' taste as it has to be heat treated at a very high temperature to kill heat resistant spores, and by doing this, there is a change in the milk's taste," Krystel said. Through this project Krystal worked within a team that assessed and tested several techniques that could be used to eliminate the cooked taste but still ensuring the long shelf life. UHT can last up to nine months and is more economical and sustainable than fresh milk."

During her time at Burra Foods, Krystel worked on the optimisation of the frozen cream packing line and identified ways to minimise waste. "At Burra Foods I had the opportunity to work on a real-time problem and the need to develop concrete and realistic solutions. This project offered me concrete and realistic solutions. I really appreciated the time that the people took to answer my many questions and how they provided guidance on the project I undertook at Burra Foods".

"I made a lot of friends with the employees at Burra Foods and also with other MITI interns. The best part of the MITI interns is that there is always a great atmosphere of camaraderie even though we are required to work very hard on our assigned projects. There would be days on the project, when we would have to work at night or over extended hours depending on when a production was running, to resolve a particular product line issue. These periods gave me real-life employment experiences that I did not expect before undertaking the MITI program'. Krystel said.

The outcomes of both projects have been significant, with the potential of saving the companies on their bottom line, something that is very important in a competitive industry sector.

"I would like to thank my supervisor for allowing me to take time off (twice) from my PhD project in order to do these industry placements. Not a lot of supervisors would have permitted that. I also want to thank the MITI team for their wonderful effort of giving students like me such a great opportunity and for narrowing the gap between university studies and working in industry."

Last day at Burra Foods with Prenesh (IT data analyst), Chris (Engineer), Neil (Powder technician), Kim (Engineer), Neil, Prathamesh, Krystel, Meghna and Vidia (Calibration technician)

Neil and Krystel at Burra Foods

THE MONASH DOCTORAL GRIP PROGRAM

The Monash doctoral GRIP (Graduate Research Industry Partnerships) program has only been established for a couple of years, however has already earnt a stellar reputation from the Science and Engineering staff and students enrolled in the program. GRIP students are invited to take part in monthly meetings, which explore relevant industrial skills required for PhD graduates through workshops and presentations run by industrial experts.

Just last month, Lynne Hayward, director of Steedan Services was invited to Monash University to present a Business Writing Skills workshop, run solely to aid and inform the GRIP students on the correct techniques to use when drafting internal documents.

The aim of the GRIP program is to ensure that students enrolled in industrial partnership PhD programs have the business skills required for the workplace at the completion of their PhD. Currently, there are four other GRIP programs in place at Monash University; the Chemicals and Plastics (C&P GRIP); Water and Sustainability in Asia GRIP and the Sustainable and Effective Public Transport (SEPT) GRIP.

The Food & Dairy GRIP has become a fourth GRIP project to be added to Monash University's GRIP offerings. These projects provide the research students an opportunity to work closely with the industry partner throughout their PhD projects. The dairy-focussed GRIPS program was created, due to the increase in dairy-based PhD programs thanks to the formation of the JRC (Joint Research Centre for Dairy innovation). This centre, headed by Professor and ACR future fellow Cordelia Selomulya, offers PhD and research opportunities which partners Monash students with multiple dairy industries both here and overseas. Not only are industrial-run workshops a signature part of the GRIP program, but all GRIP students receive a 3-month internship with their sponsored industrial partner. George Mutch, a C&P GRIP PhD student completed part of his internship in Beijing, China, late last year and has nothing but praise for the GRIP program.

"The GRIP program has helped me come into contact with a plethora of cutting-edge industry specialists in my field and through the internship provided by the GRIP program I've been able to get a feel for both what industrial research in the context of engineering truly feels like and what it's like to be part of a multinational company overseas."- George Mutch, Chemical Engineering PhD Candidate

"As the two first student members of the Food & Dairy GRIP, we have been attending the C&P GRIPS workshops for a number of months, and have been delighted to find how relevant and useful these sessions are. Although mainly focussed for the chemicals industry, there are key concepts and skills learnt in every workshop which are applicable for any industrial sector", said Grace and Jonathan.

As the number of students enrolled in the Food & Dairy GRIP continues to climb, with an estimated 15 students to be associated with the JRC centre by 2017, we are looking forward to the new dairy-focused workshops which will be offered from the GRIP program. Not only will these sessions highlight key aspects and critical skills specific for the dairy industry, but they will also provide increased opportunities for networking with industrial leaders in the dairy field, which will be key to future career-strengthening throughout the course of our PhDs and into the future.

Grace Talbot-Walsh and Jonathan Chew, Dairy GRIP and JRC members

FOOD & DAIRY INDUSTRY PARTNERSHIPS

Now recruiting PhD students for 2017

"These partnerships provide our PhD students with the opportunity to develop interdisciplinary research expertise, professional skills and networks relevant to industry."
Professor Zlatko Skrbis, Vice-Provost (Graduate Education), Monash University

Applications close on 14 April 2017; however, positions may fill prior to this date. You are encouraged to apply as soon as possible to secure your PLACE EARLY.

FOR MORE INFORMATION ON AVAILABLE PROJECTS AND HOW TO APPLY VISIT THE WEBSITE

https://www.monash.edu/food-dairy-grip/_nocache

LEADING MATERIALS ENGINEER RECOGNISED WITH INDUSTRY'S HIGHEST HONOUR

An internationally recognised expert on material degradation from Monash University was recently honoured for his distinguished contributions to materials science and engineering by the prestigious organisation ASM International (formerly known as the American Society for Metals).

Professor Raman Singh is one of the ASMs 2016 Class of Fellows, and attended the society's annual dinner in Salt Lake City, Utah late in 2016.

Professor Singh said that he was pleased to be made a Fellow of the ASM.

"It's wonderful to be acknowledged by my peers in this way," he said.

Professor Singh was nominated for the award for his outstanding contributions in understanding and mitigating material degradation through novel approaches, and for successfully establishing and leading interdisciplinary teams.

During his 19 years of research at Monash, Professor Singh has worked on a range of projects including nanotechnology and advanced materials to mitigate degradation and corrosion for aerospace, defence and medical applications.

He has had a distinguished career which has included many honours and achievements. He has edited a book about cracking of welds, is an Invited Fellow of Engineers Australia and a member of the editorial/review boards of several academic journals. He has chaired and spoken at many international conferences, and in 2017 he will chair the 17th Australian International Aerospace Congress in Melbourne which will be held in conjunction with the Australian International Airshow. He has published 15 book chapters, over 170 peer-reviewed journal articles, and received several research grants from the Australian Research Council. He has supervised 38 PhD students, and his vibrant research group at Monash University comprises of PhD students from a range of disciplines including mechanical, chemical, materials and mining engineering, as well as science.

ASM International was founded in 1913 as the American Society for Metals, and is now the world's largest association of materials-centric engineers and scientists.

The honour of Fellow of the Society was established to provide recognition to members for distinguished contributions in the field of materials science and engineering, and to develop a broadly based forum for technical and professional leaders to serve as advisors to the Society.

Monash Chemical Engineering leads Australian Universities in QS World University Rankings

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

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

28/300

Chemical Engineering School Worldwide

DAVID BOGER NAMED A US NAE MEMBER

Professor David Boger FRS FAA FTSE, from the Department of Chemical Engineering at Monash University, has been named a Member of the US National Academy of Engineering (NAE) – one of 84 new members.

Professor Boger, an ATSE Fellow since 1989, was honoured "for discoveries and fundamental research on elastic and particulate fluids and their application to waste minimisation in the minerals industry."

The 2017 election of 84 new members and 22 foreign members brings the total US membership to 2,281 and the number of foreign members to 249.

NAE membership honours those who have made outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature" and to "the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/ implementing innovative approaches to engineering education."

Newly elected members will be formally inducted during a ceremony at the NAE's annual meeting in Washington in October.

Professor Boger's contributions to fundamental research in fluid mechanics are highlighted by a class of fluids which now bear his name globally – Boger Fluids.
These fluids are constant-viscosity elastic (non-Newtonian) fluids that behave as both liquids and solids.
The detailed experimental investigations using such materials to define fluid elasticity effects in important flows, the linking of basic surface chemistry to the continuum properties and processing of particulate fluids and the development of novel methods for flow property measurement have resulted in significant industrial outcomes in the petroleum, food, polymer and minerals industries.

For a lifetime of pioneering work in fluid mechanics, at both Monash and the University of Melbourne, Professor Boger received the 2005 Prime Minister's Prize for Science.
This article was published on the Australian Academy of Technological Sciences and Engineering (ATSE) website.

STUDENT ANURAG PARIHAR TAKES 2ND PLACE IN AUSTRALIAN SYNCHROTRON USER MEETING 2016

Congratulations to PhD candidate Anurag Parihar whose poster took out 2nd prize in the Australian Synchroton User Meeting held in November 2016

Anurag's poster, titled Thermochemical conversion of low-rank fuels to bio-based products, examined low-rank fuels such as biomass and mixed municipal solid waste (MSW) can be valorised into useful products ranging from chemicals to bio-oil through thermochemical treatment.

However, disparate physical and chemical properties of these fuels entail usage of different heating rates for isolating the product of interest. Rapid thermal degradation of biomass is conducive for producing chemicals whereas slow thermal degradation of MSW would facilitate simultaneous investigation of thermochemical breakdown and associated kinetics for bio-oil production.

In this study, two different heating rates of 30°C/min and 150°C/min are employed to examine thermal degradation of MSW and biomass respectively through synchrotron infra-red (IR) microscopy. Eight different constituents of MSW namely, yard waste, food waste, paper, rubber, low-density polyethylene (LDPE), polypropylene (PP), poly-(ethylene terephthalate) (PET) and poly-styrene (PS); and biomass (softwood-Pinus radiata), impregnated with five different acid concentration of 0.01M, 0.05M, 0.1M, 0.2M, and 0.5M are considered in this study.

Thermal degradation of each constituent of MSW and acid impregnated biomass is performed at 30°C/min and 150°C/min to assess their suitability for producing bio-oil and chemicals respectively. The various aliphatic and aromatic functional groups identified in this study during thermal degradation of MSW prove its suitability for bio-oil production. For biomass, the synchrotron IR analysis shows that acid-impregnation does not alter the surface functional groups but induces catalytic effect during thermal degradation. This information can help in enhancing the yield of bio-oil and chemicals from low-rank fuels through thermochemical treatment.

The Student Poster Slam is a special session in the User Group meeting, in which students are given the opportunity to present their posters to all delegates at the meeting, including the Poster Prize judges, using just two minutes and one PowerPoint slide.

SMUCE - SOCIETY OF MONASH UNIVERSITY CHEMICAL ENGINEERS

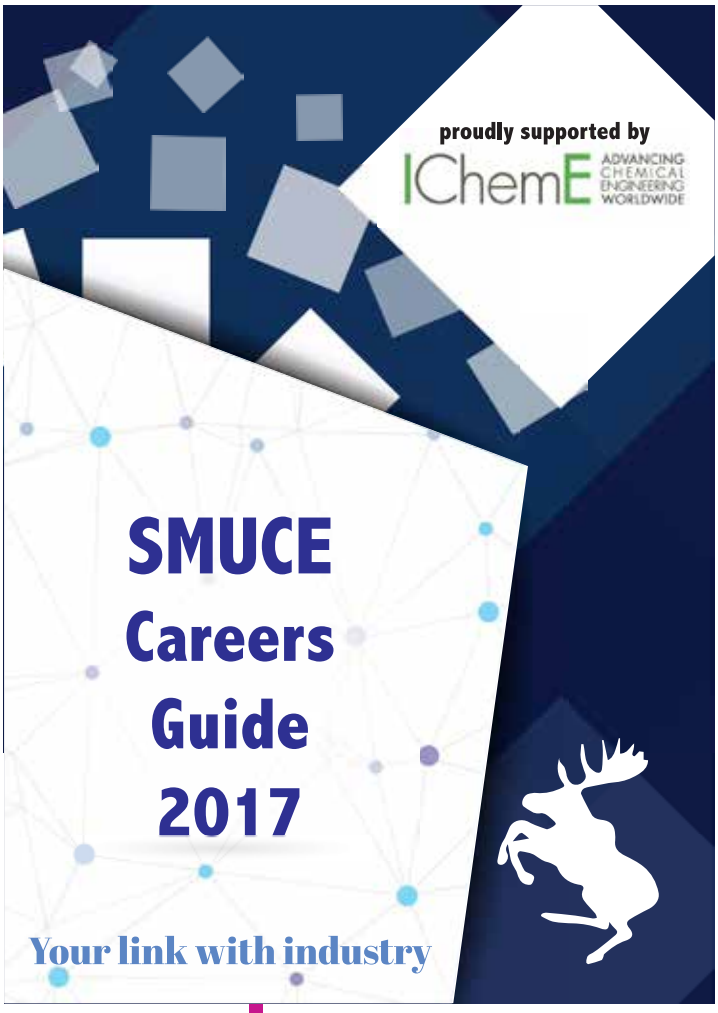
SMUCE (Society of Monash University Chemical Engineers) represents the undergraduate student body for Chemical Engineering at Monash University. Established in 1962, SMUCE plays a significant role in aiding the University experience for its 170+ members. SMUCE has designated Vice-Presidents responsible for the Academic, Industry and Social aspect of university.

Acting as a link between the Chemical Engineering department and the student body, the Academic VP voices the concerns of students to ensure they have the most enriching learning experience. This is done through attending academic staff meetings as well as organising and facilitating feedback for all undergraduate units offered by the department.

Perhaps the most important role within SMUCE is that of the Industry VP. Responsible for informing members about opportunities and pathways they may choose to seek once their undergraduate studies are finished, the Academic VP organises events such as Vacation Work Day and creates the much sought after SMUCE Career's Guide. Every Thursday SMUCE has Industry Representatives come into Monash to talk and network with students. Providing an intimate experience for students to network and share experiences with representatives, these seminars are what SMUCE is best known for by its members. (lol it's actually the pizza!)

Another important aspect of SMUCE is the social events it holds. In semester 1, SMUCE has its own Trivia Night at Sir John's Bar. It is always an enjoyable night for all involved and is a great way for everyone to let their hair down and get to know their peers in a social environment. Semester 2 is SMUCE's big social event: The SMUCE Ball. Unlike other engineering disciplines SMUCE hosts its own ball where academic staff and students get together for an exciting and glamorous evening and sit down dinner.

SMUCE is well known throughout its student body. Providing assistance for students academically and giving invaluable chances for them to set themselves up for a fruitful career. SMUCE also balances the social aspect of university to provide a diverse and unforgettable experience for all involved. Please visit us at our office opposite E2 for more information or for collaboration opportunities.



AVAILABLE NOW: THE SMUCE CAREERS GUIDE 2017

SMUCE have just released their career's guide and is available now.

Undergraduate students can get a copy from the SMUCE office located opposite the E1-E3 lecture theatres (ground floor of Building 32)

SMUCE STUDENT TESTIMONIALS

THREE WAYS INDUSTRY EXPERIENCE WORKED FOR ME - Shahzad Billimoria

1. It helped me evaluate the type of work I want to pursue

Three years into my double degree of engineering and commerce, I was at a crossroads. Did I prefer the engineering side of my degree or the business aspect? At the time, I thought I was primarily interested in highly technical core chemical engineering work, but I decided to test this belief and look for industry experience that would expose me to both elements. I secured an opportunity to join Henkel Australia for the summer at their Kilsyth plant, working within their Consumer Adhesives division. As the project centred on the analysis of new markets for existing and upcoming Henkel technologies, it was incredibly open-ended and involved marketing, finance and engineering aspects. During my time there, I was surprised to find that I thoroughly enjoyed tackling this multi-disciplinary problem and as a result became more open-minded about career paths that are not purely focussed on engineering.

2. It exposed me to a professional environment and improved my soft skills

While working in teams at university certainly improves our communication and collaboration skills, the casual social dynamic of university group projects is a far cry from the etiquette expected in a professional environment. One of my most memorable learning experiences was discovering that email was often much less effective than making a call when it came to acquiring information. As someone who is accustomed to primarily using messaging apps and organising my thoughts via written communication, I came to realise that my painstakingly crafted email to a time-poor supervisor or manager would often wallow in the low priority depths of their inbox, whereas picking up the phone usually yielded much better results. I became more articulate, direct and ultimately comfortable over the phone, while also learning to cut the waffle in my emails.

3. It increased my confidence and willingness to tackle new challenges

I am sure that while job hunting, many of us have looked at a job description and been filled with self-doubt. “My skill set doesn’t match the description exactly. I’ve never done something like this before and I might be out of my depth. Can I really be useful to this company? I’m just a student!” These were some of my thoughts when I first applied for the summer project at Henkel. I had almost no practical knowledge of manufacturing sites yet the project required that I develop an in-depth understanding of Henkel’s manufacturing processes. My commerce major was neither marketing nor finance, yet I was applying for a project that seemed to include significant amounts of both. It turns out that these fears were unwarranted - I learnt that if you are genuinely curious and enthusiastic about your work, your colleagues respond positively and make the steep learning curve that much smoother. Ultimately, it was immensely rewarding to present my findings to senior managers and to watch them seriously discuss the strategies and recommendations I had developed. I left feeling confident in my ability to learn, make meaningful contributions and add value and I encourage all of you to seek out as much industry experience as you can during your degree.

How I felt then vs how I feel now

SUMMER RESEARCH EXPERIENCE, Will Sikora

Being a third year student in a five-year degree can make it difficult in applying and being accepted to a vacation work placement. Knowing that many places only wanted penultimate year students for their vacation work I applied to them anyway - worst answer I could get is a no. Among those was CSIRO. Every summer, CSIRO runs a number of 'vacation scholarship' positions for third (and later) year students in research that typically run for 10-12 weeks. I applied simply to gain experience in a different area to that in which I had worked previously and I got just that.

I began work at CSIRO as a research engineer at the end of November around a week after exams had finished. The area was mineral resources and involved conducting Life Cycle Assessments (LCA) of copper mines and concentrators within Australia. This was conducted on behalf of a company external to CSIRO in Finland to explore typical impacts of the copper mines, where these impacts occurred in the process and the limitations of LCA.

Coming into this role at CSIRO I didn't know what to expect. I had never worked in research and for the first few weeks it can feel as though you've been thrown in the deep end. There were new concepts and phrases I had never seen before in my life specific to the mineral resources industry. On top of that, I had been given a task of compiling information and did not even know where to start. Luckily I found that a lot of what we had learnt in university helped me with getting on my feet in those first few days, not the specific equations or even definitions, but how to pick up a task and run with it, exploring different sources of information and asking for help when needed. This experience has also helped me understand why sometimes university subjects seem so disconnected or irrelevant to certain areas of engineering. This is because there is such depth even in a specific area such as mineral resources. Either way, I was glad that I was able to gain a foothold and make a start.

By about the seventh week, most of the required data had been collated. I had spent a lot of time finding various sources for each piece of information where possible and noting down everything I thought to be relevant along the way.

The problem was that often, when conducting research that hasn't had much previous input, information pertaining the specifics of the industry were scarce. Trade secrecy often meant that you could find only one piece of data for a certain category.

At first I was concerned. 'Am I just dumb? Is the information there but being a student I don't have the knowledge to find it?' were questions I asked myself initially. I raised my concerns - in a different way, of course - to the supervisor.

I was relieved when I was informed that missing data was normal and it just required justifiable assumptions. Eventually a large database of information was established and the LCA could be conducted. This involved generating numbers (impact factors calculated by others) and using them to estimate the environmental impacts of each input I had gathered.

Despite all the troubles with missing data- the project after all, was partly to explore limitations. A LCA was conducted and the results appeared to be plausible. We even had a meeting (over skype) with the person for whom the project was done. It was a relief to know that he was satisfied with the work and truly appreciated it. The work I had done was not deemed to be useless or subpar and thus, I felt a sense of accomplishment. The report is - at the time of writing - currently being written and it is hoped to be submitted to the Journal of Cleaner Production for publication.

The main thing I've learnt and want to share is that even if you think a role - be it a job, an extra-curricular activity or anything else - is not going to be suitable or useful in any way - rethink and try it (unless it's something extremely dangerous that might end in your untimely death). I say this since I was in a similar position before applying at CSIRO - not wanting to do research at all - but coming out of it, I learnt a lot that is going to be applicable in any job I undertake in the future or even just in university.

Congratulations to PhD Student Rebecca Ong, as the highest scoring student in CHE2162 – Mass and Energy Balances, who has received a copy of Associate Professor David Brennan's book "Sustainable Process Engineering".

INTERNATIONAL PERSPECTIVE, Astrid Ichsan

Hi, everyone! My name is Astrid and I am almost done with my degree (Bachelor of Chemical Engineering). I am an international student hailing from Indonesia. After a long 3.5 years, only one more bittersweet semester to go.

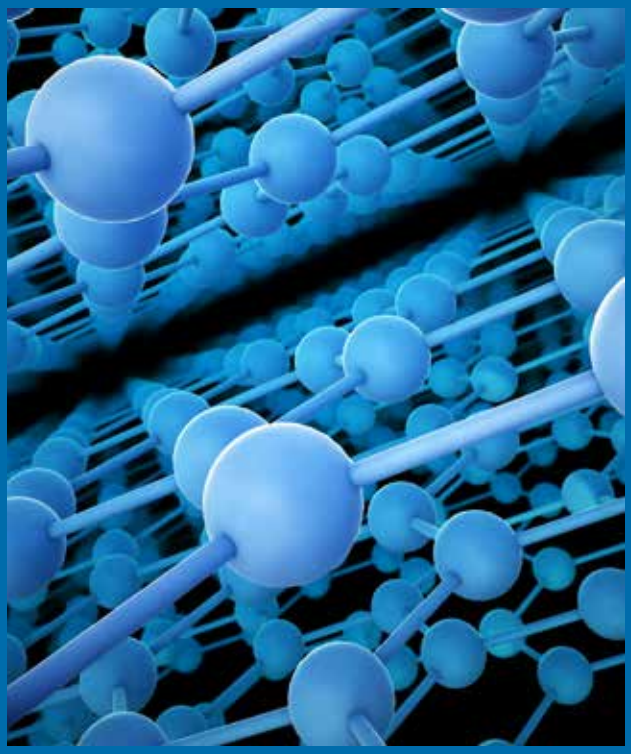
Over the years in my degree, there were countless assignments - both individual and in a group, giving me lots of all nighters and panic. Despite all that, I did not regret a single second of it. This degree has taught me a little bit about the real world - what does a chemical engineer do? What field can a chemical engineer enter? We learnt a little bit of everything; from process control and process safety, to process design, materials and corrosion - you name it. However, I would say that this degree would not be entirely complete without summer vacation work, also known as internships. It is a very valuable experience and I believe that it is a must have before graduating.

However, being an international student, the opportunity to obtain internships is scarce. Most companies in Australia only accept students who are permanent residents/citizens of Australia/New Zealand. Although it initially seems unfair, I have come to accept that there are probably underlying reasons for companies to not hire internationals whether it be regulations or just the uncertainty of whether international students would be able to stay after their degree after the training a company has provided has been completed.

Hence, I took it upon myself to actively search for more internship opportunities either online, door to door or even just ringing up smaller companies around the area. Monash has also made some effort to provide such opportunities, such as the MITI program, Summer Research Programs, careers festivals and professional development events. My efforts were not fruitless. During the summer of 2015, I was given the opportunity to partake in the summer research program organised by the Engineering Faculty. It ran for 3 months and it gave a really good insight to what is expected of a PhD student. I would highly recommend this program for people intending to further explore the world of postgraduates during their undergraduate years. I also managed to score a position as a vacation student at CSIRO this summer (Summer of 2016).

Another piece of advice I would love to share to all international students is to never be afraid to put yourself out there. As a famous saying goes, “It is who you know, not what you know”. The chance to study in a foreign country brings limitless opportunities to enlighten oneself about people from different cultures and backgrounds. I participated in various volunteering activities and also attended career seminars and networking events. Not only are these activities resume builders, it definitely broadened my horizons, improved my communication skills and made me a more open minded person enabling me to adapt to Australia better.

In a nutshell, I have to admit that chemical engineering is not easy but honing one’s soft skills as well as securing internships/jobs are even more challenging. It requires great effort and discipline to endure the steep learning curve. Fret not, both local and international students are in this together.



PHD OPPORTUNITY

A full-time funded scholarship is available for a fundamental research project on experimental and theoretical research based on physical organic chemistry.

Understanding Reaction Mechanism of Liquid Phase Catalytic Hydrogenation of Carbon Oxides

Expressions of interest are sought from outstanding candidates for PhD study in Chemical Engineering.

Dr Akshat Tanksale
+61 3 990 24388
http://www.monash.edu/__data/assets/pdf_file/0007/744226/PhD-Scholarship-in-Chemical-Engineering-EOI_Formaldehyde-Project.pdf

MITI EXPERIENCE, Jacinta Poon

Monash Industry Team initiative (MITI) is a great opportunity to gain industry experience in a multidisciplinary team. There is a large range of industry partners who participate in MITI and the program is continuing to grow. I am currently in my fifth year of my six-year Bachelor of Engineering (Honours) and Bachelor of Pharmaceutical Science.

Participating in vacation work has been a great way to see what I have learnt in university in an operating plant. The past two summers (2015/16 and 2016/17) I have participated in the program at Warrnambool Cheese and Butter (WCB). Although these two projects were at the same factory, they have had a different focus, which has allowed me to gain a larger insight into WCB and the style of work my degree can challenge me with. Returning to WCB in the summer of 2016/17, I had a bit of a head start on tackling the problem due to prior knowledge about the plant and staff.

What I have enjoyed most about working at WCB is the complete view I have gained of dairy processing. WCB's plant is unique compared to other companies in the industry, their site processes cheese, butter, whey protein, packaged milk, skim milk powder and GOS. This allows you to see how the by-product of cheese, or butter is utilised by walking across the road. I have also enjoyed the team structure of the program, as between the four people everyone always has different strengths, and this allows you to take advantage of them. It also allows you to answer a lot of questions between the group rather than looking elsewhere.

In 2015/16 we were tasked with three problems under an over branching theme of the evaluation and optimisation of thermal processes. One component of this program was developing a hydraulic model to assist in optimisation and addition of equipment onto the current system. Another component was focused on the effectiveness of a rapid cheese cooling tunnel. The final component of the project was to assess the current operation of the chemical reuse

system and evaluate the opportunity for improvement. When I returned in summer 16/17 it was nice and satisfying to see that they were using the hydraulic model we developed to assist plant upgrades.

Returning in 2016/17 our major focus has been on the minimizing of milk solid and water losses to wastewater. As a team we have been discovering causes for losses, and ways that they could be identified in the future. We have investigated where and how water is used, the individual plants water usage and what is sent to the drain. We have also had a look at where water could be reused rather than being sent to wastewater.

What I have really enjoyed about MITI is not just the project, but also the time after work living with my team. There were a fair amount of projects that were based in companies far from Melbourne, which allows you to live and experience the regional areas. Throughout my time in Warrnambool, I have visited some amazing beaches, local markets and tourism hotspots.
MITI is continuing to grow with the amount and breath of projects widening - the opportunities you can experience is also continuing to grow. I would highly recommend the MITI program to all students from all backgrounds in order to gain some hands-on experience in industry.

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

JACKY SONG REAPS THE BENEFITS OF AN OVERSEAS EXCHANGE AT HOME

One year ago, Monash University engineering and commerce student Jacky Song was preparing to travel to China. While he knew that he was going to spend time as an exchange student at Tsinghua University, he couldn't have predicted what would happen next. We speak to Jacky on his choices and opportunities.

As his studies at Tsinghua University were coming to an end, Jacky was offered an internship with AXA Group in Shanghai.

"When I was given the opportunity to work in Shanghai – the hub of commerce and trade in China – that was a no-brainer for me," he said.

During the six-month internship, his responsibilities included analysing digital markets in the Asia-Pacific, identifying large and small players in the technology sector, connecting startups with AXA Group and attending conferences.

"My biggest takeaway from this experience has to be the network I have built," he said.

After returning to Australia, Jacky continues to appreciate the benefits of his time in China.

"My network has been so effective that I have now secured another internship for the end of 2016 in Melbourne," he said.

Once he finishes his five year Bachelor of Engineering (Chemical Engineering) and Bachelor of Commerce degree, Jacky hopes to develop his technical skills as a chemical engineer at a processing plant, and to make the most of his qualification by transitioning to a business-oriented role in the future.

Jacky couldn't be happier about his decision to go on exchange, which allowed him to immerse himself in a different culture, learn a new language, and meet people from around the world while still earning credit points towards his Monash degree.

"Going on exchange was my goal ever since I completed VCE," he said.

We caught up with Jacky for a one on one conversation:

Jacky, what was it that attracted to you to study Chemical Engineering and to Monash University?

I chose Monash in 2012 because they offered double degrees. Coming from high school, I did not know what I wanted to do, so I chose two broad areas of study to keep me occupied. Furthermore, Monash has a prestigious engineering faculty, so it was also a choice of being part of something historically great.

After that first common year of engineering, I chose chemical because of the relevant industries that chemical engineers can be a part of. Traditionally, they go into mining or oil/gas, but in the recent few years, there have been more demand for skilled chemical engineers in the food, pharmaceutical, biotechnological and environmental industries – industries which are attracting more and more demand in many countries. The breadth of career choices with a chemical engineering degree was the reason why I made this choice.

What is your main chemical engineering interest?

My main interest in chemical engineering is how it relates to the commercial world. Although it is very impressive to learn how to design complicated process systems, it would be a complete waste of time if it cannot generate money to your employer! One thing that we are exposed to in the latter part of the chemical engineering degree is how to operate a chemical plant in a team setting. To me, this was the most enjoyable part of the degree, because we are required to think outside of the textbook to consider all different variables which act on maintaining steady and safe operations. Things like: how much money are we spending, how much demand is there for our product, are the by-products harmful, and so on.

You mentioned a second internship in Melbourne at the end of 2016, can you give us details?

Yes, I did a 10 week internship at Ernst & Young over the summer.

I was part of the advisory business line, working as an intern in the Asia-Pacific Insurance Technology Group (APAC ITG). This was a great experience as I was exposed to financial markets from all over Asia, and even had the opportunity to travel to Sydney at one point to meet our clients in their office. To top that off, I was offered a grad role for the end of 2017. This has taken a huge weight off my shoulders for my last year at uni.

LEADERSHIP PROGRAM STUDENTS SHINE AT ANNUAL DINNER

A group of talented young engineers recently celebrated their completion of the prestigious Engineering Leadership Program at Monash University.

The internationally recognised program prepares students to be leaders in their field and connects them with potential employers.

Alwin Wang, a Monash University student who recently graduated from the program, said the course was a really positive experience. “We had amazing speakers there with lots of life experiences and they had absolutely amazing presentations that imparted a lot of knowledge,” he said.

Monash engineering graduates are well known for their sound technical skills. But the outstanding students who participate in the Leadership Program also learn skills which are in high demand in the workplace such as communication, negotiation skills and project management. Student Arielle Tickner-Smith was the winner of the 2015 Transurban scholarship and gave a presentation at the program’s annual graduation dinner.

“In the last 18 months I’ve seen myself improve in absolute leaps and bounds, especially in my technical engineering knowledge, as well as my own confidence levels,” she said. Telstra Service Operations Chief Automation Officer, Mr Ian Wood, was one of the guest speakers at the dinner. He said that the Engineering Leadership Program helps Telstra to bring new blood into their team. “We like to see how the students go about creating and crafting solutions, their interest and intensity, their passion for what they do and their thinking outside of the box,” he said.

Other key industry partners involved in the program include Visy and Woodside Energy.
Dean of Engineering, Professor Frieder Seible, said that the program was highly valued by industry.

“This is really a program which helps our leadership students to set themselves apart from other graduates,” he said.

Monash student Annie Aldridge agreed, saying that she felt more job ready since completing the three year long program.“I have a lot more skills now, and I feel like I am more aware of what the workforce has in store for me,” she said.

Annie, Arielle and Alwin were among the 43 engineering students who graduated from the program in 2016. At the graduation dinner, sponsored by Woodside Energy, Telstra and Visy, students were seated with industry representatives to encourage networking and the development of professional relationships. The table centres were all high-tech student projects, including drones and 3D printed prosthetic hands.

Manager, Student and Industry Engagement Zara Hamon said that the Monash Engineering Leadership Program has been very successful for both students and industry, and encouraged more organisations to get involved in the program.“When one of our very high achieving students is awarded a scholarship from industry it benefits both sides. While it eases the financial burden for the student, our industry partners are able to build connections with some of the most talented engineers in the country before they even enter the workforce,” she said.

In 2016, the Monash Engineering Leadership Program was supported by Austrade, BECA, Centre for Engineering Leadership and Management, Clive Weeks AO and Helen Weeks, Dr C M Tay, CPB Contractors, Doric Group, Dubsky Family, Ericsson, Fulton Hogan, GHD, GlaxoSmithKline, Jacobs, John Holland, Nick Apostolidis, Orica Ltd, Pitt & Sherry, QANTAS, Simplot, Snowy Hydro, Telstra, Transurban, Visy, Wilson Transformers, Woodside Energy and Worley Parsons.

China Scholarship Council supporting students at MONASH

Hengsong Ji, a visiting student from Jiangsu University in China, has been in the department since July 2016 investigating coal ash and biomass ash slagging characteristics. Ji will remain in Melbourne until June 2017 as part of the China Scholarship Council OT program.

Under the supervision of Monash academic staff, his aim is to learn new research methods to solve biomass slagging problem under combustion and gasification.

Monash Engineering offers excellent opportunities for high achieving Chinese students to undertake an undergraduate scholarship program at Monash, sponsored by the China Scholarship Council (CSC). Candidates are first nominated by their university in China and then selected by Monash based on academic performance and English language skills. Successful candidates receive a CSC scholarship to cover their living allowance and return airfare to Australia.

MONASH STUDENT WINS PRIZE AT 2016 WA SYMPOSIUM OF NANOBIOTECHNOLOGY

Congratulations to Monash Chemical Engineering PhD student Mr Amlan Chakraborty who won the People's Choice Best Presenter Award at the 2016 WA Symposium of NanoBiotechnology held at The University of Western Australia in December 2016

The symposium, which is hosted by the Australian Nanotechnology Network, in sponsorship with the Australian Society for Biochemistry and Molecular Biology and the John Morris Group, and supported by the Australian Research Council, focuses on the amalgamation of research areas pertaining to nanotechnology and biotechnology.

Over the symposiums two days, international invited speakers included Prof John Dobson (University of Florida) and Prof Laurence Hurley (University of Arizona). The conference program allowed the opportunity for PhD students and Early Career Researchers to present in a three-minute thesis style presentation.

PhD candidate Amlan, who is supervised by Prof Cordelia Selomulya (Chemical Engineering) and Prof Magdalena Plebanski (Immunology) is undertaking an ARC and NHMRC funded research project on Immunomodulatory role of functionalised nanoparticles on Antigen Presenting Cells.

At the symposium, his presentation was titled Immunomodulatory role of surface functionalised

nanoparticles on Antigen Presenting Cells, in which he showcased his work on the designing of surface functionalised nanoparticles which can be encapsulated on micro-sized careers for use as vaccines.

Amlan believes that in the near future, treatments of diseases such as asthma and COPD is possible by utilising nanoparticles based agents. Although there are many obstacles to overcome, nanoparticle based immunotherapy certainly brings a bright prospect for medical science.

MACNAB-LACEY PRIZE - RUNNER'S UP

Peter Slane, Director Australasia, Institution of Chemical Engineers (IChemE) [back]
Kim Sho, Sean McKellar, Mitchell Fly, April Hinde [middle]
Andrew Hoadley, Karen Hapgood [ends]

The institution of Chemical Engineers MacNab Medal for Excellence in Sustainability-focused Design was awarded to the University of Manchester in 2016, with the team from Monash University also receiving a special commendation. Of the Monash entry the I.Chem.E. said "The highly-commended mention went to a team at Monash University, Australia, for its project of a "L-Glutamic Acid Production Facility".

The six-strong team was presented with its certificate in Melbourne, Australia last December. Teams from Monash University have previously won the 2013 and 2014 Macnab-Lacey Prize."

The 2016 Final Year Design Project was the design of a low carbon footprint methanol facility, which consumed waste carbon dioxide and also hydrogen from renewable energy as part of the feedstock. The announcement of the Pratt Prize will be made in May 2017.

CHEMECA 2017

The theme for Chemeca 2017 is "INNOVATION THROUGH SCIENCE AND ENGINEERING" and celebrates the pivotal role of chemical engineers and industrial chemists in creating new knowledge and translating it into trailblazing technologies that enhance our quality of life.

As one of the largest ever gathering of scientists and engineers to be held in Australia, the RACI Centenary Congress aims to showcase innovative research and technology and to provide inspiration for creating new opportunities to address future challenges. As a platform to promote interdisciplinary thinking that is the core of creativity and innovation, it will facilitate professionals from diverse areas of chemical sciences and engineering to interact, collaborate and deliver innovative solutions for a sustainable world and way of life.

A world-class line up of invited speakers have been assembled, including Monash Chemical Engineering's acting Head of School Professor Sankar Bhattacharya. Young researchers and students – our future leaders – are provided opportunities to showcase their research and be inspired to innovate. The Chemical Engineering Awards of Excellence dinner will be a highlight of Chemeca 2017 to honour and celebrate the exceptional people who contribute to chemical engineering and industrial chemistry.

Chemeca 2017 and the RACI Congress will be held at the Melbourne Convention and Exhibition Centre.

23-28 July 2017 | Melbourne

raci 100 Centenary Congress

CHEMECA 2017 KEY DATES

- Abstract Submissions Open (close 30 March)
- Early Bird Registration Closes 23 April
- CHEMECA DATES: 23-26 JULY
- RACI CONGRESS DATES 23-28 July 2017
- REGISTRATION http://www.racicongress.com/Chemeca2017/index.php

THE DEPARTMENT OF CHEMICAL ENGINEERING ALUMNI NETWORKING EVENING
Held during the 2017 Chemeca Conference:

Date: Wednesday 26 July 2017
Time: 6.00pm – 7.00pm

Venue: Melbourne Convention Centre, Level 1

Hosted by: The Department of Chemical Engineering, Monash University

Registration http://www.racicongress.com/Chemeca2017/index.php

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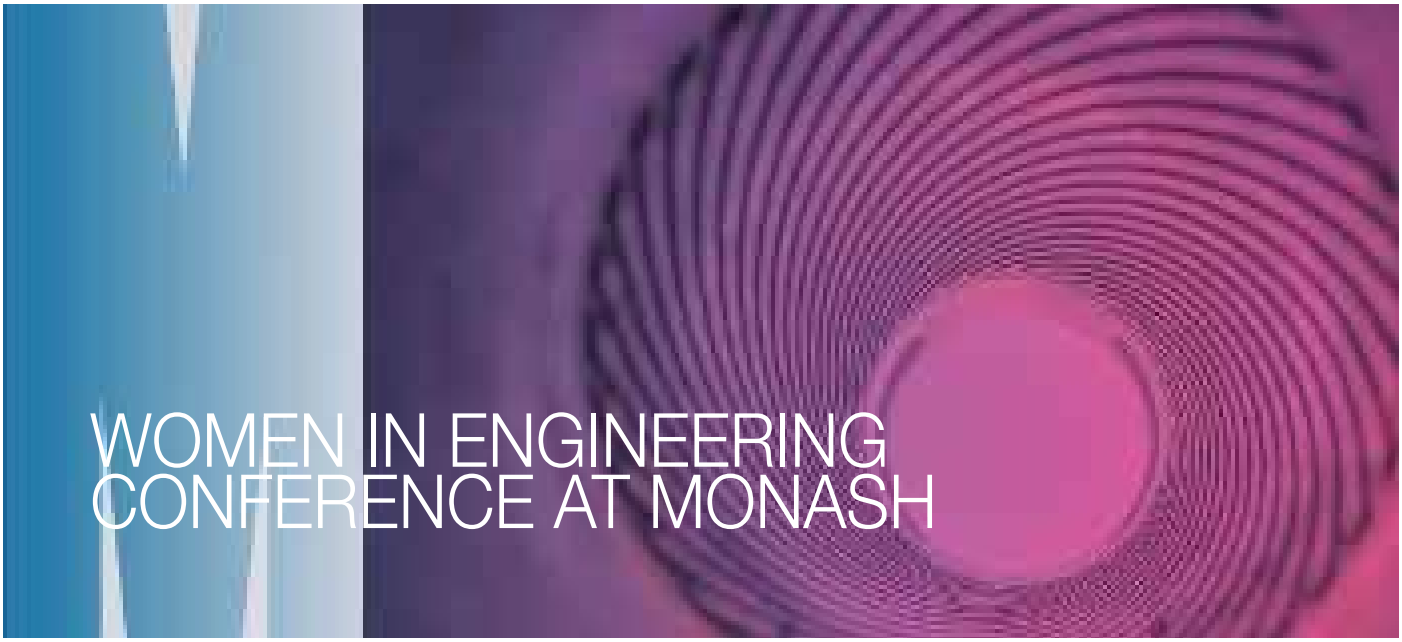


WOMEN IN ENGINEERING CONFERENCE AT MONASH

Women aspiring to careers as engineering academics have another reason to celebrate International Womens Day today – Monash University has just announced the return of a unique event specially designed to support women in engineering to progress their academic careers.

The Future Women Leaders conference will gather early career academics in engineering from around Australia. Attendees will attend workshops, learn strategies to deal with the specific challenges facing women in engineering and network with their peers.

Professor Ana Deletic is one of the convenors of the event. She's uniquely placed as an expert on the issue, being one of the few women in Australia who has made it to the top of her field. She's passionate about increasing the number of women in engineering faculties in Australia, and supporting sustainable career paths for them.

"It's well documented that diverse teams perform better, so it's absolutely clear that in order to solve the problems facing our world, we must ensure that we're nuturing and retaining the best talent," she said.

"Women are perfectly capable of being great engineers, but there are cultural barriers, such as unconscious bias, which can prevent them from reaching their full potential. We're looking at ways to remove those barriers and lead the change," she added.

The conference is just one of many initiatives that Monash University has implemented in order to support women in engineering. Another significant initiative is the women-only fellowships which will be advertised again this year. These engineering fellowships support women in the early stages of their career, allowing maximum flexibility for each candidate and their particular career development needs.

Dr Julie Karel joined Monash late last year as one of two inaugural Research Fellows in the program, and says that her experience so far at Monash has been really positive.

"Everyone is very supportive and I can really see how my research and my academic career could flourish here," she said.

"There's a really strong spirit of collaboration and team work," she added.

Professor Deletic and her colleagues are now calling for registrations for the two-day conference, which will be held in May. For more details, visit http://www.monash.edu/engineering/event/future-women-leaders-conference

For more information about gender equity programs at Monash University visit https://www.monash.edu/gender-equity

FUTURE WOMEN LEADERS CONFERENCE

The two day conference hosted by Monash University will gather early career academics in engineering from around Australia. Attendees will attend skill development workshops, learn strategies to deal with the specific challenges facing women in engineering and network with their peers.

15-16 June 2017, Melbourne VIC

MORE INFO: http://www.monash.edu/engineering/event/future-women-leaders-conference

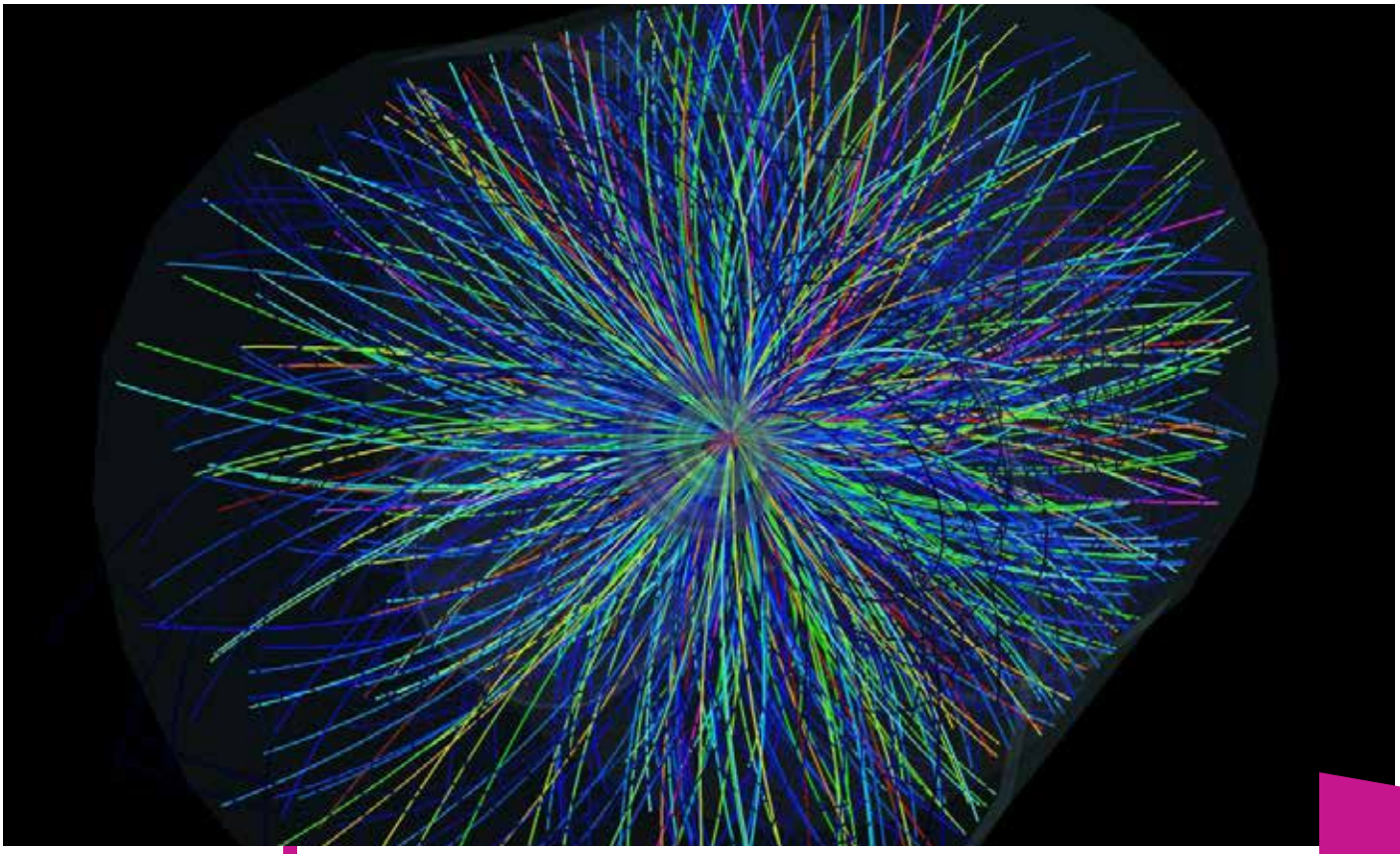
ARC RESEARCH HUB FOR COMPUTATIONAL PARTICLE TECHNOLOGY TO BE BASED AT MONASH AND LED MY AIBING YU

The ARC Research Hub for Computational Particle Technology, based at the Department of Chemical Engineering at Monash University (Clayton), will develop and apply advanced theories and mathematical models to design and optimise processes that are widely used in the minerals and metallurgical industries.

Headed up by Professor and Pro vice-Chancellor Aibing Yu, the $10 million dollar hub will generate new theories, computer models and simulation techniques through close collaboration with leading international companies JITRI (Jiangsu Industrial Technology Research Institute), Baosteel, Longking, and Rio Tinto. With new job opportunities for PhD and postdoctoral researchers, the hub will also offer a unique environment for training young researchers and engineers in the newly emerging area of computational particle technology.
Provost and Senior Vice-President, Professor Edwina Cornish said the hub is set to have a significant impact across a range of industries. “I’m delighted that Monash will play a key role in the ARC’s Industrial Transformation Research Program, which seeks to develop solutions to current industry challenges,” she said. “The hub will boost a range of industries that are of vital importance to Australia’s economic and technological future, including the minerals, metallurgical, materials, chemical, energy, pharmaceutical and environment sectors,” Professor Cornish said.

List of Hub researchers

Prof Aibing Yu (Hub director)
Prof Karen Hapgood
Prof Dongyuan Zhao
Prof Murray Rudman
A/Prof Xuchuan Jiang
Prof Cordelia Selomulya
Dr Ruiping Zou
Dr Wenyi Yan
Dr Zongyan Zhou
Dr Baoyu Guo
Dr Yansong Shen
Dr Shibo Kuang
Dr Kaiwei Chu
A/Prof Runyu Yang
A/Prof Haiping Zhu
Dr Qinghua Zeng
Dr Kejun Dong
A/Prof Vladimir Strezov
Prof Guoxiong Wang
Dr Baojun Zhao
Dr Sunny Song
Dr Timothy Evans
Dr Xiaomin Ma
Prof Jinming Zhu
Mr Desheng Hu
Dr Renhu Pan
Prof Liang Fan
Prof Jennifer Curtis
Prof Jinghai Li
Prof Richard Williams
Prof Stefan Luding



NEW BOOK OUT NOW: FABRICATION, PROPERTIES AND APPLICATIONS OF PLASMENE NANOSHEET

Professor Wenlong Cheng from the department has co-authored a chapter of Reviews in Plasmonics 2016.
Title: Properties and Applications of Plasmene Nanosheet.
Authors: Qianqian Shi, Dashen Dong, Kae Jye Si, and Wenlong Cheng, Editor Chris D Gedds, Springer, 2016, ISBN: 9783319480800.
Volume 2016 of the series Reviews in Plasmonics pp 109-136
DOI 10.1007/978-3-319-48081-7_6
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