UNSW SYDNEY

Australia's Global University

School of Materials Science and Engineering

Annual Report 2019

Welcome from Head of School Professor Michael Ferry

IT IS A PLEASURE TO INTRODUCE THE 2019 ANNUAL REPORT.

The School continues to perform strongly across the three pillars of UNSW's 2025 Strategic Vision: Educational & Research Excellence, Social Impact, and Innovation & Engagement.

I would like to start with a tribute to our Founding Head of School, Emeritus Professor Sir Rupert Myers KBE AO, who passed away in February this year on his 98th birthday. Sir Rupert joined the School in 1952 as the Foundation Chair of Metallurgy (1952-61) prior to taking on higher duties within the University as Pro-Vice Chancellor (1961-69) and Vice Chancellor (1969-81). We provide a photo tribute to Sir Rupert's immense contributions to both our School and the University.

The School has successfully navigated through its first year of the UNSW3+ trimester academic year. As anticipated, we faced various challenges throughout the year and I thank all staff and students for their exceptional effort in transitioning our courses to a three-term structure. Despite the challenges we faced, the School's myExperience Course and Teaching scores were excellent.

Our dedicated staff and students make the School a great place to work and study, and their various achievements are warmly acknowledged.

The School congratulates Drs Kris Kilian, Sophie Primig and Danyang Wang for their promotions to Associate Professor, Associate Professor Jianqiang Zhang for his promotion to Professor, Lucy Zhang for receiving a Dean of Science Staff Excellence Award in the area of Operational Excellence, and Dr Pramod Koshy for his 2019 UNSW Teaching Award in the General Category of Teaching Excellence.

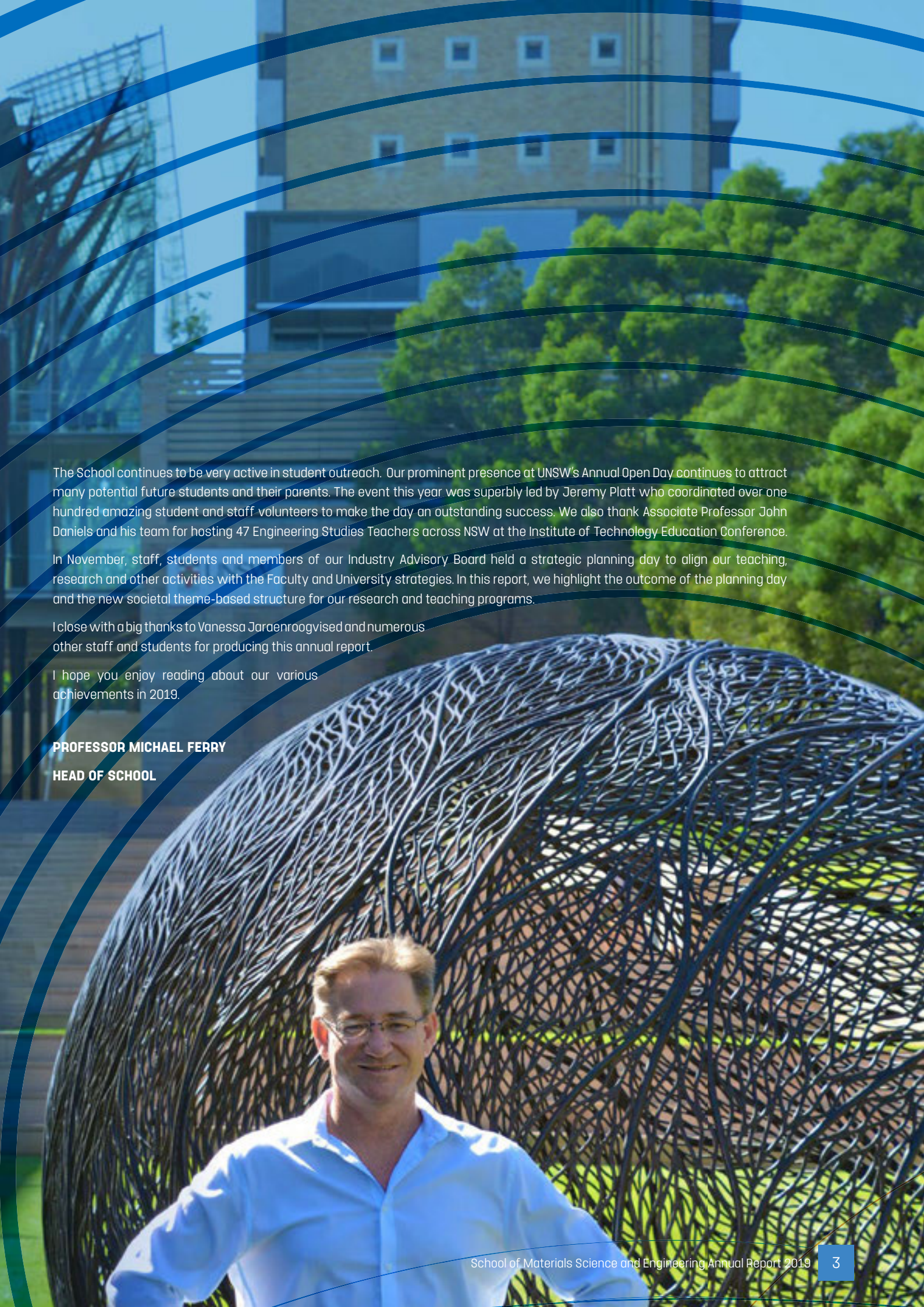
Three of our undergraduate students, Mia Maric, Jonathon Hopkins and Martin Pacak, were awarded University Medals with Jonathon also being awarded a University Medal in Chemical Engineering! Several of our final year students won full scholarships to carry out PhD research at the most prestigious universities in the world, and so many other students won awards and prizes throughout the year.

To fund our research, staff received several of the highly competitive Australian Research Council (ARC) Discovery and Linkage grants and other grants and awards. As a highlight, Scientia Professor Veena Sahajwalla, Director of the Centre for Sustainable Materials Research and Technology (SMaRT), secured major ARC funding to establish a research hub on micro-recycling of battery and consumer wastes, NSW State Government funding to establish the NSW Circular Economy Innovation Network and NSW Physical Sciences funding to commercialise technology for transforming waste materials into value-added products for use in the built environment.

Research excellence from our staff and students is further demonstrated through their published works in world leading multidisciplinary journals, Nature, Nature Materials, Nature Communications and Science Advances, in addition to numerous publications in the highest-calibre disciplinary journals in their respective fields. A summary of staff and student research funding and their publications is contained herein.

The School continues to lead a range of initiatives for addressing important global issues. For example, Kevin Laws is developing a new type of lead-free brass for circumventing lead contamination in our drinking water, Rakesh Joshi is developing graphene-based membranes for water purification, and Veena Sahajwalla is leading a very broad research program on sustainable manufacturing and recycling science.

Our very active student societies continue to work tirelessly in engaging with both new and existing students and our industry partners, and for creating a very close-knit School community. It was great to see so many events held throughout the year, including MATSOC's Industrial Training Presentation Evening, Career Expo, Q&A Industry Panel Evening, MATSOC Speed Networking, MATSOC Trivia, First Year Camp and Annual Harbour Cruise, through to PGSOC's Peer mentoring Afternoon Tea, Movie Nights, PGSOC RUOK, Trivia Brunch to celebrate women in STEM on International Women's day and their weekly Friday afternoon Social Event.



The School continues to be very active in student outreach. Our prominent presence at UNSW's Annual Open Day continues to attract many potential future students and their parents. The event this year was superbly led by Jeremy Platt who coordinated over one hundred amazing student and staff volunteers to make the day an outstanding success. We also thank Associate Professor John Daniels and his team for hosting 47 Engineering Studies Teachers across NSW at the Institute of Technology Education Conference.

In November, staff, students and members of our Industry Advisory Board held a strategic planning day to align our teaching, research and other activities with the Faculty and University strategies. In this report, we highlight the outcome of the planning day and the new societal theme-based structure for our research and teaching programs.

I close with a big thanks to Vanessa Jaraenroogvised and numerous other staff and students for producing this annual report.

I hope you enjoy reading about our various achievements in 2019.

PROFESSOR MICHAEL FERRY

HEAD OF SCHOOL

Vale Professor Sir Rupert Myers KBE AO

MUCH-ADMIRED FOUNDING HEAD OF SCHOOL AND FORMER VICE CHANCELLOR

The School was saddened to receive the news in February that our Founding Head of School, Emeritus Professor Sir Rupert Myers, passed away on his 98th birthday. Sir Rupert was a distinguished metallurgist, academic and university administrator.

Rupert Myers was born in Melbourne on 21 February 1921. He was educated at Melbourne High School and then at the University of Melbourne, where he graduated with first class honours in Metallurgy, followed by MSc and PhD degrees in the same field. After completing his PhD in 1948, Sir Rupert moved to the Atomic Energy Research Establishment at Harwell, England, then returned to Australia in 1952 to join UNSW's newly-established School of Metallurgy as its Foundation Chair. Sir Rupert led the School for nine years before taking on executive positions as Pro Vice-Chancellor in 1961 and Vice-Chancellor in 1969. He continued in this esteemed position until his retirement in 1981 where he was instrumental in establishing the University's character and presence in the academic world.

Under Sir Rupert's leadership, the School grew rapidly throughout the 1950s to become a world-class metallurgy department, attracting exceptional staff and students. The current School of Materials Science and Engineering, with its excellent international reputation for exceptional research and teaching, grew from the old School of Metallurgy during a time of significant expansion in education and research in materials science. As leader of the University, Sir Rupert is renowned for many other outstanding achievements, including establishing the Faculty of Law, developing a University College (now UNSW Canberra) within the Australian Defence Force Academy, and locating the Australian Graduate School of Management to the university.

Although Sir Rupert retired from official University duties in 1981, he remained very close to the School for the rest of his life and was a regular guest at School and University functions. He cared deeply about the School and was a tireless and enthusiastic supporter of its well-being and expansion. Many students and staff will fondly remember their conversations with Sir Rupert during the times he visited the School. It is such a great honour for all of us to have been blessed with Sir Rupert as our inaugural Head of School.

Next time you visit the School, please pop up to Level 3 of the Hilmer building and you will find a magnificent photograph of Sir Rupert adorning the eastern wall. Stop and spend a moment to reflect on how fortunate we all are to have had such caring first Head of School.

Table of Contents

27 ACADEMIC STAFF

4 FUTURE FELLOWS

20 PROFESSIONAL &TECHNICAL STAFF

Numbers AT A GLANCE

340 UNDER GRADUATES

24 RESEARCH STAFF

$3.12m NEW GRANT FUNDING

$2.2m STRATEGIC UNSW INCOME 2018

1 ARC LAUREATE FELLOW

168 HIGHER DEGREES STUDENTS

268 REFEREED RESEARCH PUBLICATIONS 2018

84 MASTERS BY COURSEWORK

$11.5m RESEARCH FUNDING

A New Structure for Our Teaching & Research Programs

The School of Metallurgy was founded in 1952 as a contemporary post-WWII discipline focusing on the science and technology of metals, an initiative deemed critical at the time when Australia was creating a modern manufacturing sector as part of a key initiative to rebuild its economy. The School's original focus was physical and chemical metallurgy, but gradually evolved to encompass ceramic, polymer and composite materials, which instigated a name change in 1980s to the School of Materials Science and Engineering. Moving into the 21st century, our discipline can best be described as a broad hybridisation of metallurgy, polymer science, solid-state physics, materials chemistry, biomedical science, and engineering.

Since its inception, the School has focused its teaching and research around the traditional metallurgical/materials disciplines. Figure 1 illustrates the most recent structure showing functional materials at the centre. This structure is not completely satisfactory since the distinction between a purely functional or structural material is often blurred, with many contemporary materials possessing both attributes. Process metallurgy is shown as a satellite field, but this is less than adequate since it is contained in advanced manufacturing, the principal enabler of virtually every useful material in modern society. Other emerging research fields in the School are not clearly represented in this diagram.

Our discipline has outgrown this commonly adopted structure as we continue to discover new materials and processes. Significantly, very few modern-day devices and structures are built from a single class of material. For example, semiconductors, metals, ceramics and polymers, each possessing a suite of unique properties, are routinely used in combination to create complex devices like integrated circuits, optoelectronic devices and energy storage systems, with other material combinations creating our transport vehicles, large-scale infrastructure and biomedical devices and components, etc.

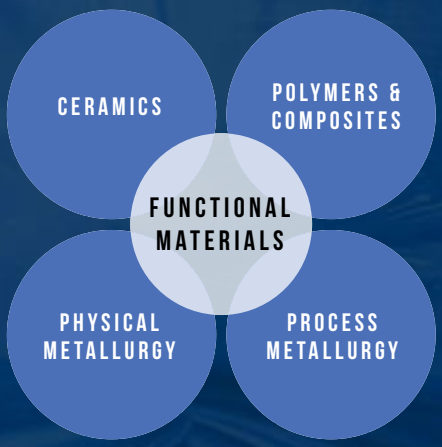


Figure 1: The School's most recent structure for teaching and research

The School is keeping abreast of this rapid evolution of our discipline by reshaping our teaching and research programs around a basic question:

Why do materials scientists / engineers devote considerable time and effort in designing more sustainable processing routes, improving the properties of existing materials and creating new materials with entirely unexpected properties?

Beyond our basic scientific curiosity and the thrill of discovery, we consciously design materials and sustainable processes that impart a **substantial benefit to society** through the way they positively impact the environment, improve human health, increase our standard of living, increase productivity of our vital resources, enhance national security, or by simply promoting economic prosperity.

Taking this fact into account, we have discontinued the classic materials-centric structure of Figure 1 and devised a new **society-centric structure**, shown in Figure 2, consisting of four interconnecting themes:

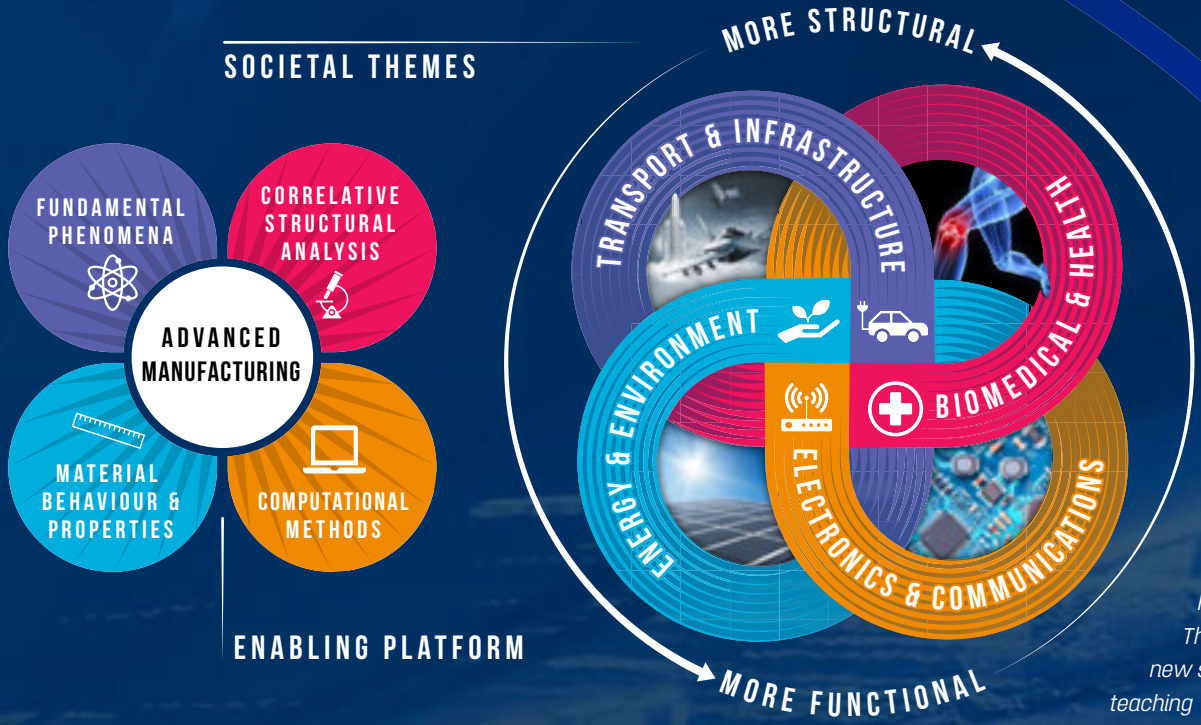


Figure 2: The School's new structure for teaching and research.

Transport & Infrastructure:

Primarily structural materials used expressly for creating the means of transportation, to large-scale structures and infrastructure that dominate our daily lives, including land, sea and aerospace vehicles to buildings, superstructures, machines and any other fixed or moving infrastructure.

Energy & Environment

Materials that play a critical role in the production, storage and conversion of energy, through to eco-materials, created by sustainable processes using either raw constituents or recycled waste, that impart an overall positive impact on the environment. These are integral materials in next generation fuel cells, solar devices, gas-powered generators, electric vehicles, water purification systems, recycled products, etc.

Electronics & Communications:

Primarily functional materials with structural requirements used in electrical, electronics and microelectronics applications, including components and devices that comprise integrated circuits, circuit boards and visual displays, to cables, wires and optical fibres for transferring power and information, etc.

Biomedical & Health:

Structural materials exhibiting specific functionality to largely functional materials that are designed to interact with biological systems for therapeutic and diagnostic medical purposes. These materials are used in dental devices, orthopaedic implants, artificial organs, implantable devices, artificial skin, drug delivery, etc.

Underpinning this new structure is an **enabling platform** necessary for understanding the structure-property nexus and fundamentals of materials processing. This platform is common across our teaching and research programs and consists of fundamental phenomena, multi-scale computational methods, correlative structural analysis, and material behaviour and properties. The cornerstone of this platform is advanced manufacturing, which creates all the materials of significant benefit to society.

We are redesigning our teaching programs in line with this new structure to better engage students from school to graduate level in appreciating both how and why our discipline has an immensely positive impact on the world around us.

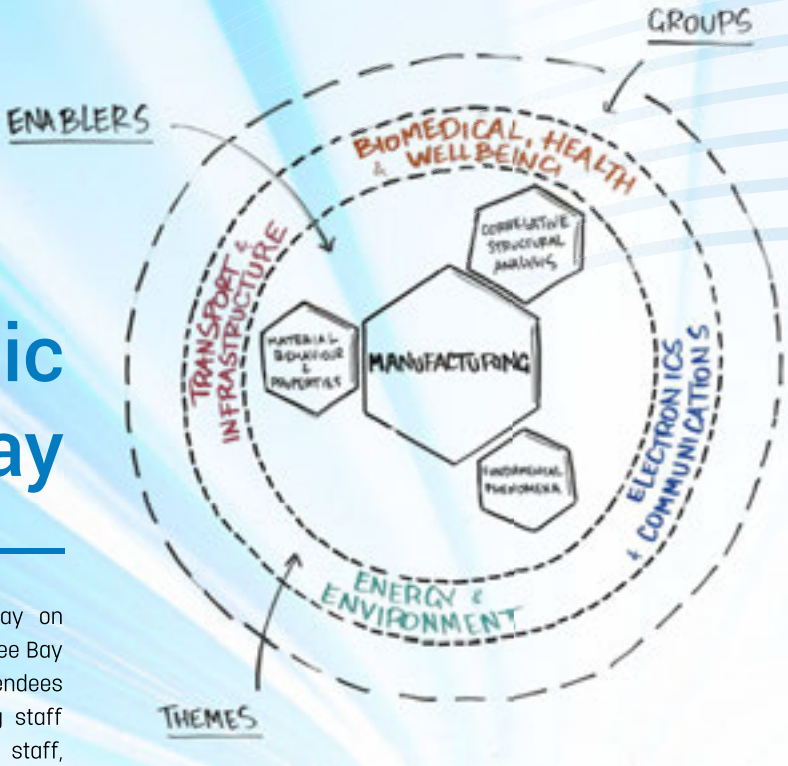
We are discontinuing our elective streams based on the fields in Figure 1 and designing a single, unified BE program comprising a suite of modern courses and thematic electives that are integrated with computational methods and materials selection and design. The revised program will also enhance the quality of our existing combined degree programs and facilitate the creation of exciting new combinations.

To support the School's research and better engage our researchers, four Theme Leaders will join our Research Committee and be responsible for coordinating the various theme-based research groups, encouraging communication and collaborating between groups through to cross disciplinary collaboration with other Schools, research centres and institutes both within UNSW and elsewhere.

This exciting new direction is expected to strengthen the reputation of the School both as an innovator in teaching of materials engineering and a team of world-class researchers focusing on the needs of a modern and future society.

MICHAEL FERRY

Strategic Planning Day



Our school had a Strategic Planning Day on Thursday 21st November 2019 at the Coogee Bay Hotel. It was a full day event with over 40 attendees including the Dean, Deputy Dean, all teaching staff and selected research, technical, administrative staff, students and Advisory Board members.

The day was held to help establish a clear direction and a collective vision for the success of our programs. We focused on both teaching and research areas and aimed to aligned our strategy with the UNSW2025 Strategy.

The day started with ice breaking activities and then Professor Emma Johnston (Dean) presented an overview of the global environment for materials science and engineering, the state of the nation for the industry in Australia as well as the position of UNSW within this. Then, Professor Michael Ferry (Head of School) presented his visions for our school and introduced our new thematic structure for both teaching and research areas. In the afternoon, there were two parts to the activities.

The first part was the presentations from three presenters in the topics of research by Jan Seidel (Director of Research), education by Owen Standard (Director of Teaching) and enabling by Lucy Zhang (School Manager). Then we were asked to individually plot our school visions of success and then break into a small focus group to explore our visions of success in HDR, undergraduate coursework programs, postgraduate coursework programs and research.

The day was a success, with all staff and students supportive of the new thematic structure for our school's research and teaching and shared their opinions about our visions and recommendations for success. We have a set of strategic actions and priorities for our implementation plan.

Thank you to our strategic planning day committee including Professor Nagarajan Valanoor, Professor Jan Seidel, Associate Professor Runyu Yang, Dr. Judy Hart, Lucy Zhang, our Dean (Professor Emma Johnston), our Industry Advisory Board Member (Steven Kennedy), all school staff and students and to our facilitator, Dirk Vos from Two collaborate.







Undergraduate Studies

Undergraduate Programs Offered

The main undergraduate degree program offered by the School is a Bachelor of Engineering Honours (BEHons) in Materials Science and Engineering. The program consists of four years of full-time study and requires students to complete at least 60 days of approved industrial training (in materials engineering or a related field) and is fully accredited with Engineers Australia. In addition, the BEHons program is offered as formal structured combination with the following programs: Bachelor of Engineering Science in Chemical Engineering (BEHons/BSc); Bachelor of Commerce (BEHons/BCom); and a Master of Biomedical Engineering (BEHons/MBiomedE).

In the BE program students complete a common engineering first year, a common second year of fundamental materials engineering courses and mathematics courses, followed by more discipline-specific materials courses in Years 3 and 4, as well as an Honours research project in Year 4. Students major in either Materials Engineering, Ceramic Engineering, Physical Metallurgy or Process Metallurgy by selection of appropriate professional electives in Years 3 and 4 and an appropriate Honours research project in Year 4.

The School also offers a major in Materials Science in the Bachelor of Science (BSc) coordinated by the Faculty of Science. The BSc (Materials) consists of three years of full time study and Honours can be obtained by a further year of full-time study. The BSc can also be combined with degree programs in other Faculties, including Bachelor of Engineering, Bachelor of Arts, Bachelor of Laws, etc. The major in Materials Science is also offered in the 4-year Bachelor of Advanced Science Honours (BAdvScHons) coordinated by the Faculty of Science.

The primary aim of the School's undergraduate programs is to deliver graduates possessing the fundamental knowledge, skills, and capabilities needed to succeed in the discipline of Materials Science and Engineering, as well as having the generic graduate attributes expected in a university graduate and, in the case of the BEHons program, having the Stage 1 graduate engineering competencies prescribed by Engineers Australia. The School's undergraduate programs are designed to have strong relevancy to today's material's industry and research whilst being adaptable to future trends and growth in the discipline.

Implementation of Trimester Teaching Calendar

The new trimester academic structure that was developed as part of the ***UNSW 2025 Strategic Plan*** was implemented in 2019. The trimester structure consists of three academic teaching terms, each being 10 weeks duration, with students undertaking a maximum of three standard courses per term. Changing to the new system occurred relatively smoothly but the new academic structure did present a significant change in University activities and timing for both students and staff alike.

New Enrolments

Admission to the School's BE programs is through the Universities Admissions Centre (UAC) for local students. International students with appropriate qualifications apply through UAC International or directly through UNSW Apply Online. Enrolments into the School's BE programs have been healthy over the past ~5 years and are summarised in Table 1. There was a significant decrease in the first year intake in 2019 and this was attributed, in part, to the new trimester structure and the School/University will address this for 2020. Despite this, the School continues to have the largest undergraduate program in the discipline nationwide by a considerable margin. Similar to previous years, the quality of the new local students was high as indicated by ATAR entry scores of >90 for the School's undergraduate programs. International students comprised approximately one third of the 2019 student intake with approximately 30% being female.

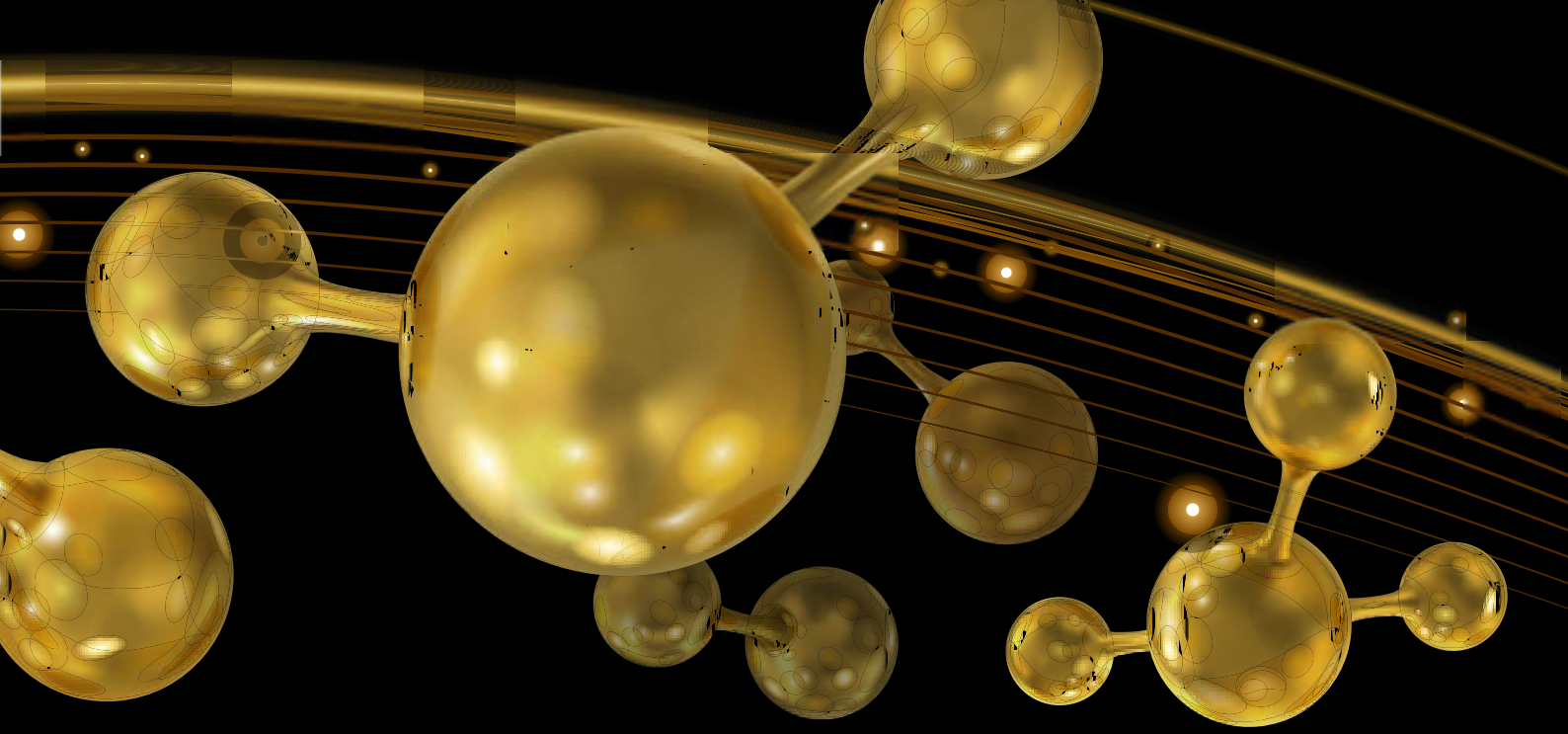


Table 1: First Year Intake (2015–2019)

Program	2015	2016	2017	2018	2019
3131 BE(Materials Sci. & Eng.)	89	94	98	95	35
3132 BE(Materials Sci. & Eng.)/BEngSci.	11	5	2	6	1
3133 BE(Materials Sci. & Eng.)/MBiomedE	21	19	20	33	19
3136 BE(Materials Sci. & Eng.)/BCom	12	3	6	1	0
Total:	133	121	126	135	55

Graduating Class

The BE degree is awarded at Honours First Class (H1); Second Class Division 1 (H2/1), Second Class Division 2 (H2/2), or Pass classifications as determined by a weighted average mark calculated based on the year of study and the relative weighting of each course in the curriculum for that year. In addition, an exceptionally high level of attainment for H1 may be recognised by the awarding of the University medal. A summary of the graduating class is given in Table 2.

Table 2: 2019 Graduating Class

Program	H1 + Medal	H1	H2/1	H2/2	Pass	Total
3131 BE Materials Science and Engineering (Honours)	1	3	1	6	0	11
3135 BE(Materials Sci & Eng)	2	1	1	2	3	9
3136 BE(Materials Sci & Eng)/BCom	0	0	0	1	0	1
3137 BE(Materials Sci & Eng)/BE(ChemEng)	1	2	0	0	0	3
3138 BE(Materials Sci & Eng)/MBiomedE	2	8	1	0	0	11
3972 BAdvSci(Materials Sci)	0	0	0	0	0	0
Total	6	14	3	9	3	35

Dr Owen Standard

Undergraduate Program Coordinator

Co-op Scholarship Program

The Co-op Scholarship Program provides industry-funded scholarships to UNSW undergraduate students in various Faculties and degree programs. These scholarships provide students with a significant stipend (~$20,000 per annum for 4 years) and substantial opportunity for industrial training with the sponsoring companies.

For the School of Materials Science and Engineering, Co-op scholarships are an effective means to attract high-quality students into our discipline and to provide them with beneficial industrial training in the engineering sector.

Since the introduction of Co-op scholarships in Materials Science and Engineering in 1989 there have been a total of 129 scholarships from 30 different industrial sponsors. Co-op scholars are selected not only on the basis of their academic ability (successful students have ATARs typically 99+), but also on their communication skills, commitment and motivation, perseverance and resilience, teamwork skills, and leadership potential as well as passion and understanding for the materials science and engineering discipline.

In 2019, a total of 3 scholarships (Table 1) were provided by two industrial sponsors – Rio Tinto and Weir Minerals. Both companies are long-term sponsors of the program and their contribution to it, and more significantly, to the Co-op scholars they have supported is highly valued. The Co-op scholar who commenced in 2015 was employed by one of the sponsors upon completing his degree at the end of 2019 – this is testament to the quality and purpose of the Co-op program, namely, to develop of high-quality graduates with high potential for leadership in industry.

Table 1: Statistics of Co-op Program in Materials Science and Engineering – (2015 to 2019)

Intake Year	2015	2016	2017	2018	2019	Total
Current Year of Degree	4	3 (IT)	3	2	1	
Number of Scholars:						
Ceramic Engineering	–	–	–	–	–	0
Materials Engineering	1	–	–	2	–	3
Physical Metallurgy	–	–	–	–	–	0
Process Metallurgy.	–	–	–	–	–	0
Total	**1**	**–**	**–**	**2**	**–**	**3**

Co-op Scholars complete at least 68 weeks of structured and highly relevant industrial training with the sponsor companies which, from 2019, consists of 4 weeks at the end of year 1 (optional), 20 weeks during Term 3 of Year 2, and two 24 week placements in Year 3.

Students are paid a scholarship stipend for the first 4 years of their Co-op program with an Honours scholarship possible for those students who elect to undertake their Honours research project with a sponsor company.

Students take 5 years to complete their degree but this is offset by the scholarship and, more significantly, by the immensely valuable graduate skills, networking, and workplace experience obtained from the industrial training placements. Each IT placement is reviewed by the Academic Coordinator in the form of an interview with the scholar and sponsor representative(s) and by written appraisals of the placement by the scholar and sponsor. Industry sponsors quantify the quality and value of work completed by the scholars during their placements to give the students meaningful feedback on the value (and importance) of their work to the business.

In addition to the industrial training placements, the Co-op Program provides students with an ongoing professional development program to help them develop strong graduate attributes and to make a smooth transition to the workplace. The Co-op Program provides scholars with access to a range of support networks and academic mentor is assigned to each program cohort to offer specific program advice and guidance. Workshops and training activities are offered throughout the duration of the scholarship and these provide an interactive environment for scholars to learn about professional expectations and ethics, reflect on their own work experiences individually and with peer support, and gain advice from industry representatives.

The industrial sponsors are provided with highly motivated, capable students to complete important and valuable industrial work. It also provides sponsors the opportunity to have direct involvement in the education and development of our School's students and from whom they can potentially recruit their future managers and leaders.

CO-OP GRADUATES ARE HIGHLY SOUGHT BY INDUSTRY AND MANY OF THOSE WHO HAVE ENTERED THE MATERIALS INDUSTRY HAVE RISEN TO SENIOR LEADERSHIP AND MANAGEMENT POSITIONS.

The School takes this opportunity to again thanks its Co-op sponsors for the efforts they put into organising the placements as well as their training, guidance, and support of scholars during the placements, and for their continued generous support of the Co-op Program.

Owen Standard

Academic Coordinator

Co-op Program in Materials Science and Engineering

www.coop.unsw.edu.au

Academic Staff

Senior Lecturer
Dr Claudio Cazorla

Claudio's research expertise is built on the study of bulk and low-dimensional condensed matter systems using advanced quantum simulation methods. The topics he investigates are relevant to a broad range of fundamentally and technologically important fields such as Nanotechnology, Materials Chemistry, Earth and Planetary Sciences and Atomic Physics. Claudio is particularly interested in the fundamental study of and technological applications involving multi-ferroic and fast-ion conductor materials.

Associate Professor Sammy Chan

Sammy's research interests are in the areas of energy materials, hydrogen storage and metal matrix composites (MMCs).

ARC Future Fellow **Associate Professor Dewei Chu**

Dewei's research interests include design, fabrication and printing of metal oxides and suflides based nanoionic materials for nanoelectronics (including sensors, memories and transistors), as well as energy storage and conversion materials (including supercapacitor electrodes, solid-state electrolytes, and electro-catalysts). His group targets to develop solution processed, printable and flexible nanoionic materials for cost-effective and energy-efficient wearable electronics.

Professor Alan Crosky

Alan's research focuses on the effect of structure (both micro and macro) on mechanical behaviour. Specific areas of research include directed fibre placement in fibre reinforced plastic composites, failure of composites, natural fibre composites, wood plastic composites and engineering failure analysis.

Associate Professor John Daniels

John's research focuses on the understanding of the structural origin of physical properties of materials. This research has, to date, been primarily directed in the field of electro-mechanical materials where a wide range of underlying structural processes at different length scales leads to the coupling of mechanical load and electrical charge.

Head of School
Professor Michael Ferry

Michael's research interests are concerned mainly with the mechanisms of microstructure and texture evolution during solidification, solid-state phase transformation and deformation & annealing with recent emphasis on the mechanical and physical properties of crystalline and amorphous light metals.

Senior Lecturer
Dr Judy Hart

Judy's research interests are in developing new semiconducting materials, particularly solid solutions and doped materials, for use in renewable energy applications such as photocatalysis and solar cells. The focus of this work is understanding relationships between composition and properties and finding effective ways of using computational and experimental techniques in parallel.

Lecturer
Dr Caitlin Healy

Caitlin's research interests are the design, development and characterisation of new metallic alloys. With a focus on single phase high entropy alloys and using the compositionally complex designs to enhance binary intermetallics.

Academic Staff

Dean of Engineering
Professor Mark Hoffman

Mark's research expertise is in the area of structural integrity of materials, specifically the design of materials for high reliability in complex environments through a combination of computational modelling and investigation using an extensive mechanical property research laboratory at UNSW. His research covers fracture mechanics, fatigue and wear and tribology from macro- to nano-scale.

Senior Lecturer
Dr Kevin Laws

Kevin's research interests are concerned with the design, development and fundamentals of new or advanced metal alloys; specifically amorphous alloys (bulk metallic glasses) and single-phase high entropy alloys. This is closely tied with the design and development of new alloy production technologies and applications for these materials.

Senior Lecturer
Dr Rakesh Joshi

Dr Rakesh Joshi FRSC AFIChemE is a Senior Lecturer at the School of Materials Science and Engineering and leading a Graphene Research Group.. He is the Fellow of the Royal Society of Chemistry (FRSC), A/Fellow of the Institution of Chemical Engineers (AFIChemE) and among a select group of researchers who have been awarded each of the world's most prestigious relevant International Research Fellowships; the JSPS Invitation Fellowship; the Humboldt Fellowship and the Marie Curie International Fellowship. He is currently leading various industry funded research projects on application. His research interest includes experiment design for application of graphene and 2D materials, membranes, separation and purification, diffusion mechanism.

Professor Sean Li

Sean's research interests mainly focus on advanced multifunctional materials including 2D electron gases of complex hetero-structured oxides, energy materials and other electrical and optical oxide based materials.

Senior Lecturer
Dr Damia Mawad

Damia's research interests are in conductive polymers as active materials in flexible organic bioelectronic devices. She leads a multidisciplinary research team that brings expertise in chemistry, physics and material science aimed at developing chemical strategies and electronic circuitry towards the realisation of flexible bioelectronics with advanced functionalities.

ARC Future Fellow
& Scientia Fellow **Associate Professor Dr Kris Kilian**

Kris's research group explores how natural and synthetic materials influence the signalling that controls cell fate and function. Combining both 'soft' and 'hard' materials chemistry with nano- and micro-fabrication techniques, they specialise in designing and developing synthetic tissue models to more accurately explore cell signalling and tissue assembly across numerous physiological and pathological conditions including development and cancer.

Deputy Dean - Research
Professor Paul Munroe

Paul's research is focused on the characterization of materials using electron microscopy and related methods. This includes publication of a significant body of work focused on ion beam technology. He is also active in a range of areas in characterization of materials such as functional thin films, intermetallic alloys and biochars.

Academic Staff

Emeritus Professor Oleg Ostrovski

Oleg's major contributions are in the field of pyrometallurgical technologies for minerals processing, iron-, steel- and ferroalloy-making. Areas of research include thermodynamics, kinetics and mechanisms of metallurgical reactions, properties of molten metals and slags, reduction, smelting and refining processes, and environmental issues in pyrometallurgy.

ARC DECRA Fellow
& Scientia Fellow
Associate Professor Sophie Primig

Sophie's current research contributions are in processing-structure-property relationships of structural metallic materials for high-performance applications such as aerospace. Currently, these materials include Ni-based superalloys and advanced steels processed by industrial forging or metal 3D printing. She combines state-of-the-art microscopy techniques with mechanical testing and contemporary modelling approaches. Her research philosophy is to achieve a balance between fundamental discovery and industrial application.

Director - SMaRT Centre,
ARC Laureate Fellow
Scientia Professor Veena Sahajwalla

As a leading expert in the field of recycling science, and founding Director of the Centre for Sustainable Materials Research & Technology at UNSW, Professor Veena Sahajwalla is producing a new generation of green materials, products and resources made entirely, or primarily, from waste. Veena also heads the ARC Industrial Transformation Research Hub for 'green manufacturing' – a leading national research centre that works in collaboration with industry to ensure new science is translated into real world environmental and economic benefits. Veena has been extensively recognised for the innovation and significance of her work, including via election to be a Fellow of the esteemed Australian Academy of Science.

Professor Jan Seidel

Jan's research interests are in the area of advanced electronic, photonic and spintronic materials, including scanning probe microscopy, nanotechnology enhanced photovoltaics, electrochromism, nanoscale phase separation, nano-optics, spectroscopy, plasmonics, x-ray based synchrotron techniques and high-resolution transmission electron microscopy.

Professor Chris Sorrell

The main focus of Chris's research has been the processing of ceramics, including fabrication, forming, and densification of bulk materials, thick films, and thin films. While his overarching approach is the use of phase equilibria to inform his strategies, his emphasis on publications is the elucidation of phenomenological mechanisms underpinning the data. His current research is focussed on chemocatalytic, biocatalytic, and photocatalytic nanomaterials for energy, environmental, and biomedical applications.

Academic Staff

Deputy Head of School,
Senior Lecturer
Dr Owen Standard

Owen's research is in the processing/ microstructure/ property relationship of advanced ceramics for functional applications including colloidal processing of electroceramics, compositional and microstructural modification of bioactive and bionert ceramics, sol-gel deposition of functional ceramic coatings, development of sol-gel coatings on textile fibres and ceramic coatings on biomedical alloys.

Professor
Nagarajan Valanoor

Nagy's most significant contribution is in the field of thin film epitaxy functional property relationships for ferroelectrics, dielectrics and multiferroic nano-materials. Research includes thin-film oxide epitaxy, scanned probe microscopy of functional materials and Landau-Ginzberg modelling of phase transitions. Nagy is also our postgraduate coordinator.

Associate Professor
Danyang Wang

Danyang's most significant contribution is in the field of growth and characterization of functional oxide thin films and heterostructures for nanoelectronic and energy applications. Areas of research include thin film technology, functional materials and devices, micro/nanofabrication techniques, heterointerface effects.

Professor Tom Wu

Tom's research focuses on the vapour- and solution-based synthesis of transition-metal oxides and hybrid halide perovskites, in the forms of thin films, nanomaterials and mixed-dimensional nanocomposites. His team is interested in exploring composition-structure-property correlations in emerging materials, targeting at diverse disruptive electronic, data storage and energy conversion technologies.

Associate Professor
Runyu Yang

Runyu is focussed in the field of particle/ powder science and technology. His primary research interests lie in particle technology, aiming to understand the behaviour of particles through rigorous modelling and simulation at microscopic and macroscopic levels. This knowledge is then applied to solving problems in various industrial applications.

Emeritus Professor
David Young

David's most significant contributions are in the field of high temperature alloy-gas interactions. Particular emphasis is placed on the diffusion and phase transformation processes which support these reactions. Current work includes fundamental studies of corrosion by CO_2, metal dusting reactions and water vapour effects on oxidation.

Professor Jianqiang Zhang

Jianqiang's research is focused in the field of gas-solid reactions at high temperature, including high temperature corrosion and processing metallurgy. Research emphasis is on reaction thermodynamics and kinetics, phase transformation and characterisation, reaction mechanism understanding, sustainable materials processing and new materials development.

School Committees

School Advisory Committee

Michael Ferry *(Chair)*
Bill Joe
Farshid Pahlevani
Lucy Zhang
Owen Standard
Sophie Primig

Research Committee

Jan Seidel (Chair)
Jianqiang Zhang
Michael Ferry
Oleg Ostrovski

Education Committee

Owen Standard *(Chair)*
Caitlin Healy
Danyang Wang
Judy Hart
Nagarajan Valanoor
Runyu Yang
Sammy Lap Ip Chan

WHS Committee

Jianqiang Zhang (Chair)
Anthony Zhang
Carmel Jaconelli
John MacLeod
Michael Ferry
Rahmat Kartono
Rakesh Joshi
Khushalini Ulman *(Postgraduate Student Rep.)*

Equity, Diversity & Inclusion Committee

Damia Mawad *(Chair)*
Andrew Addie
Jeremy Platt
Lucy Zhang
Michael Ferry
Owen Standard
Paul Munroe
Vanessa Jaraenroogvised
Brenda Shi *(Postgraduate Student Rep.)*
Brenda Leung *(Undergraduate Student Rep.)*

School Scholarship Committee

Michael Ferry (Chair)
Lucy Zhang
Owen Standard

School Co-op Scholarship Representative

Owen Standard

Postgraduate Coordinators

Nagarajan Valanoor
Danyang Wang

Undergraduate Program Coordinator

Owen Standard

Honours Projects Coordinator

Kevin Laws

Master by Coursework Coordinator

Runyu Yang

Misconduct and Grievance Officer

Owen Standard

Faculty Undergraduate Assessment

Owen Standard
Sammy Lap Ip Chan

Overseas Degree Programs/ Asia Engagement

Sammy Lap Ip Chan

Women in Materials

Judy Hart

Faculty Enterprise Committee

Dewei Chu

Seminar Coordinators

John Daniels
Claudio Cazorla

School Staff

Research Staff

Postdoctoral Fellow	Joseph Arsecularatne
Research Associate	Wen Fan Chen
Postdoctoral Fellow	Sagar Cholake
Research Associate	Rifat Farzana
New Generation Network Scholar, Postdoctoral Fellow	Vaibhav Gaikwad
Postdoctoral Fellow	Nima Hanghdadi
Postdoctoral Fellow	Long Hu
Postdoctoral Fellow	Chandara Jayasundara
Postdoctoral Fellow	Yifeng Jiang
Senior Research Fellow	Pramod Koshy
Research Associate	Nitish Kumar
Postdoctoral Fellow	Hamid Lashgari
Postdoctoral Fellow	Chun-Ho Lin
Senior Research Associate	Samane Maroufi
Senior Research Fellow	Farshid Pahlevani
Research Associate	Bo Qu
Senior Research Associate	Daniel Sando
Postdoctoral Fellow	Peggy Schoenherr
Research Associate	Pankaj Sharma
Postdoctoral Fellow	Sagar Shirsath
Postdoctoral Fellow	Simrjit Singh
Research Fellow	Sara Taherymoovi
Postdoctoral Fellow	Felix Theska
Postdoctoral Fellow	Tao Wan
Postdoctoral Fellow	Yun Xie
Postdoctoral Fellow	Xing Xing
Research Fellow	Martin Xu
Postdoctoral Fellow	Jian Yang
Senior Research Associate	Jianliang Yang
Postdoctoral Fellow	Adnan Younis
Postdoctoral Fellow	Le Zhang
Postdoctoral Fellow	Qi (Peggy) Zhang

Technical Staff

Technical Officer	Soo Woon Chong
ITC Support Officer	Jane Gao
Technical Officer	Anirban Ghose
Technical Officer	William (Bill) Joe
Technical Officer	Rahmat Kartono
ITC Support Officer	Danny Kim
Technical Officer	Hamid Lashgari
Technical Officer	Xi Lin
Laboratory Manager	Irshad Mansuri
Technical Officer	David Miskovic
Senior Research Scientist	Thiam Teck (TT) Tan
Technical Officer	George Yang
Safety Officer	Anthony Zhang
Technical Officer	Qi (Peggy) Zhang

Administrative Staff

Manager, Operations & Business Strategy SMaRT	Uttra Benton
Administrative Officer	Alan Chow
Executive Assistant to Prof Sean Li	Kim Foster
Projects Officer/Executive Assistant to HoS	Vanessa Jaraenroogvised
Student Advisor	Michael Lai
Projects Officer/Executive Assistant to HoS (Maternity Leave)	Laura Mcnally
Community & Current Students Engagement Officer	Jeremy Platt
Research & Administration Assistant, SMaRT	Nahid Sultana
Research Support Officer	Qing Xia
School Manager	Lucy Zhang

Industry Advisory Board

Dr Adam Berkovich	*Rio Tinto Aluminium*
Prof. Lyndon Edwards	*ANSTO*
Dr Catherine Foley PSM FTSE FAIP FinstP	*CSIRO*
Mr Michiel Freislich	*HATCH*
Mr Michael Gow	*PGH Bricks & Pavers*
Dr Edward Humphries	*Weir Minerals*
Mrs Cathy Inglis	*Brickworks*
Mr Steve Kennedy	*Cochlear Limited*
Dr George Melhem	*Perfect Engineering Pty Ltd*
Dr Jason Hodges	*Bluescope Research*
Mr Andrew Petersen	*Business Council for Sustainable Development Australia*
Prof. Emma Johnston	*UNSW*
Prof. Michael Ferry	*UNSW*
Dr Owen Standard	*UNSW*
Mrs Lucy Zhang	*UNSW*

Our Financial Performance in 2019

For the 2019 financial year, budget was calculated based on estimated 2018 costs plus incremental increases for the full year impact of hires made in 2018 and successful promotions during 2018. Allocation includes an efficiency saving of 2.5%. We have an overall 4% cut. Our total student numbers have continued to grow, with larger than ever postgraduate coursework student cohort.

We had another successful year in gaining five prestigious ARC discovery grants, one Linkage grant and millions in overseas industry funds. The School is under Professor Michael Ferry's leadership as Head in 2019. The School hosted many outreach events like the Institute of Technology Education Conference 2019, Y10 work experience, L'Oreal Girls in Science, World Mental Health Day Morning Tea, and the Indigenous Pre-Program. We finished the year with well-achieved strategic target.

Income

The School receives its income from three primary sources:

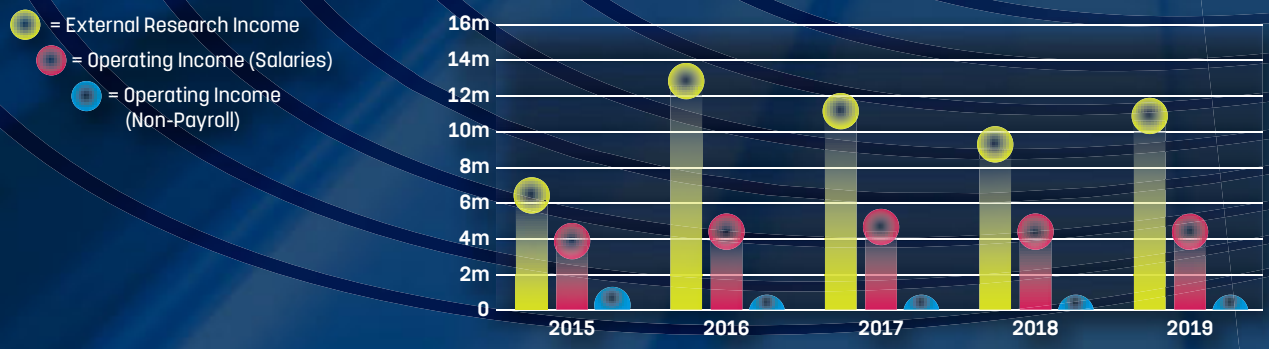
Operating income is allocations from the University, via the Faculty, to fund the day to day running of the School. For the 2019 financial year, budget allocations have been made using our current budget allocation principles. It is still based on enrolment plan student load from local and international undergraduates, postgraduate course work and higher degree research students.

Research income is from research grants obtained from bodies outside the university. Past and current research performance, and future research potential, are incentivised and supported by the University through *Strategic Funds*.

The graph below shows trends in the School's operating and research and restricted funds.

Operating Income

Operating income budgets have been derived from teaching revenue, research revenue from the Commonwealth Government, indirect cost recoveries on contract research and other revenues projected from historical levels, adjusted for price and volume. Our allocated operating budget primarily is used for salaries for teaching and research academics, as well as technical and professional staff. Even though a number of the School's academic staff hold externally-funded research fellowships, there is invariably a shortfall in these fellowships which the School covers from its operating budget allocation, deriving a specific, though capped, allocation from the University for this purpose. This budget is also used to pay for casual teaching staff. Other major expenditure items are support of teaching laboratories, daily operational expenses, marketing and undergraduate recruitment, undergraduate scholarships, allocations to teaching staff based upon research supervision and various research outputs including publications and providing start-up funds for newly started staff.



Equipment	Lead Applicants	Allocation ($)
HBM Data Acquisition System for Strain Gauge Measurements to Augment Existing Mechanical Testing System (Instron, MTS and BOSE)	Bill Joe	$15,000
Alhpa 1-2 LDplus Entry Freeze Dryer Package	Damia Mawad, K Kilian, C Sorrel, DW Chu, J Arsecularatne	$10,000
A Portable Variable-Temperature Stage for Electrical Measurements (Linkam HFS600E Heating/ Freezing Probe stage)	Danyang Wang, P Zhang, D Sando, L Zhang, N Valanoor	$16,247
Laboratory Scale Thermomechanical Processing & Clean Quenching Facility	Kevin Laws, JQ Zhang, C Healy, D Miskovic, S Primig	$5,251
RheolabQC Viscometer for Furnace Integration	Samane Maroufi, O Ostrovski, I Mansuri, F Pahlevani, V Sahajwalla	$14,752
High Sensitivity Sample Preparation Facility	Sophie Primig, K Laws, JQ Zhang, J Daniels, J Seidel	$18,749

From the capital equipment budget, the School's Advisory Committee assessed applications for small equipment grants based on end-user engagement and research impact, but also on the impact they will make in support of the School's research grant income and teaching outputs.

The table above summarises the successful bids.

Income		
University:		
Teaching	$13,665,459	
Other	$32,572	$13,698,031
Allocation to School:		
Teaching and Research	$6,493,366	
Fellowship salary shortfalls	$55,719	
Capital equipment funding	$114,801	$6,663,886
Expenditure		
Salaries	$5,886,833	
Non-salary	$635,065	
Capital expenses	$256,323	$6,778,221
Variance		($114,335)

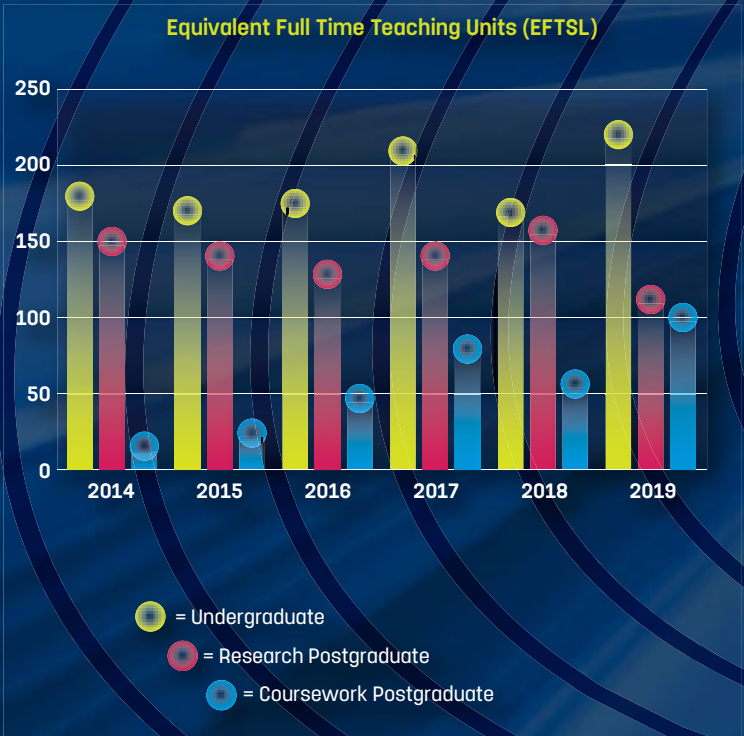
The table above shows the breakdown of the School's operating income. Due to increased cost mainly in capital equipment, we have a variance which is absorbed by the Faculty.

Our Financial Performance in 2019 (continued)

Teaching Load

The primary driver for operating income at the School level is undergraduate and postgraduate teaching load.

The graph below shows the strong growth which the School has succeeded in recent years especially the number of Coursework Postgraduate and Research Postgraduate students.



UNSW Strategic Funding

UNSW aspires to be Australia's global university, improving and transforming lives through excellence in research, outstanding education and a commitment to advancing a just society.

The University is currently in the implementation phase of Strategy 2025. As projects are approved as they are enabled financially through strategic allocation. In 2019, these included:

Project Name	Project Manager	Amount ($)
SHARP hire	Tom Wu	$1,012,882
SHARP: Lance Li	Sean Li	$74,517
Research Support	Mark Hoffman	$32,154
Research Support	Sean Li	$511,431
Safety Net Support	Cazorla Silva,Claudio	$157,317
Strategic award – S Joseph	Stephen Joseph	$40,000
Scientia fellow	Kristopher Kilian	$21,715
Scientia fellow	Sophie Primig	$54,284
Fellowship Transition	Dewei Chu	$142,145
High Temp E-Waste Investigations	Veena Sahajwalla	$482,068
Green Manufacturing	Veena Sahajwalla	$2,350
Laureate Postdoc Support	Veena Sahajwalla	$94,590
Intelligent E-Waste	Veena Sahajwalla	$61,800
SPF02 Materials	Various	$131,900
SPF04 Materials	Various	$143,900
Total:		$2,963,053

Research Infrastructure Scheme

The University receives a Research Infrastructure Block Grant. Through a competitive internal grant process, UNSW is able to provide a world-class research environment to attract and retain a critical mass of research excellence. In 2019, the School was awarded the following major items:

Lead Chief Investigator	Project Title	Grant ($)
Veena Sahajwalla	Waste Material Hyperspectral	$82,470
Nagaraja Valanoor	MSE Pulsed Laser Deposition	$200,250

Education Focused Fund

As part of the UNSW 2025 Strategy, 2019 is the first year of three teaching terms. We have two teaching focussed staff. The School has received some teaching focused funds to help with an online learning platform.

Project Manager	Project Title	Grant ($)
Judy Hart	DU_MATS1192	$8,213
John Daniels	DU_MATS1101	$12,210
Sammy Chan	DU_MATS2004	$10,000
Owen Standard	DU_MATS2003	$10,000
Caitlin Healy	EF Career Development	$4,100

Research Income

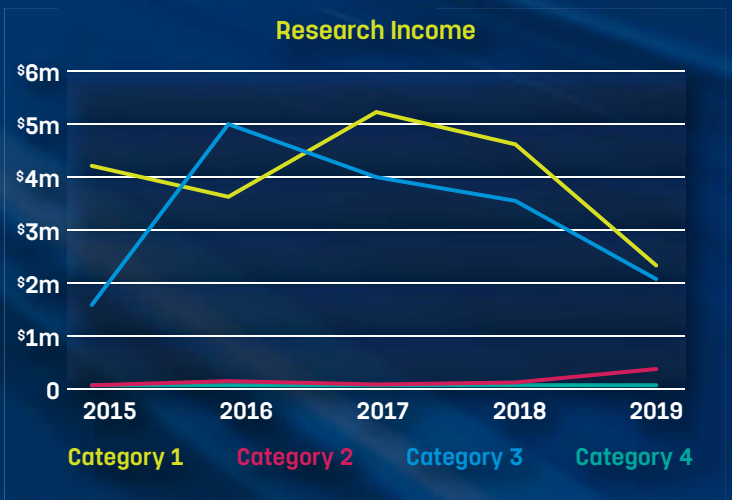
The School's research income comprises the largest fraction of the overall income of the School. Although overall we experienced a slight drop in income, possibly due to the stalling geopolitical climate, we had a successful outcome winning two new ARC Discovery Grants and one Linkage Grant.

Expenditure

The main component of School expenditure is staff salaries which comprised over 80% of total non-capital operating expenditure. This is in line with the majority of schools across the campus.

The table below shows the School's main expenditure items in 2019.

Item	Amount ($)
Student Research Allocations	$100,000
Undergraduate scholarships	$50,000
Publications allocation	$100,000
Teaching laboratories	$84,963
Computer lab upgrade	$47,150
Safety	$12,000
School Office	$35,000
Staff Start Up	$110,000
Marketing	$28,000
Repair, Maintenance & building utilities	$25,000
International recruitment	$10,000
Undergraduates association support	$5,000
Postgraduates association support	$8,000



Work Health & Safety (WHS)

The School of Materials Science and Engineering is committed to providing a safe work environment for all staff, students, and visitors in compliance with *Work Health and Safety Act 2011, WHS Regulations 2017* and as implemented through the UNSW Work Health and Safety Policy.

The members of the School WHS Committee in 2019 were Jianqiang Zhang (Chairperson), Michael Ferry (HOS, management representative), Owen Standard (Deputy HOS), Anthony Zhang (School Safety Officer), Rahmat Kartono (technical and administrative staff representative), Rakesh Joshi (Academic representative), and Khushalini Ulman (postgraduate student representative). Khushalini left the committee in the later part of 2019 and the School gratefully acknowledges her contribution to the Committee. Khushalini will be replaced by Florence Lui for 2020.

The Committee met quarterly to discuss, monitor, and implement WHS policy and procedures, to investigate hazards and incidents, and to consult with staff and students. WHS activities in the School during 2019 included:

Building

- Relocation of some staff due to the opening of SEB and coordination with newly opening SEB for safety issues.

Compliance

- Revision and implementation of new afterhours access policy in the School
- Lead-related work lab testing, compliance examination, safety procedure revision and implementation
- Licences obtained for new chemical use
- Review of Hilmer building Emergency Control Organisation, and New Chief Warder for Hilmer
- Completion of the University WHS self-audit tool for which the School received a compliance rating of 95%

Inspections

- Quarterly workplace /laboratory safety inspections and completion of corrective actions
- Electrical tagging & testing of all single-phase lab. equipment (annually) and all 3 Phase equipment in the School
- End of year WHS committee lab inspection and corresponding corrective actions

Training

- WHS Awareness and Ergonomics and Sexual Harassment online completed by all staff
- University "Supervisor Training" course completed by all academic and research staff
- Mandatory School WHS info sessions (~11 per year) for all new staff, postgrad and honours students
- Annual emergency evacuation training and practice drills for the entire building
- External laser usage training (BSMS)
- External gas usage training (Supagas) completed
- Contractor engagement training completed by laboratory staff
- Mental Health First Aiders of 4 selected staff training completed

Chemical audit

- MSE competition of an audit on all chemicals in JAGGER

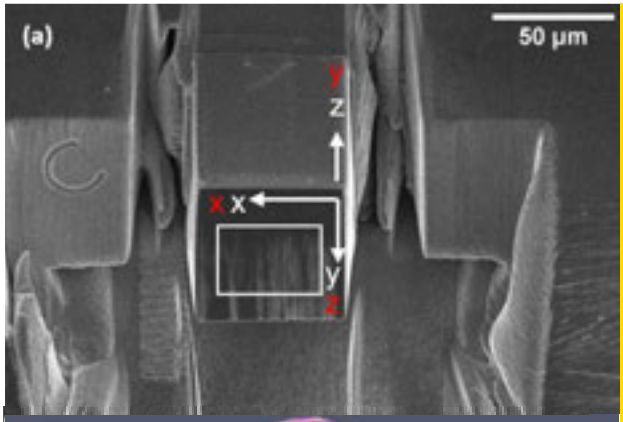
School WHS committee would like to thank all staff and students in the School for all their understanding, cooperation and compliance with WHS requirements and procedures.

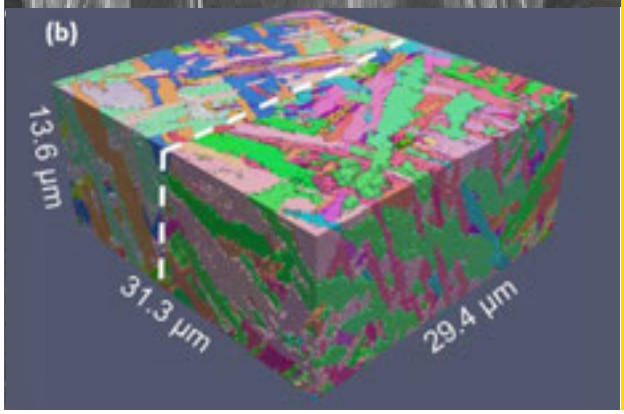
Jianqiang Zhang – WHS Chairperson

Strategic Priority:
Academic Excellence

Theme 1:
Research Quality

Factories of the Future





A/PROF SOPHIE PRIMIG is leading a team of UNSW-based researchers exploring the underlying mechanisms of interphase instabilities during additive manufacturing of metals. This research is part of the Australia-US Multidisciplinary University Research Initiative Program (AUSMURI) between UNSW and The University of Sydney, an investment program encouraging Australian universities to collaborate with Universities in the United States.

This AUSMURI project was the first of its kind that was supported by the Next Generation Technologies Fund, managed by DST, and focusses on research and development in emerging and future technologies.

'Additive manufacturing, commonly known as 3D printing, enables layer-by-layer printing of metal objects. It is expected to transform design and manufacturing, and lead to a reinvigoration in local manufacturing, with huge economic impacts. It is an effective and sustainable method to manufacture high-performance parts with complex geometries," says Sophie.

The AUSMURI project targets additive manufacturing of engineering alloys for aerospace, defence and energy applications, where unprecedented microstructures are formed as a result of large thermal gradients and gyrations.

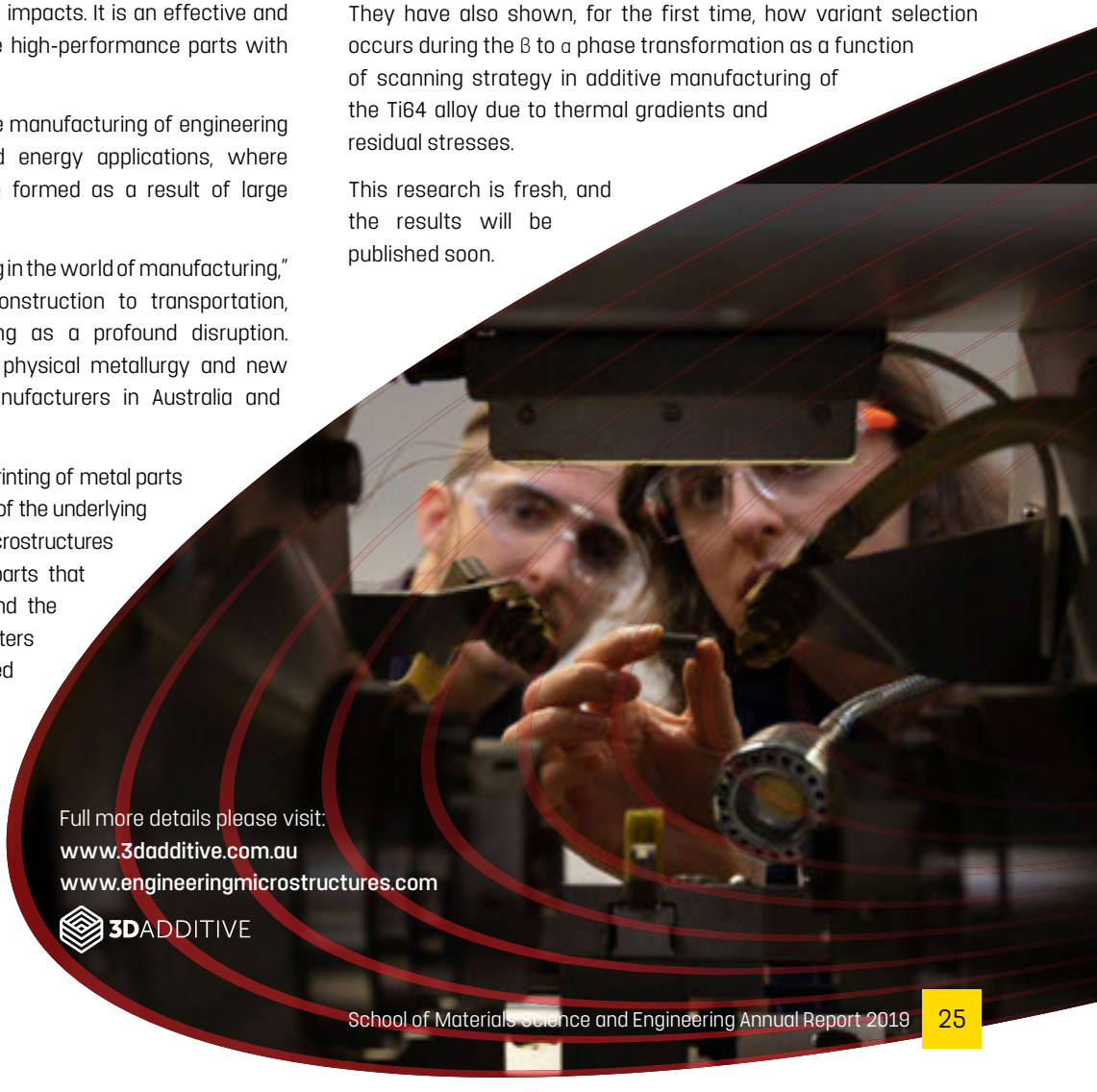
"Something very exciting is happening in the world of manufacturing," says Sophie. "From defence to construction to transportation, additive manufacturing is emerging as a profound disruption. This has created new frontiers in physical metallurgy and new technological opportunities for manufacturers in Australia and internationally."

The main current challenge with 3D printing of metal parts is the lack of scientific understanding of the underlying processes that lead to complex microstructures and properties. In order to rely on parts that are built, it is essential to understand the influence of different printing parameters in more detail. This can be achieved by using correlative microscopy techniques that yield information at the macro-, micro- and nano-scale.

"3D printing is incredibly complex. We know how complex welding is. Now think of thousands of highly localised welding passes and the superposition of all of those thermal and stress cycles," says Sophie.

A recent result from Sophie's team is microstructural design via in-situ multimodal precipitation γ' particles during electron powder bed fusion of the INC738 alloy for enhanced mechanical properties. They have also shown, for the first time, how variant selection occurs during the β to α phase transformation as a function of scanning strategy in additive manufacturing of the Ti64 alloy due to thermal gradients and residual stresses.

This research is fresh, and the results will be published soon.



Full more details please visit:
www.3dadditive.com.au
www.engineeringmicrostructures.com

3DADDITIVE

Strategic Priority:
Academic Excellence

Theme 1:
Research Quality

Graphene for Water, Energy & Environment

DR RAKESH JOSHI is leading a team known as UNSW Team Graphene for developing applications of graphene-based materials with an objective to taking graphene from lab scale to industrial scale. Joshi's graphene team works very effectively with industry to transform the scientific curiosity into industrial product. "Our team focuses graphene research to generate innovative solutions that industry can use."

Prior to joining UNSW in 2015, Joshi was the Marie Curie International Fellow to work at the University of Manchester with Nobel Laureate Professor Andre Geim on applications of graphene. Joshi's research is focused primarily on graphene oxide and the development of graphene-based membranes (Science 2014). With Professor Geim, Joshi developed graphene-based membranes that offer new means of filtering water with multiple potential public health, agricultural and environmental benefits.

UNSW Graphene Team has initiated, and led, a series of industry-funded research projects related to the applications of graphene. This includes the world-first graphene oxide (GO) membrane that can be 'tuned' to selectively filter out a wide range of contaminants as well as a GO-based 'super desiccant' that completely outperformed silica gel in all desiccant applications and is suitable for numerous industrial applications (Chemical Science 2018). Using a unique transitional metal-incorporated graphene oxide (TMGO) membrane (Advanced Materials 2020), Joshi's team recently demonstrated a new mechanism for molecular diffusion. This new mechanism lays the foundations for an entirely new class of high-performance graphene oxide (GO) membranes that can be selectively tuned to deliver precise, effective gas separation - including the recovery of valuable resources such as methane from gas mixtures, with significant potential for delivering reliable, effective gas separation for multiple high-impact industrial and environmental applications.

Joshi's innovative research is useful for industry and very recently his two technologies GO filter and GO super desiccant have been selected in the list of top 100 inventions by spinoff.com; the German-based platform for international professionals that drives 'science to business' research translation.

The graphene team is working with Sydney Water to develop graphene oxide membranes for water filtration. Our project is going very well – even at low pressures, our membrane can remove 99% of all-natural organic matter from drinking water, while keeping the water flux high, so, we're stepping up activity on that- says Joshi. Joshi's team is upgrading the membrane designs (Patent Filed, 2019) to construct a small pilot plant that could be tested in the field.

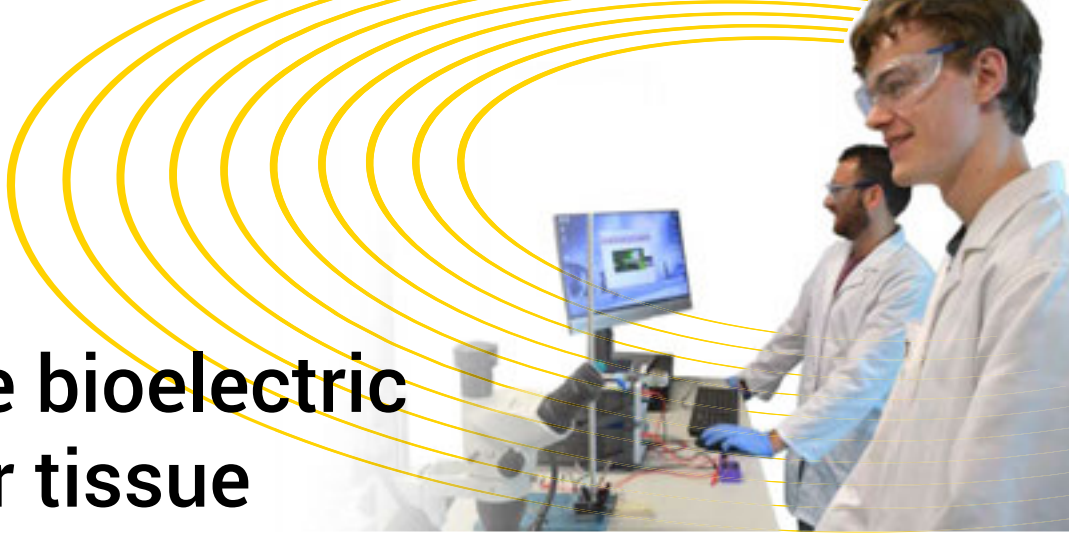
This group is working on other topics too. For example, collaborating with a tire manufacturer to extract methane from waste tyres, and use it to produce graphene on steel to make it stronger. Joshi has recently developed a graphene filter to purify methane from biogas produced in wastewater plants.

The research team, has demonstrated at lab-scale that graphene membranes can be used to extract methane present in biogas. The research indicates that it is possible to purify methane from biogas in a wastewater treatment plant environment, creating a potential source of renewable energy.

Joshi's research will generate far-reaching direct and associated benefits. For example, the upgrading of membrane technology for water plants to purify water, and of biogas generation to obtain high purity methane, would have global implications

Strategic Priority:
Academic Excellence

Theme 1:
Research Quality



Rewiring the bioelectric signal of our tissue

DR DAMIA MAWAD is leading a multidisciplinary team of researchers developing organic flexible bioelectronics based on conductive polymers - type of flexible materials with electrical properties that have potential for repairing damaged electroresponsive tissue.

Bioelectronics, the seamless integration of electronic devices with living systems, are being explored as biomaterial-based approaches applied at the biointerface to electro-couple with the tissue and restore the bioelectric signal.

"This is particularly relevant, for example, for repairing damaged cardiac tissue after a heart attack", says Damia. "A heart attack creates a scar which slows and disrupts the conduction of the bioelectric signal propagating along the cardiac wall. This leads to potentially fatal disturbances of the heart rhythm. Our research to develop flexible bioelectronics is designed to address this serious problem".

Damia's research, published in Science Advances, has led to the development of a flexible conductive patch which improves the conduction of electrical impulses across damaged heart tissue. The flexible patch, which has been shown to work in animal models, is long lasting and has the significant advantage that it can be stuck onto the heart without the need for stitches.

"Conductive polymers work when they are dry, but most become non-conducting in a very short time when placed in bodily fluids," says Damia. "By careful design of the chemistry, we have developed a conductive patch that is stable and retains its conductivity in physiological conditions for more than two weeks, compared with the usual one day of other designs".

Damia adds that "this was a significant advance in the field, enabling us to test the patch in an animal model and demonstrate for the first time that flexible organic bioelectronics based on conductive polymers can enhance conduction of electrical impulses across damaged heart tissue".

The patch in its current form can be used for basic research to better understand how conductive materials interact with tissue and influence the electrical conduction in the heart, as well as better understand the physiological changes associated with heart attacks.

"We envisage heart attack patients eventually having patches attached as a bridge between the healthy and the scar tissue, to help prevent cardiac arrhythmia.

"This will require a patch with sophisticated electronic circuitry that can identify, process and modulate relevant bioelectric signals to provide 'closed-loop' therapy", says Damia.

With this vision towards translation into the clinic, Damia has built a multidisciplinary team of chemists, physicists and material scientists who continue to work on conductive materials with enhanced electronic response and better integration at the biointerface.

Strategic Priority:
Academic Excellence

Theme 1:
Research Quality

Solution-Processed Light-Responsive Nano-Electronics

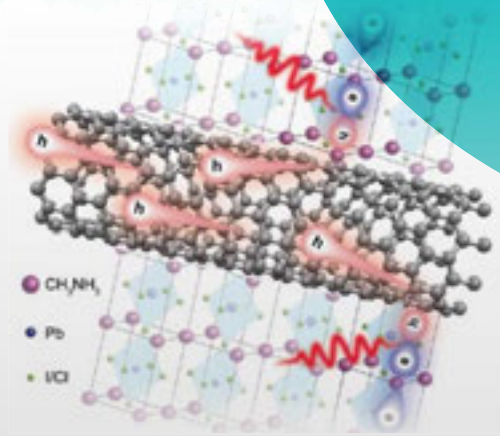
Prof Tom Wu is leading a team of about ten researchers exploring novel nanomaterials, thin films and hybrid heterostructures, with a focus on their electronic, magnetic and optical functionalities. The aim of the group is to solve problems in the domains of energy and electronics research and to discover next-generation materials to enable disruptive technologies.

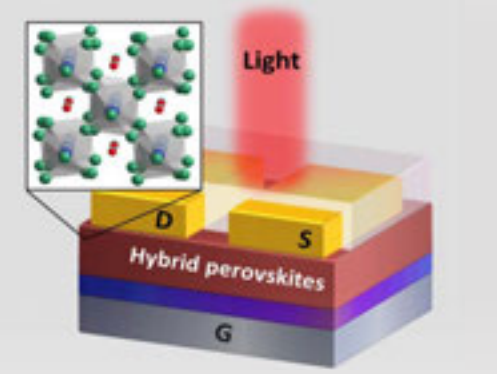
One current theme of Wu group's research is to use hybrid organic-inorganic materials and heterostructures for high-performance solution-processed electronics. Organo-metal halide perovskites have been extensively explored for photovoltaic and lighting applications because of their unique physical properties such as superior light absorption, defect tolerance, and tunable bandgap in the visible regime. But perovskite-based devices are limited by charge mobility (often several orders of magnitude lower than common semiconductors like silicon). To overcome the mobility bottleneck, leveraging on the advantage of low-temperature solution processing, hybrid perovskites are coupled with high-purity semiconducting single-wall carbon nanotubes in mixed-dimensional nanocomposites, which significantly enhance charge transport and device performance.

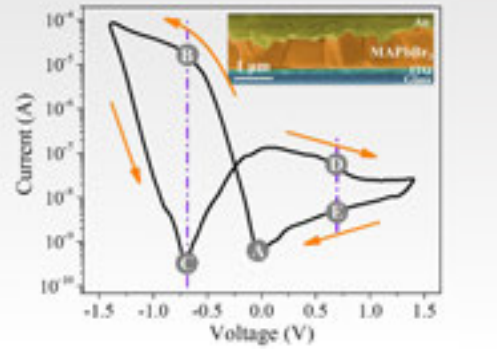
In another research theme, all-inorganic perovskite nanocrystals have been synthesized using a bottom-up approach and studied for optoelectronic devices, particularly x-ray detector and scintillator applications. Via tailoring the anionic component of colloidal precursors during the synthesis, those solution processed perovskite nanocrystals can generate X-ray-induced emissions that are easily tunable across the visible spectrum, which allow the fabrication of X-ray detectors with a low detection limit and high sensitivity.

Besides transistors and detectors, halide perovskite thin films and nanostructures are also explored for memory applications via leveraging on their unique properties of strong light-matter coupling, extremely broadband absorption, and rapid ionic transport.

By increasing the thickness of perovskite thin film layer, the mechanism of resistive switching memory could be converted from ion-conducting filament-type into junction-determining interface-type. Very recently, artificial iconic memories are fabricated using perovskite/metal multilayers, enabling the photodetection and image storage in a monolithic device.







Full details of the works can be found in:

F. Li, et al. (2017) "Ultrahigh Carrier Mobility Achieved in Photoresponsive Hybrid Perovskite Films via Coupling with Single-Walled Carbon Nanotubes", ***Advanced Materials***, 29, 1602432.

Q. Chen, et al. (2018) "All-inorganic perovskite nanocrystal scintillators", ***Nature*** 561, 88.

X. Guan et al. (2018) "Light-responsive ion-redistribution-induced resistive switching in hybrid perovskite Schottky junctions", ***Advanced Functional Materials*** 28, 1704665.

C. Ma, et al. (2020) "Solution-Processed Mixed-Dimensional Hybrid Perovskite/Carbon Nanotube Electronics", ***ACS Nano.***

Strategic Priority:
Academic Excellence

Theme 1:
Research Quality

Materials and Manufacturing Future Institute

THE UNSW

Materials and Manufacturing Future Institute is a landmark interdisciplinary institute established in late 2018 as part of UNSW's 2025 Strategy. It is one of four Futures Institutes who are tasked with addressing some of humanity's most pressing challenges, providing a dynamic framework to facilitate cutting-edge research, design and innovation.

Interdisciplinary research and collaboration are at the heart of the Futures Institutes. The UNSW Materials and Manufacturing Futures Institute serves as a hub between the university and industry, linking researchers and academics with industry-leaders and manufacturers. Here, bold and pioneering materials research meets cutting-edge design and development, driven by state-of-the-art advanced manufacturing, artificial intelligence and integrated technology.

This notably includes Australia's most advanced high-performance roll-to-roll printing/nano-imprint facility, with functionality for Oxide MBE, PPMS, AC Hall Effects and more. Utilizing high-throughput methods to significantly reduce time and cost, this ground-breaking equipment has extensive printed-electronics capabilities with a wide range of real-world applications, including renewable energy, energy storage, digital health, food safety, water treatment, national security and information technology.

We interact with printed electronics almost every day -- the filter and liquid crystal layers in LCD screens, antennas, flexible keyboards, solar cells, LEDs, and more. The new roll-to-roll printer and nano-imprint facility will enable the Materials and Manufacturing Futures Institute to not only improve existing products, but also target previously impossible consumer propositions and applications. Our research directions include cost-effective, stretchable and disposable printed electronics for use in biomedical devices and sensors, high-performance super-capacitors and Li-ion batteries, wearable electronics, high-performance membranes for water treatment, in-situ monitoring sensors for athletes, or for agriculture, or to measure food freshness, just to name a few.

We are also excited to be contributing to innovations in renewable energy manufacturing and storage, keeping in-step with the national energy strategy and growing public consciousness. Additionally, we will commence monitoring of the health and moisture of local trees and surrounding environments, providing accurate environmental information to assist with satellite predictions of bush-fires and other weather events.

This industry-scale roll-to-roll printing/nano-imprint facility is a ground-breaking piece of equipment, and its commissioning will undoubtedly establish a new and exciting area of innovation in the world of materials design and development. Instead of just research for the sake of research, the MMFI will enable and accelerate materials innovation with an eye to delivering real-world social benefit and solutions to global problems – transitioning from serendipity-driven research to property-driven design. The UNSW Materials and Manufacturing Future Institute is excited to continue connecting world-class academia, industry leaders and Government organisations to deliver real-world benefits in today's global economy and transform the future of research.

Materials and Manufacturing Futures Institute UNSW Sydney

Strategic Priority:
Academic Excellence

Theme 1:
Research Quality

NSW Circular Report

NSW Circular is a network that brings together stakeholders from across Government, Industry, Research Organisations and Communities to find innovative solutions to reduce and reuse waste and materials and enhance sustainability.

It aims to contribute to the development of a circular economy – where waste is valued as a resource – by fostering a more sustainable approach to the design of goods and services, use of resources and management of waste. The Network is an initiative of the NSW Government with UNSW Sydney appointed as Host in February 2019.

SMaRT Scientia Professor Veena Sahajwalla was named Director of NSW Circular and set about building a team and strategy, in consultation with the Government funding arm, the NSW Office of Chief Scientist and Engineer, and within several months a newly branded entity was formed in accordance with the contract arrangements.

Over the past year, NSW Circular has helped to bridge gaps across by promoting connectivity and co-ordination through various engagements, such as workshops, events, pilot projects and curation of relevant reports and information. NSW Circular has been identifying and developing opportunities and tools that are needed for promotion of innovative solutions to reform waste.

The first pilot project was with Mirvac at its Marrick and Co development in Marrickville that showed how waste materials such as waste glass, textiles, and plastic can be reused in the built environment and reformed through smart engineering into new products.

In August, NSW Circular together with the University of New England's SMART Region Incubator and its Centre for Agribusiness partnered in a series of events and business visits to help create local circular economy solutions.

NSW Circular is also exploring the opportunities provided by the photovoltaic industry in Australia by analysing the current state of play of the industry and how circular business models could apply to the lifecycle of a photovoltaic panel and recommending ways forward for industry stakeholders.

Additionally, NSW Circular has also partnered with the Advanced Manufacturing Growth Centre (AMGC) in numerous events, including one for the Central Coast and Hunter businesses to develop local circular economy solutions.

NSW Circular's pilot project partnership with Sustainable Schoolwear is another example of a pilot success where waste textiles and plastics are reformed into ceramic-style flat panel building products to build school desks. The project used old school uniforms to test the creation of flat panels and is defining the process and capability for the diversion and upcycling of textile waste.

"The circular economy and its supporting technologies have a range of social, environmental and economic benefits which will help address several of the United Nations Sustainable Development Goals (SDGs), principally SDG 12: responsible consumption and production", said Professor Sahajwalla, highlighting the need to close the loop in manufacturing.

Strategic Priority:
Academic Excellence

Theme 1:
Research Quality

2019 SMaRT Centre Report

THE GREEN MICROFACTORY was launched by the federal Minister for the Environment, Susan Ley at UNSW Sydney in 2019. The Green Microfactory is helping to deliver world-first technologies that include turning discarded plastic into high-quality 3D printing filaments. The microrecycling technology is the culmination of years of work led by the SMaRT Centre Director, Professor Veena Sahajwalla, and allows industries to build modular recycling solutions which can be scaled up as demand grows.

Innovations developed at the SMaRT Centre also include turning contaminated and mixed plastic into furniture products and into revolutionary Vitakets used in making steel. Veena has been invited to contribute to policy ideas for the released draft NSW 20-year Waste Strategy Issues Paper and its Plastics Discussion Paper during the visit of NSW Environment and Energy Minister Matt Kean.

Creating new supply chains and value from discarded materials could help Australia be at the forefront of the fight against waste and create jobs. One of the SMaRT Microfactories takes end-of-life glass and textile products and transforms them into tables and countertops which contain significant recycled materials, and which are on show at some of Mirvac's display apartments.

The SMaRT Centre also secured the Physical Sciences Fund of the NSW Office of Chief Scientist and Engineer to help bring industry-changing ideas to market. The funding will help to commercialise UNSW's Microfactory concept, which can reform waste materials including glass, single-use coffee cups, used coffee grounds and textiles into ceramic-based panel products that can be used as tables, countertops and tiles.

Veena said, "We've developed manufacturing technology and capability so waste can be reformed into value-added materials and products, as well as kept out of landfill. Environmental benefits aside, this scientifically developed technology will help to drive the emerging circular economy, create jobs and enhance social and economic outcomes, not just for local communities but more broadly for the nation."

More good news is that Professor Sahajwalla will lead the ARC Research Hub for Microrecycling of Battery and Consumer Wastes. The aim of this project is for industry to adopt commercially viable technology and processes where low value or complex waste is reformed into high-value materials, creating jobs and environmental and social benefits.

Green Steel—Polymer Injection Technology has won the 2019 BHERT (Business Higher Education Round Table) Award for 'Outstanding Collaboration in Research & Development—Major Partnerships' recognises excellence in R&D activity undertaken jointly by researchers in tertiary education institutes and partners in business and industry. BHERT CEO Dr Peter Binks said, "Professor Sahajwalla has established a leadership position for Australia in low emission steelmaking, and in doing so has provided both growth opportunities for Australian steel and helped reduce environmental challenges for the nation. Her innovation and resourcefulness over the last decade have been remarkable." The partnership with OneSteel to develop and commercialise the technology, and now with MolyCop to make it available in international markets.

Veena has spoken at dozens of events and conferences across the world including the 33rd All India Induction Furnaces Association (AIIFA) Annual Conference in India, Josh Brady Public Forum, World Engineers Convention Australia, Global institute of Sustainability (GIOS), Arizona State University, USA, PLuS Alliance Symposium, Alliance Symposium, Arizona State University, USA, International Green Materials Workshop, Taiwan, and the Lloyd's Register Foundation International Consortium of Nanotechnologies (ICON) Summer School, Singapore. These presentations inspired scientists and engineers to address environment challenges and grow research innovations for the benefit of our communities and industries.

Over 2019, Veena was involved in more than 250 recorded media stories and interviews across radio, TV, print and online, helping to raise the profile and reputation of UNSW and the school.

Strategic Priority:
Innovation and Engagement

Theme 2 & 3:
Partnership & Knowledge Exchange

2019 Staff Awards & Achievements

ARC Research Grant Awards Success

The School was awarded the following Australian Research Council grants in the 2019 round:

Discovery Grants

1. Professor Jianqiang Zhang and Emeritus Professor David Young and their team *"High temperature corrosion induced by multiple secondary oxidants"*
2. Professor Paul Munroe and his team *"Designed to last: novel gradient coatings for extreme environment"*

Linkage Grants

1. Emeritus Professor Alan Crosky and his team 'Microbiologically Induced Stress Corrosion Cracking in Underground Mines'
2. A/Professor Sophie Primig and her team "Advanced hard metals: microstructure-property-processing relationship".
3. A/Professor Sophie Primig and her team "Structure-property relationships of next generation aero-engine materials"

ACARP grant

Dr Pramod Koshy, Dr Xing Xing, Emeritus Professor Oleg Ostrovski, Professor Charles Sorrell and their team "Effect of Coke Properties on High Temperature Strength and Hot Metal Reactivity Under Blast Furnace Conditions"

ARC Postgrad Event

Jan Seidel and Pankaj Sharma awarded 2019 outstanding Supervisor Awards.

UNSW Teaching Award in the General Category of Teaching Excellence

Dr Pramod Koshy received this award in recognition of his teaching excellence in both undergraduate and postgraduate students.

UNSW Science Staff Excellence Award for the Operational Excellence Award

Lucy Zhang received this award in recognition of her excellent work in operational matters across areas in both academic and professional staff in our school.

Welcome Additions

The School welcomed new academics including

1. Dr Benjamin Pace has been appointed Lecturer, Education Focused role.
2. Associate Professor/Associate Director Shery Chang. Shery is Associate Director at the Electron Microscopy Unit, Mark Wainwright Analytical Centre.
3. Dr Tushar Kumeria has been appointed Senior Lecturer. He is an NHMRC Early Career Fellow with a research focus on porous nanomaterials.

Academic Promotions

1. Professor Alan Crosky has been appointed Emeritus Professor.
2. Dr Caitlin Healy has been appointed Lecturer, Education Focused role.
3. A/Professor Jianqiang Zhang has been promoted to Professor.
4. Dr Sophie Primig, Danyang Wang, and Kris Kilian has been promoted to Associate Professor.
5. A/Professor Sophie Primig has been elected President of the New South Wales Branch of The Institute of Materials Engineering Australasia Ltd (IMEA).
6. Professor Veena Sahajwalla has been appointed as Director of NSW Circular Economy Network.

Other Awards

Professor Tom Wu is ranked as one of the Global Highly Cited Researchers 2019 by Clarivate Analytics.".

Centres Awards

1. SMaRT Centre, led by founder Professor Veena Sahajwalla, received the 2019 BHERT (Business Higher Education Round Table) Award for Outstanding Collaboration In Research & Development – Major Partnerships.
2. SMaRT Centre been awarded $2 million from the NSW government to set up and run the new NSW Circular Economy Innovation Network.
3. SMaRT Centre been awarded their second Australian Research Council (ARC) Industrial Transformation Research Hub grant, this time $3.3 million, with similar contributions from industry to develop microrecycling of battery and consumer wastes.

Strategic Priority:
Innovation and Engagement

Theme 2 & 3:
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2019 Student Awards & Achievements

University Medals

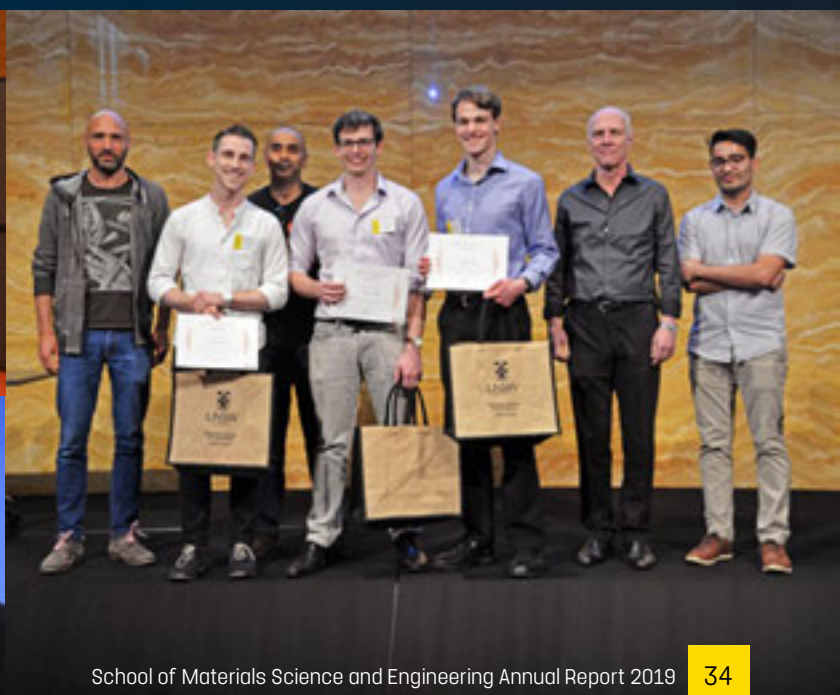
Gajan Shivaramann, **Keenan Burrough**, **Vicki Zhong**, **Alan Cen** and Li**am Stephenson** have been awarded University Medals for substantial academic achievements throughout their degrees.

Conferences Awards

1. **Gaurav Vats** received IEEE-UFFC Student Award at ISAF 2019, Switzerland 2019. He also received the Tiina and Antti Herlin Foundation grant (Finland) addressing the urgent mitigation of climate change. And, 1.) Marie Skłodowska-Curie Actions (MSCA) Individual Fellowship 2019 by the European Commission.
2. **Scarlett Kong** won the Best Student Poster Award at the DMTC(link is external) Annual Conference & the Student's Pitch Academic's Choice Award from The 2019 ISAF-ICE-EMF-IWPM-PFM Joint Conference.
3. **Thomas Molley** received best rapid presentation award at the 2019 Matrix Biology Society of Australia and New Zealand (MBSANZ) conference.
4. **Yangyang Zhang** received the IEEE UFFC-S Award for Ferroelectrics School in Beijing, P. R. China

Scholarship Awards

1. **Florence Lui** has been awarded a prestigious Fulbright Future Scholarship. Also, Florence has been awarded European Molecular Biology Laboratory Australia (EMBL) Short-term Travel Grant.
2. **Mia Maric** awarded full PhD scholarship to Manchester University
3. **Ralph Bulanadi** awarded full PhD scholarship to University of Geneva
4. **Richard Chen** awarded full PhD scholarship to Cambridge University
5. **Sid Doshi** awarded full PhD scholarship to Stanford University
6. **Scott Jones** awarded 2019 Infrabuild Steel undergraduate scholarship.
7. **Vitor Rielli** and **Mia Maric** awarded the UNSW Scientia PhD scholarship



Poster Competitions

PGSOC Poster Competition

1. **Thomas Molley, Richard Winkler** and **Jonathan Hopkins** were awarded 1st, 2nd and 3rd prize, respectively for their posters "Microcapsules for Multifunctional Autonomous Self-Healing Biocomposites", "Understanding Static and Dynamic Domain Structures of Epitaxial PZT Bilayers on Silicon" and "Synthesis and Characterization of Phosphonated PEDOT: A Novel, Water-Processable Conjugated Polyelectrolyte".

Other Poster Competitions

2. **Ilizel Retita** received the MS&E School Award in the 1 minute presentation competition in the Postgraduate Research Showcase.
3. **Pankaj Sharma** received the Best poster award at ARC CoE FLEET annual meeting 2019
4. **Yangyang Zhang** received the Best Poster Award Nominee at Materials Research Society (MRS) Fall Meeting, Boston, USA

Materials Australia Undergraduate Student Presentation

1. **Sophie Armstrong** and **Liam Stephenson** were awarded 1st and 2nd prizes, respectively, for their presentations "Platinum Degradation in Bovine Calf Serum on Electrode Arrays" and "The Challenges of Additive Manufacturing".
2. **Ding Yu** was awarded 2d prize for his poster "Can food acid increase the wear of dental composite tooth restorations?"

Demonstrator Awards

Adam O'Neil and **Ayda Khosravani** received demonstrator awards for being most effective in the delivery of lab and tutorial classes to our undergraduates.

Thesis Awards

1. **Dohyung Kim** received the Dean's Award for Outstanding thesis 2019
2. **Mia Maric** received the Perfect Engineering award for best Honours thesis in Metallurgy', UNSW Sydney

Strategic Priority:
Innovation and Engagement

Theme 2 & 3:
Partnership & Knowledge Exchange

William Jervis

Work Integrated Learning

My industrial training experience was jump-started through my involvement in the Defence Engineering Internship Program in the summer of 2017-2018.

This Australia-wide program pairs top engineering undergraduates with small-medium enterprises in the defence industry to promote interest in pursuing careers in the defence engineering sphere. I was paired with RUAG Australia, a defence contractor with facilities in Melbourne and Adelaide.

The placement was at the Wingfield metal treatment facility, where a state-of-the-art automated metal finishing line processed components for the ongoing Joint Strike Fighter Program (JSF).

Over the course of my internship I assisted Craig Pollard, the plant's process engineer, with quality assurance activities throughout the plant, as well as monitoring the metal treatment baths to ensure that key constituent concentrations fell within strict defence industry requirements.

My favourite part about working at RUAG Australia was the cutting edge equipment and perfected procedures that surrounded processing the expensive and intricate fighter plane parts; since individual JSF components were so costly and specialised, it was imperative that each step of the production process be carefully monitored and controlled within a small margin.

This encouraged a strong focus on precision and delivering top quality.

The second internship I completed was at Brickworks Ltd in 2019. In this position I was supervised by Silvia Wong and Dr Taka Numata as I worked on quality control and product innovation at the NATA-accredited Brickworks lab in Horsley Park.

This role gave me a wide variety of valuable experience in real-world product troubleshooting, industrial testing, and problem solving in the engineering context. My regular tasks included testing daily output of bricks for compressive strength, efflorescence, expansion factor, water absorption, and salt attack.

I would also work on independent projects to provide material data for new products or help to formulate fixes when customers had particular product needs.

A key highlight from my time at Brickworks was definitely the legendary Hungry Baker Fridays, when the team would take the brief trip to a local eatery and emerge half an hour later full to the brim with delicious food and good cheer.

The welcoming atmosphere and friendly team members at Brickworks were an awesome addition to the technical experience I gained from this placement.

Strategic Priority:
Innovation and Engagement

Theme 2 & 3:
Partnership & Knowledge Exchange

Poster Competition

The School hosted its annual Industrial Training (IT) event on Tuesday 10th March 2019. It was superbly managed by Michael Lai, MATSOC and many volunteers. This event showcases, in a series of short presentations by our undergraduate students, their industrial training period in various organisations both in Australia and around the world. The event is a major component of our undergraduate curriculum towards graduating students as professional engineers. Further, not only do they graduate with some real on-the-job experience, they also qualify for accreditation by Engineers Australia.

The presentations showed that students have gained significant learning experience from their industrial trainings. And, they have boosted their confidence to be ready to enter the industry.

The winners were:

1ST PLACE:
WILLIAM JERVIS – Ruag Australia & Brickworks.

2ND PLACE:
COCO KENNEDY – NCSU Summer Research exchange.

3RD PLACE:
BRENDA LEUNG – Quality Control in Investment Casting.

PEOPLE'S CHOICE (POSTER):
CRESENTIA MADELINE – Research at NTHU.

PEOPLE'S CHOICE (PRESENTATION):
CARRIE ZHU – Effect of Graphene Oxide Sheets on Ultrafiltration Membranes.

We were pleased to have many judges and presenters: Michele Hannon (UNSW), Kim Finnie (Ceramisphere Pty Ltd), Samuel Ho (ABC Refinery), Tyrone Li (Perfect Engineering), Victoria Coleman (National Measurement Institute), Michael Millen (CSIRO), Samantha Grimm (Resmed) and Silvia Wong (Brickworks).

Strategic Priority:
Innovation and Engagement

Theme 2 & 3:
Partnership & Knowledge Exchange

Mobility Program to Taiwan 2019-2020

DURING THE SUMMER BREAK OF DECEMBER 2019 - FEBRUARY 2020, our students Xinyu (Joy) He, Lionel Lie, Vienna Wong, Ying (Ellma) Zhang, and Dongfang Zhao had the opportunity to participate in a research internship at National Chiao Tung University (NCTU), Hsinchu, Taiwan under the New Colombo Plan (NCP). We were given the opportunity to work on different projects. Whilst weekdays were spent in the labs, weekends were reserved for travel, exploring both Hsinchu and other cities in Taiwan. Hsinchu, located in-between the major cities Taipei and Taichung, made weekend day trips possible. We would also occasionally meet up with and travel with other NCP students located at different universities.

Xinyu He - Epitaxial Growth of Diamond

My project was working on epitaxial growth of diamond on silicon by microwave plasma chemical vapour deposition (CVD) with Professor Li Chang's group.

In this short term exchange study, I not only learned professional knowledge in new fields, learned different teaching methods in different schools, but also experienced different folk cultures. In fact, the language systems and culture of Taiwan and Mainland China are basically the same, but I still felt a great culture shock. I highly recommend that people from various countries and regions actively participate in the next exchange activity and learn more professional knowledge and human customs, which will help further enrich the learning life.

Lionel Lie – Introduction to Terahertz

I chose Professor Lin as my supervisor. My experiment focused on setting the layout on the map that is made by Professor Tu.

This internship program taught me how to use equipment in the optical lab, such as; cleaning the lens, turning on the synergy machine and setting up the laser straight. Terahertz radiation can be used to obtain material characterisation.

Vienna Wong - Electrophoretic Deposition of Chitosan

I joined Professor Pu Wei Wu's Artificial Materials and Energy Technologies (AMET) Laboratory, which specialises in electrochemistry.

Undertaking research in AMET labs has been an extremely rewarding and invaluable experience. I am very grateful to have had such wonderful and generous lab members which made this experience all the more memorable and enjoyable.

Witnessing the global nature of scientific research as well as partaking in this research myself has given me confidence as well as improved my critical thinking and problem-solving skills.

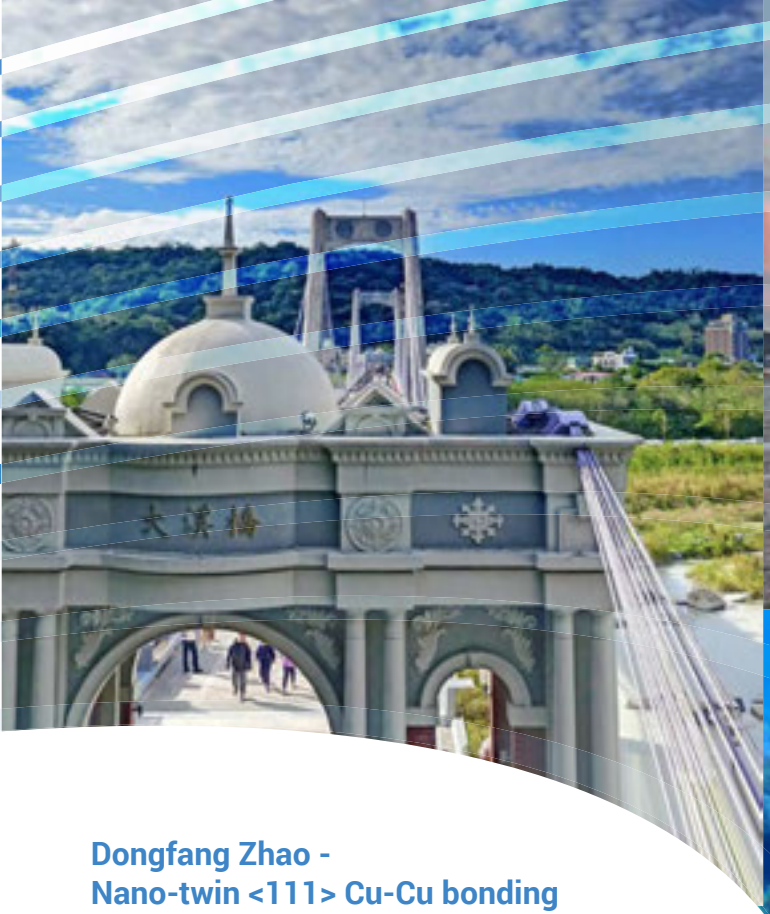
The cultural enrichment that accompanied this program also broadened my educational experience and international contacts as well as life-long friends in the field were made possible.

Ying Zhang - High Entropy Alloyss

I joined Professor Erving Wen Huang's Metals Research and Applications (MRA) Laboratory during this short-term research program. My project is mainly focusing on the magnetic properties of equiatomic alloy CoCrFeMnNi (single-phase) and its fatigue behaviour.

I learned a lot of experiences and knowledge in actual lab work and how to analyse the result by using theoretical knowledge.

My most exciting traveling experience was where I experienced diving for the first time. Even though it was a windy day, the sea world was so beautiful and impressive.

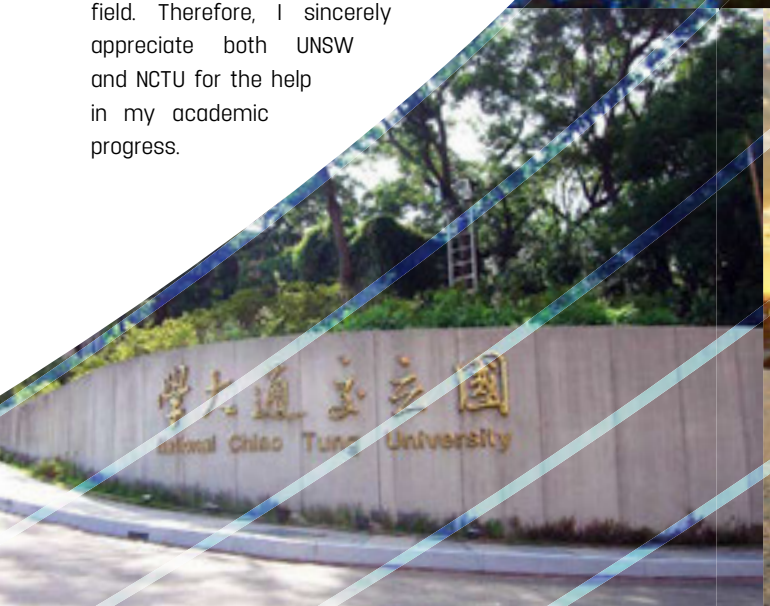


Dongfang Zhao - Nano-twin <111> Cu-Cu bonding for 3D packaging

I joined Prof. Chih Chen's research group co-worked with TSMC, conducting integrated circuit related research with other research students.

Meanwhile, Taiwan is one of the best places for cycling thanks to the crowded urban agglomeration on the west coast and fantastic natural view on the east coast. To experience local culture in deep, I had a cycling trip around Taiwan during Chinese New Year. North to south and south to north, I met all kinds of people of different ages and from different areas around the world. It brought me the promotion of physical fitness as well as the extension of the horizon.

I benefited very much from this exchange program which provided me a fantastic chance to conduct semiconductor related research in a world-class lab co-worked with TSMC. I learned many courses about semiconductor materials but never had such a chance to do practical experiments even though I was always interested in research in the semiconductor field. Therefore, I sincerely appreciate both UNSW and NCTU for the help in my academic progress.



Strategic Priority:
Academic Excellence

Theme 3:
Student Experience

Gajan Shivaramann

MY UNDERGRADUATE DEGREE in Materials Science and Engineering at UNSW was an incredibly rewarding experience. Coming into a brand-new building with advanced lab equipment and study spaces was a huge bonus to kick-off university.

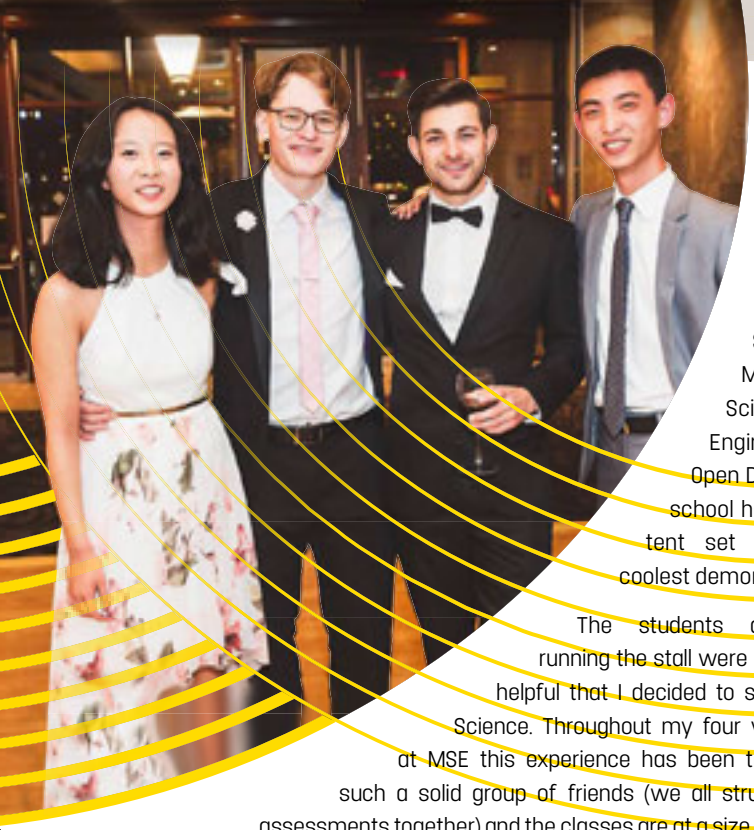
It also acted as an awesome home-base to get to know the Matsci cohort and form close relationships with the staff and lecturers.

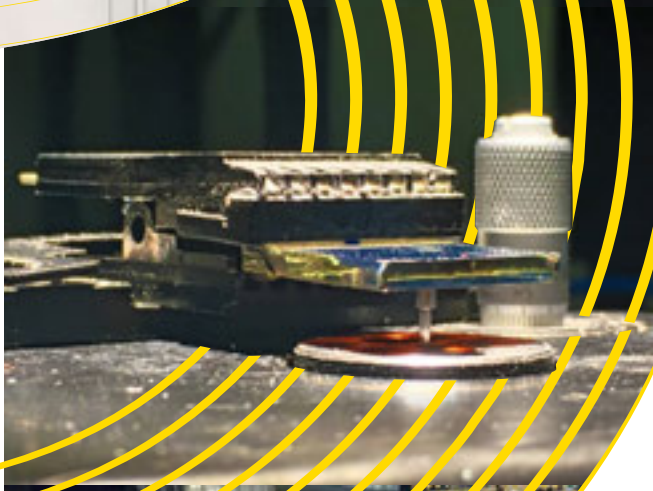
On top of this, the opportunities afforded by the degree itself went beyond its scientific roots with a smart focus on developing the analytical and professional skills recognized across many jobs and industries. It has been invaluable to have the reputation of the School and University behind me when marketing myself as an engineering graduate.

Strategic Priority:
Academic Excellence

Theme 3:
Student Experience

Keenan Burrough





I WAS FIRST introduced to the UNSW School of Materials Science and Engineering at Open Day,, where the school had the biggest tent set up with the coolest demonstrations.

The students and lecturers running the stall were so friendly and helpful that I decided to study Materials Science. Throughout my four years studying at MSE this experience has been true, I've made such a solid group of friends (we all struggled through assessments together) and the classes are at a size where you can really get to know the lecturers and even help them with some research.

At the end of my second year, I had the privilege of going on a research exchange under the New Colombo Plan to Taiwan, set up by A/Prof Sammy Lap Ip Chan. I got to experience a new culture and working environment where I worked on new perovskite materials for solar panel research. I made lifelong friends there and learned so much over the break.

The school society MATSOC has been a big part of my time at uni. They hold sports days, BBQs, trivia nights and an annual Ball, which is how I first met my friends at MatSci. It's a great way for students to meet each other and part of why my time at uni was so enjoyable.

My last year at uni was the hardest as I completed a thesis project. The school offers a wide range of interesting topics, including industrial partnership projects. I was lucky enough to do a thesis project with ANSTO on glass for nuclear wasteforms, set up by my supervisor Dr. Pramod Koshy. I got to meet and work with researchers that are top in their field and experience the Australian research scene.

My time at UNSW MSE as an undergraduate was amazing thanks to the passionate people and wealth of opportunities at the school, and I wish the best of luck to anyone starting their studies!

Strategic Priority:
Academic Excellence

Theme 3:
Student Experience

Scarlett Kong

MY PHD EXPERIENCE at UNSW Materials

I was always curious about materials and how they worked as a child. So, choosing to study Materials Science and Engineering was an easy decision. I had an amazing undergraduate experience at UNSW, where I learnt about materials and what makes them behave the way they do, got involved with the student community, went on exchange and made lifelong friends along the way.

And after completing my honours thesis, I decided that I wasn't done and wanted to continue doing research.

I am currently completing my PhD in collaboration with Thales Underwater Systems and DMTC Ltd., on characterising the structure and electromechanical properties of textured piezoelectrics for underwater acoustic applications. As a PhD student in the School of Materials Science and Engineering, I was able to not only develop the skills I needed for research, such as coding and conducting experiments, but also improve my science communication and presentation skills.

This has allowed me to travel around Australia and Europe to present my work, conduct experiments at international research facilities, learn from industry experts and receive awards for my achievements. Additionally, working on an industry partnered project showed me how university-based scientific research can be translated into industry and have an impact on the wider community.

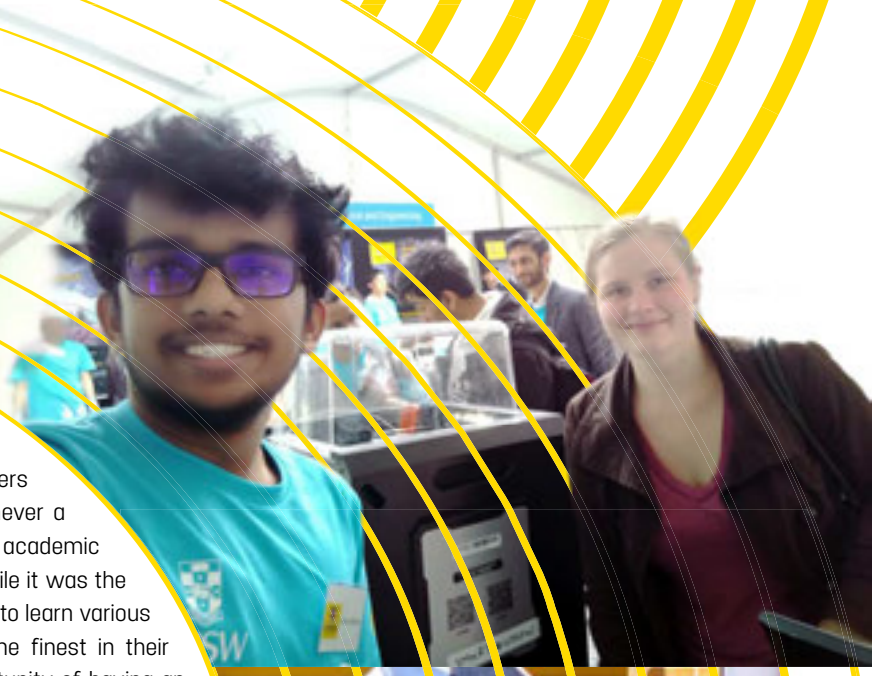
While studying and research is the focus while I complete my PhD, engaging with the wider UNSW community is also an important experience I wanted to have, to learn more about the world outside of academic research. So far, this has been an extremely rewarding experience. I've been able to represent higher degree research students at the Faculty of Science and Academic Board and share my passion for STEM with the general community as a student ambassador for the Faculty of Science.

My PhD experience with the School of Materials Science and Engineering has been wonderful and I feel confident with the skills and knowledge I have gained, that I can tackle the next challenges after my PhD.

Strategic Priority:
Academic Excellence

Theme 3:
Student Experience

Varun V. More



I AM VARUN V. MORE, a Masters by Coursework student who started my studies at UNSW in 2018 when the university still followed the semester system. Now, after two years (almost) of studies here at the School of Materials Science and Engineering, my decision to select this masters programme seems to be fruitful. Indeed, the beginning was never a cake walk. Coming from a completely different cultural and academic background, it took me a while to adapt to this new culture, while it was the peer- mentoring that help me to find some new friends. Getting to learn various courses from faculties, of which some are considered as the finest in their respective fields was truly as incredible experience. The opportunity of having an independent research project in my masters degree can be termed as the cherry on the cake. It has not only helped me to apply the theoretical concepts into real-world applications, but also served as the platform to master technical aspects while learning various skillsets that makes a student more employable and to work on projects which can add an exclusivity to resume of the researcher.

However, it was the PGSOC which has truly helped me to evolve socially and professionally as well. Since getting introduced to PGSOC in the initial days of my studies, I was very keen to be a part of this team, and eventually I got the opportunity to work on the Executive Committee of this constitutional club for two years.

Right from organising professional events like the Annual Poster Competition, End of the Year Party to organising social events such as the Friday Socials and Trivia Night and Sports Day with the undergrads, representing the issues faced by students to the administration of the School, PGSOC has given me an immense opportunity to develop my skillset. Indeed, I had a memorable time at UNSW along with learning the technical aspects of materials, working on a cutting-edge research project and making some friends for life.

Strategic Priority:
Academic Excellence

Theme 3:
Student Experience

MATSOC 2019 Annual Report

Foreword

2019 was a year of change and adjustment for MATSOC, but despite this, we were able to start the year strong with the 2019 MATSOC executive committee organising and executing a variety of our traditional social and professional events, as well as newer events created through our own innovation to further support and assist our students as we move forward. Our ability to adapt to the changing environment around the university speaks volumes to the commitment and dedication of this year's executive committee, and as the 2019 President, I could not have been prouder of their hard work. This year, our goals were expanded to further support our students and provide them with the necessary information and engagement to assist them throughout their studies and future endeavours. In order to facilitate this expansion, our events involved significant collaboration with our various industry contacts such as BlueScope Steel and Cochlear, alongside various UNSW entities such as the School of Materials Science and Engineering (MSE), the Materials Postgraduate Society (PGSOC) and other engineering school societies. From this collaboration, we were able to expand the scope of our activities with greater engagement with industry, improve inter-society community events and further strengthen contact with materials students at other universities.

Events Summary and Highlights

In 2019, we held a total of 17 events, of these, only 2 were solely run by MATSOC, with the remainder being collaborative events with other societies. These collaborations marked an extraordinary achievement by MATSOC, brought about by the adjustment of our schedule due to the introduction of trimesters and has not detracted from the quality of the events that are run by the society. Some of these adjustments include reducing the number of events held between weeks 5 and 7 to accommodate the new Mid-trimester examination period as well as avoiding later periods in the term to avoid clashes with End-of-trimester exams.

Our 2019 Objectives:

1. To continue to provide a platform for Materials Science and Engineering Students at UNSW to engage with their peers and industrial partners, whilst expanding our social and industrial outreach.
2. To build upon the well-established goals and work from previous iterations of MATSOC to continue our expansion and growth into the future.
3. To facilitate the growth of our students as professional Materials Engineers with opportunities and exposure to industry, alternative graduate pathways, and professional development.

Concluding Remarks

This year, we have significantly expanded our engagement with the wider university community, engaging with various societies to achieve an unprecedented level of inter-society collaboration.

We have seen continued engagement from students and enthusiasm from new students and this is something that we hope will continue into the future. Our success this year would not have been possible without the hard work of the 2019 executive team and of our predecessors, who have created a rigorous framework for our society to build upon.

Furthermore, our events this year would not have been possible without the tireless efforts from the executive committee, the support from Arc and the generous sponsorship from Cochlear, BlueScope Steel and the School of Materials Science and Engineering.

Thank you all for your ongoing support to ensure that we achieve our goals and investing in the future of Materials Students at UNSW. Moving forward to 2020 and beyond, we will continue to facilitate the growth and development our Students and the School Community.

Xihua Chen - 2019 MATSOC President

Our 2019 highlights:

- The first ever Combined Chemical Engineering and Materials Science and Engineering Speed Networking Evening which saw a 100% increase in student attendance from last year.
- Continuing our long standing collaboration with the Chemical Engineering Society and Food Science Association to host the First Year Camp, Mid-Year Cruise and Annual Ball.
- Engaging our students with 28 different representatives from different materials industries this year, an improvement from the 17 in 2018.
- Our annual Trivia Night held in the Ainsworth Design Studio which has been hailed as "hands down the best ever" and "freakin' awesome" amongst some of our Staff and Students.

Strategic Priority:
Innovation and Engagement

Theme 2 & 3:
Partnership & Knowledge Exchange

PGSOC Report

This year has been the most exciting, yet the busiest for PGSOC. As the new executive team took over in late 2018, we were ready to bring the most inclusive environment for the postgraduate student community so far.

Over the past 10 months, PGSOC worked on developing communication skills, leadership, and body and mind exercises, the team were really committed to increasing the engagement levels among the postgraduate students, here are some of the events:

- A workout boot camp with an expert fitness trainer
- Chinese New Year celebration
- The comeback of Monthly Movie nights
- A confident public speaking workshop
- A mindfulness meditation practice
- Welcome BBQs at Maroubra Beach for new students in Term 1 and 3 2019
- Guest speaker for the seminar series: from a PhD student to starting his own company, with Dr Will Crowe
- Starting with why: discovering your leadership purpose. A series of workshops in collaboration with UNSW Leadership Program
- Sports Day with MATSOC: basketball (Term 1) & soccer (Term 3)
- Trivia Night with MATSOC
- Halloween special 2019

And finally:

- The 2019 Poster Competition, in collaboration with the school this year we upgraded the venue to Leighton Hall and nearly 60 students are expected to present their research progress.

It has been without a doubt a year full of fun activities, proof that teamwork is the best approach to accomplish any project. And also, that we can have fun while we do research.

All of these events have set a new record for the outgoing committee, among the most important ones:

- An increase of 30% of students overall satisfaction with the activities.
- An overall 50% engagement increase after the reintroduction of the table tennis on Friday Socials.
- A sense of inclusion was preserved and the level of engagement through social networks increased 60% compared to that in 2018.
- PGSOC participated in Open Day with their own stall for the first time.

We wouldn't have been able to achieve all of these without all your support, and on behalf of PGSOC I would like to thank the School of Materials Science and you for making PGSOC great again!

WENCESLAO JAIMES OCAMPO (2019 PGSOC President)

Strategic Priority:
Social Impact

Theme:
Equality, Diversity and Inclusion

Equality, Diversity and Inclusion

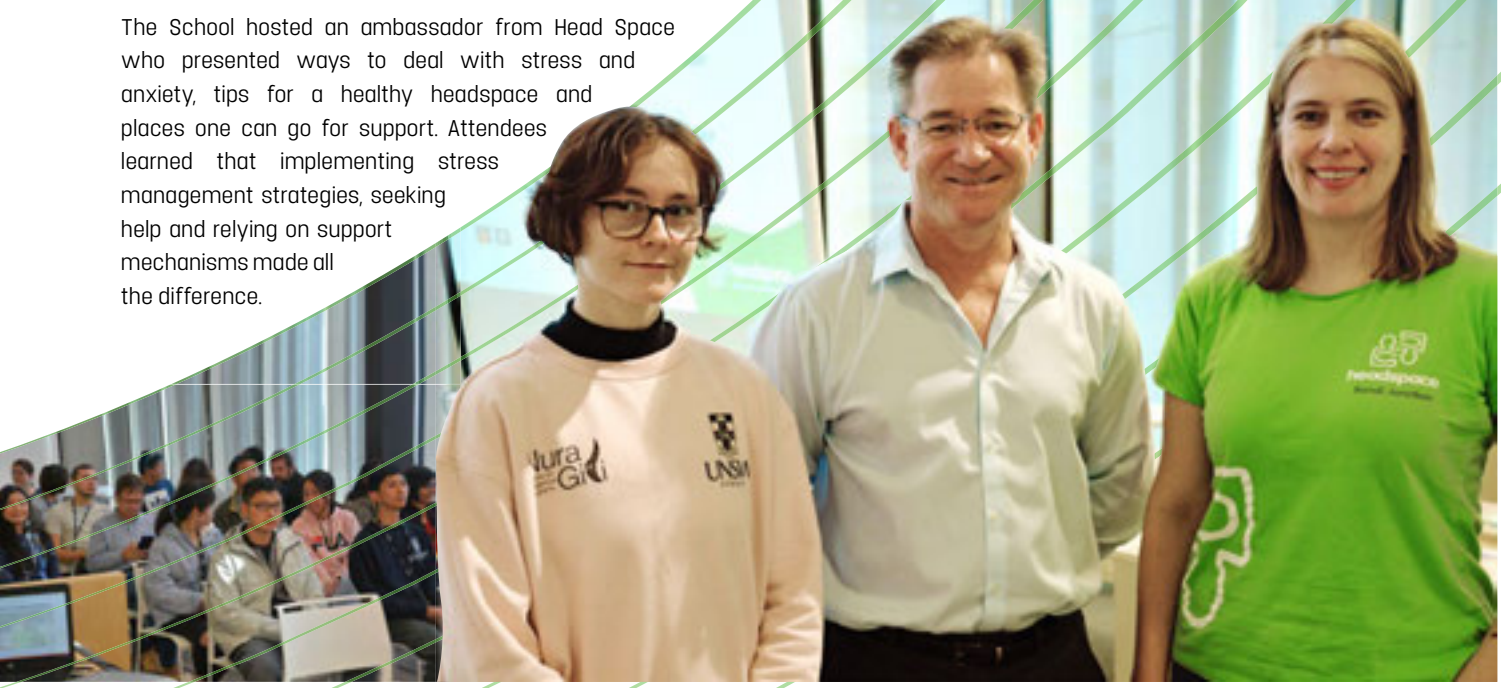
The School aims to provide a safe, supportive and inclusive environment for all students regardless of their race, sex, age, religion, disability, sexual orientation or gender identification – a place where our staff and students are best supported to reach their full potential.

In keeping with this philosophy, the School's Equity Diversity and Inclusion (EDI) Committee leads and inspires this diversity agenda through planning and supporting EDI events organised by our student societies. In collaboration with PGSOC, the committee launched an awareness campaign to raise awareness of our undergraduate and postgraduate students about "R U OK day" significance.

Pamphlets and relevant contact information were posted in the school and streamed on the digital displays in the month of September.

In October, staff and students in the School came together to celebrate "World Mental Health Day", raising awareness of indiscriminate mental health issues, which can be a reality for people around us and to break the stigma surrounding mental illness, encouraging those struggling to seek help when needed.

The School hosted an ambassador from Head Space who presented ways to deal with stress and anxiety, tips for a healthy headspace and places one can go for support. Attendees learned that implementing stress management strategies, seeking help and relying on support mechanisms made all the difference.



Strategic Priority:
Social Impact

Theme:
Equality, Diversity and Inclusion

Women in Materials

The UNSW Women in Maths and Science Champions Program is a development program to support our female research students and early career scientists to become science professionals.

We have five PhD students and early career scientists in the UNSW's Women in Maths and Science Champions Program 2019 named Vivasha Govinden, Tasmia Zaman, Caitlin Healy, Samane Maroufi and Paria Gharavi.

"There have been many highlights of being involved in the UNSW Women in maths and science champions program. A key one for myself was learning how to discuss your research with the media. Learning more about how the news industry works gave me great insights on how to feel comfortable in discussing my research with the media and general public in everyday life. Hearing from UNSW's own Dr Belinda Liddell about her journey from being solely a researcher to a great science communicator was inspiring. It gave me hope to become more involved in the world of science communication"

CAITLIN HEALY

"Being a female researcher, last year I got the opportunity to become a part of this program. It was a great experience for me. The program guided us to prepare ourselves for the future career and build a strong network among the women in maths and science from all over the world". "Now, I have the confidence to become a public profile and make a positive impact in science community". "Overall, the program is a package to develop leadership quality among the women in math and science"

TAZMAN ZAMAN

"Being involved in this program was an opportunity for me to improve my communication skill and learn how to apply the right strategy and technique to get my audience (from media, public, high school students) engaged and enthusiastic when I talk about science and my research"

SAMANE MAROUFI

"This program serves as a platform to raise awareness on women in STEM. The compulsory 20 outreach hours commitment forced me out of the laboratory, and I am happy of the outcome. I still remember the day when we did an Aspire demonstration and a year 10 student exclaimed 'Oh wow! I never knew science was this cool!'. Through these outreach activities, we hope that showcasing science as not only an interesting subject but also as a successful field with high employability will lead to an increase in high schoolers, especially girls, taking STEM subjects for their HSC. Personally, the programme is contributing immensely for my professional development with its timely and relevant workshops"

VIVASHA GOVINDEN

Strategic Priority:
Social Impact

Theme:
Equality, Diversity and Inclusion

Marketing Outreach Report 2019

The last year of the decade was incredibly productive in the outreach world, seeing a large increase in hands on activities, a new professional development workshop and the biggest Open Day ever! Some of the highlights included:

OPEN DAY

The 2019 Open Day was the biggest UNSW has ever seen with over 38,000 students coming to experience what we have to offer. The School of Materials Science and Engineering had the biggest tent on display and we doubled our liquid nitrogen ice cream servings this year to over 1700! Thousands of prospective students participated in a range of our interactive workshops including charpy testing of frozen chocolates and lollies, catapults and their materials, SMaRT Centre recycling and of course using liquid nitrogen to produce delightful sorbet and ice cream. Open Day remains the largest source of information and inspiration to prospective students.

INSTITUTE OF TECHNOLOGY EDUCATION CONFERENCE 2019

Engineering Studies is an HSC subject exploring a range of physical and chemical concepts, with a large emphasis on materials science and subsequently many students from this subject area come to study with us after completing their HSC. There are very few professional development workshops to upskill teachers in poorly understood points of the syllabus and our school is ideally placed to provide these resources. In collaboration with the Institute of Technology Education, 47 passionate teachers came to our school for a day of talks, workshops and tours. This was the first time our school has participated in an Engineering Studies focused day and the feedback by both teachers and research staff were highly positive. The day was a two-way learning experience which fostered many new connections. We plan to stay in touch and hope to see these teachers and their students in 2020!

VISITS TO THE SCHOOL

St Andrews College and Parramatta Catholic College – Two schools in Sydney's West teamed up to bring their 25 yr 12 Engineering Studies students to MSE for a packed day of syllabus linked workshops. Students tried their hand at micrography and witnessed metal grains firsthand, got to drive a car using hydrogen they electrolyzed and also toured the campus and our facilities and were particularly fascinated by our metal 3d printer!

Indigenous Pre-Program – The Indigenous Pre-Program features a week of activities preparing students for their STEM degree at UNSW. We hosted a passionate group of 8 students to experience what the school has to offer. Students got to check out 3d printed bone scaffolds and hydrogels that are used to promote growth and then got to participate in the destruction of a range of food groups with our charpy impact tester.

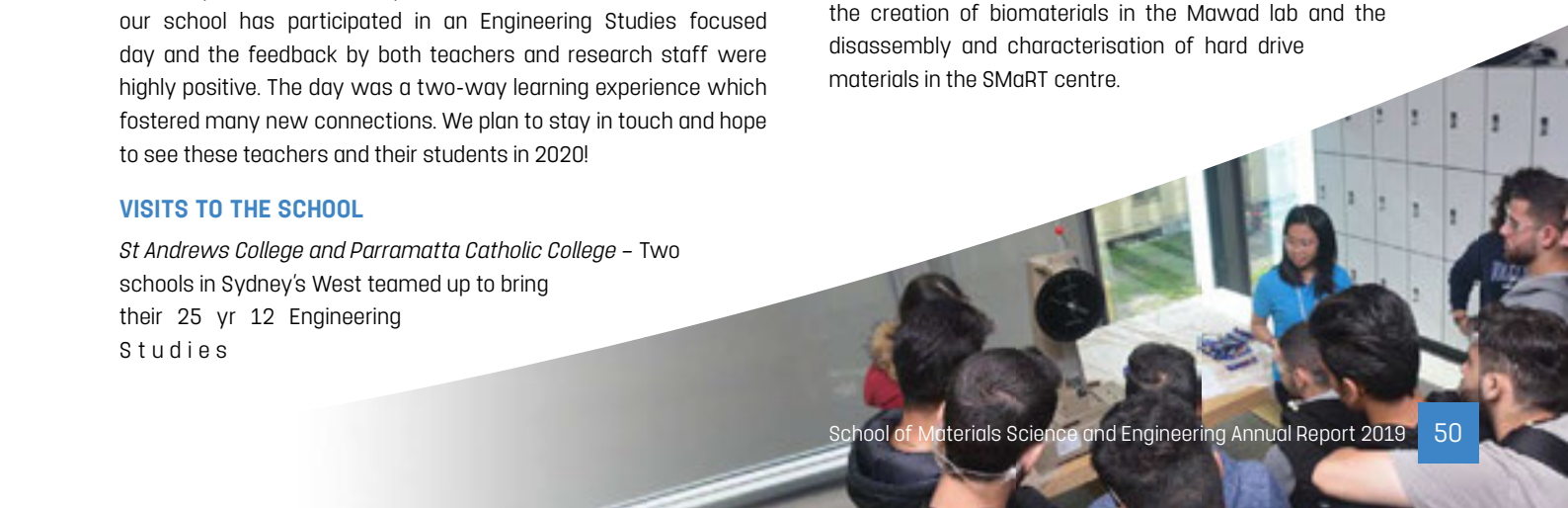
Bankstown Community College – Our largest outreach event in the Hilmer building this year was a visit from 38 students, from refugee backgrounds, who came for a tour and a range of workshops. These students enjoyed trying their hand at a magnetic levitating train and exploring the wonders of shape memory alloys, with a demonstration of a spring recoiling in boiling water.

L'OREAL GIRLS IN SCIENCE

The L'Oreal Girls in Science event brings 300 aspiring young women to UNSW to get a taste of higher degree study options. This year the event followed an expo style and our ambassadors Scarlet Kong and Xi Chen walked these students through our biomedical and shape memory displays. Students got to guide a stent made of shape memory alloys into a 3d printed oesophagus and put together the varied materials that make up a hip replacement.

WORK EXPERIENCE

The Work Experience program brings the brightest yr 10 students onto campus for a week and we had a great time with our cohort of 25 students who came for a day of tours and workshops. The students took part in a range of topical research including the creation of biomaterials in the Mawad lab and the disassembly and characterisation of hard drive materials in the SMaRT centre.



EARLY YEARS AND COMMUNITY ENGAGEMENT

Science in the Swamp – Hundreds of students and community members came to Centennial Park to experience a wide variety of science activities including tasters from our school. These young students grasped materials concepts quickly and will hopefully be returning to UNSW in the coming decade!

National Science Week Primary School Fete – Primary School Students love elasticity! This was the take home from a catapult workshop with 100 students from years 3 and 4 from schools in our local area. Students got to hone their skills and accuracy using a range of everyday materials while learning about potential and elastic energy.

PEER MENTORING

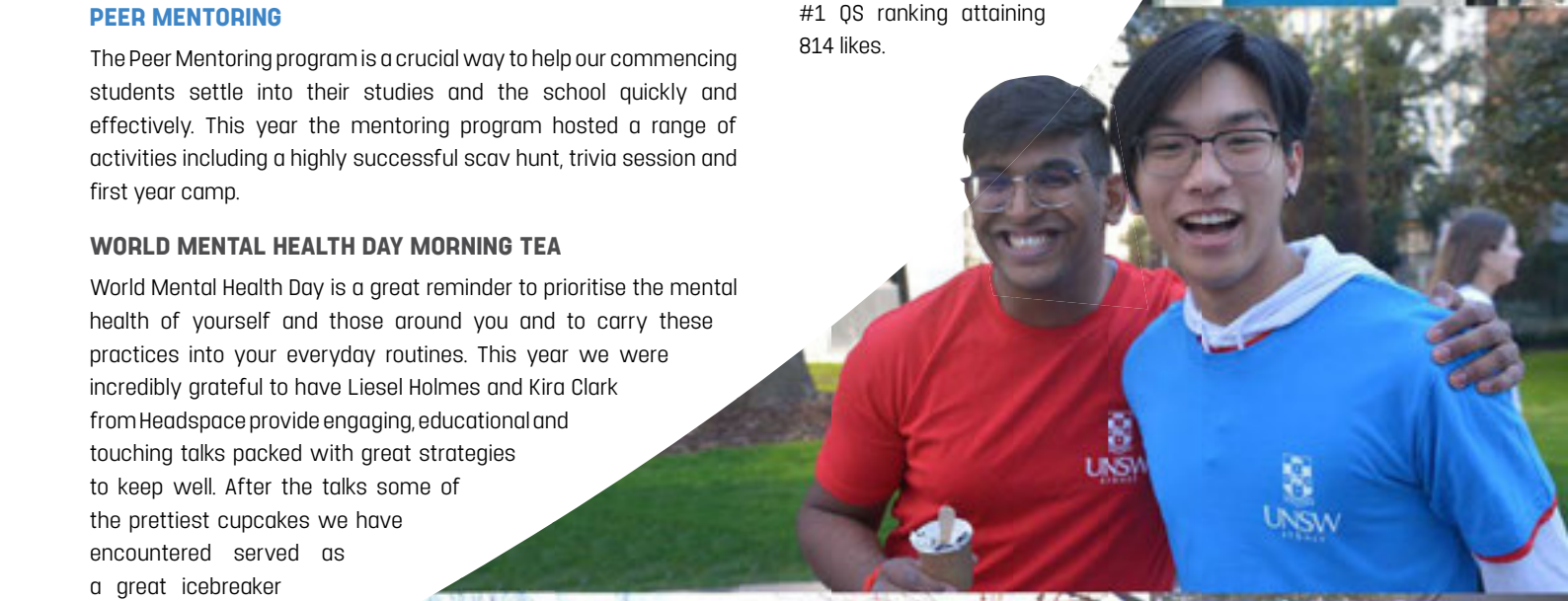
The Peer Mentoring program is a crucial way to help our commencing students settle into their studies and the school quickly and effectively. This year the mentoring program hosted a range of activities including a highly successful scav hunt, trivia session and first year camp.

WORLD MENTAL HEALTH DAY MORNING TEA

World Mental Health Day is a great reminder to prioritise the mental health of yourself and those around you and to carry these practices into your everyday routines. This year we were incredibly grateful to have Liesel Holmes and Kira Clark from Headspace provide engaging, educational and touching talks packed with great strategies to keep well. After the talks some of the prettiest cupcakes we have encountered served as a great icebreaker leading to some engaging chats between our staff and students.

SOCIAL MEDIA

After a 3 year hiatus, the school is now back on Instagram and this year we also increased our reach on Facebook significantly. Several well performing posts were also boosted for additional reach, with great success including an Instagram post about our #1 QS ranking attaining 814 likes.



Current Research Grants

ACARP COMPETTITIVE GRANTS

Koshy P, Chavara D, Chen W F, Drew M, Gupt SK, Lomas H, **Sorrell CC,** Toppler K, Xing X, *In-Situ High Temperature Strength of Low CSR Cokes,* $190,000

Koshy P, Chen WF, Drew M, Gupta S K, Lomas Mahoney M**, Sorrell CC,** Xing X, Yu J, *Effect of Blend Characteristics on the High-Temperature Strength Evolution and Relevant Mechanisms in Cokes*, $309,800

Mahoney M, Monahan B,J, **Ostrovski O,** Rogers H, Sharp J, Zhang G, Zulli P, Xing X**,** *Characterising the degradation of cokes made from Australian coals and subjected to simulated blast furnace operating conditions*, $362,620

AINSE

Bhattacharyya D**,** Zeng J, **Valanoor, N,** *Ion irradiation on Multilayered Oxide Heterostructure with Possible Topological Properties - PhD student Jiali Zeng,* $7,500

Burns, S R**,** Deng G**,Valanoor N,** *Exploring magnetoelectric coupling in ferroics; neutron scattering experiments probing the magnetic phases of BiFe03. PGRA for Stuart Burns,* $24,443

Gilbert E, Vats G, **Seidel J**, *Formation of a stable long range magnetic skyrmion lattice in thin films of the room temperature chiral material Co8Zn8Mn4, PhD student - Gaurav Vats,* $16,332

Koshy P, Burrough K, Gregg D, **Sorrell CC**, *Effect of Hot Isostatic Pressing on Corrosion at Waste Glass-Canister Interface - Scholarship for Honours Student Keenan Burrough,* $5,000

Munroe P, Palmer N, Wang Z, *Assessment of the Radiation Damage of Graphite for Molten Salt Reactor (MSR) Systems - Honours Scholarship for Nicholas Palmer*, $5000

Palmer N**,** Wang Z**, Munroe PR,** *Assessment of the Radiation Damage of Graphite for Molten Salt Reactor (MSR) Systems - Scholarship for Nicholas Palmer,* $6,000

Paull O, Hamish C**, Valanoor N**, *Interfacial magnetism effects and multiferroic thin films for device applications - PGRA for Oliver Paull***,** $22,500

Paull O H C**, Valanoor N,** *Strain, orientation, and interface effects on the multiferroic properties of BiFe03 thin films - PhD Oliver Paull***,** $5000

Vats G, **Seidel J,** *International Travel Scholarship to attend 2019 Joint ISAF-ICE-EMF-IWPM-PFM conference for Gaurav Vats,* $1,000

ARC CENTRE OF EXCELLENCE

Fuhrer M, Hamilton A, Ostrovskaya E, Helmerson K, Wang X, Kalantar-Zadeh K, Bao Q, Culcer D, Davis M, Klochan O, Medhekar N, Parish M, **Seidel J**, Schiffrin A, Sushkov O, **Valanoor N**, Vale C, Wang L, Phillips W, Castro-Neto A, Galitski V, Hannon J, Hoefling S, Hone J, Krausz F, Klose F, Littlewood P, MacDonald A, Paglione J, Refael G, Sinova J, Spielman I, Oezyilmaz B, Tadich A, Xue Q,*ARC Centre of Excellence in Future Low Energy Electronics Technologies*, $34,177,652

ANSTO

Koshy P, Cai Y, **Sorrell CC, Zhang J,** Zhang Y, *Tailored waste forms for actinide immobilization, $2,340.*

Li S, Zhang J, *isotope engineering and nuclear characterisation of novel nanoscale thin film functional materials - scholarship for ji zhang,* $103,950

Ionescu M, Klose F, **Li S,** *Isotope Engineering and Nuclear Characterisation of Novel Nanoscale Thin Film Functional Materials,* $217, 530

Koshy P, Sorrell CC, Yeoh MLY, *Hot-isostatically pressed Synroc-C for reprocessing wastes,* $3,600

ARC DISCOVERY PROJECTS

Cazorla Silva C, *Rational Design of Novel Multiferroic Materials for Energy Harvesting and Energy Efficiency,* $621,374

Dai J,Tan X,Tan X, Zhang L W Y, **Wang D,** *Lead-free oxide perovskites for highly efficient solar cells,* $300,000

Ferry M, *A new crystallographic approach to deformation and annealing of metals, $*425,500

Ferry M, Primig S, *Unlocking the diverse property profile of ultra-lightweight Mg alloys, $*490,000

Sorrell CC, Hart J, Koshy P, *Engineering Quantum-Size Bioceramics: Photocatalytic / Sonocatalytic Ceria***,** $301,500

Hu B, **Wu T,** *Light-Responsive Spin Transport and Spintronics with Stable Perovskites*, $450,000

Lauto A, Malliaras G, Office D, **Mawad D,** *Bioelectronics: addressing the biointerface challenge*, $393,215

Li S, *High Performance Complex Oxide Heterostructures for Nanoelectronic Devices,* $373,500

Manske D, Rubhausen M, Ulrich C, **Seidel J,** *Topological spin systems as basis for novel multifunctional materials,* $355,000

Morozovska A, **Valanoor N,** Weyland M**,** Zhang L W Y, **Munroe PR,** *'Designer defects' - A new approach to functional oxide interfaces, $*473,900

Morozovska A, **Valanoor N,** *Engineered control of polarization rotation in ferroelectric bilayers,* $400,500

Xie Z, Xu J, **Munroe P, Design of Tough,** *Durable and Corrosion-resistant Coatings,* $325,500

Zhang J, Young D, *Reducing gas and ash corrosion in advanced power generation,* $480,000

ARC INDUSTRIAL TRANSFORMATION RESEARCH HUB

Benton U K, Dippenaar R J, Douglas A, Fernandes M, Lloyd S**, Ostrovski O,** Prusty G, Rasmussen K JR, Singh R,Tooze I**, Sahajwalla V,** *Transforming Waste Directly in Cost-effective Green Manufacturing, $*2,181,756

Benton UK, Dippenaar RJ, Douglas A, Fernandes M,**Ostrovski O,** Prusty G, Rasmussen KJR, Singh R, Tooze I, **Sahajwalla VH,** *Transforming Waste Directly in Cost-effective Green Manufacturing,* $100,000

Dippenaar RJ, Douglas A, Fernandes M, Lloyd S,**Ostrovski O**,Prusty G,Rasmussen, KJR, Singh R,Tooze I**, Sahajwalla, VH,***Transforming Waste Directly in Cost-effective Green Manufacturing,* $1,162,500

Dippenaar RJ, DA, Fernandes M, Lloyd S**, Ostrovski O,**Prusty G, Rasmussen KJR, Singh R,Tooze I, **Sahajwalla VH,***Transforming Waste Directly in Cost-effective Green Manufacturing,* $40,000

Dippenaar R J, Douglas A, Fernandes M, Lloyd S, **Ostrovski O,** Prusty G,Rasmussen KJR, Singh R, Tooze I, **Sahajwalla VH,***Transforming Waste Directly in Cost-effective Green Manufacturing,* $50,000

Dippenaar RJ, Douglas A, Fernandes M, Lloyd S, **Ostrovski O,** Prusty G, Rasmussen KJR, Singh R, Tooze I, **Sahajwalla VH,** *Transforming Waste Directly in Cost-effective Green Manufacturing,* $462,500

Dippenaar RJ, Douglas A, Fernandes M, Lloyd S, **Ostrovski O,** Prusty G, Rasmussen KJR, Singh R, Tooze I, **Sahajwalla VH,***Transforming Waste Directly in Cost-effective Green Manufacturing,* $400,000

ARC FUTURE FELLOWSHIPS

Bhattacharya S**, Joshi R , Sahajwalla V,** *Thermal isolation: a novel pathway to transforming complex waste, $*267,804

Wang D, *Oxide-Semiconductor Epitaxy: Towards Next Generation Nanoelectronics,* $873,125

Current Research Grants

ARC DECRA FELLOWSHIPS

Primig S, *Engineering hierarchical microstructures in high strength low alloy steels,* $368,446

ARC LAUREATE FELLOWSHIP

Benton U K, **Sahajwalla V,** *Fundamental high temperature e-waste investigations for high-value products*, $2,370,000

Sahajwalla VH, *Fundamental high temperature e-waste investigations for high-value products,* $1,779,501

ARC LIEF GRANTS

Bilek M M M, Conibeer G J, Goding J, Guo Z P, Mai Y W, Phillips M R, Waite T D, Xie Y M, **Li S,** *Nanoimprint Systems: Expanding Research Capability of Roll to Roll Printer, $*468,474

Primig S, *Advanced mechanical property testing suite,* $37,500

Wu T, *Multi-functional 3D imaging system for on-working devices*, $22,500

ARC LINKAGE PROJECTS

Huang H, Jiang Z, Wang L, **Zhang J,** *Understanding the role of nanoparticles in water-based lubrication*, $45,000

Sorrell CC, Koshy P, *Fibre-Reinforced Composites: Single-Crystal Mullite Fibres from Topaz, $*340,000

Sorrell CC, Pandolfelli V, da Luz A P, Koshy P, *New Paradigm for Materials Technology for AZS Glassmaking Refractories*, $340,000

Sorrell CC, Koshy P, *Fibre-Reinforced Composites: Single-Crystal Mullite Fibres from Topaz,* $195,000

Ostrovski, O, Zhang C, **Zhang J,** *Investigation of CaO-Al203-based mould fluxes for the continuous casting of high-Al steel,* $150,000

Primig S, *Advancing the Australian specialty alloy processing capability,* $330,000

AUSTRALIAN GOVERNMENT GRANTS

Conway PLJ, Escobedo-Diaz JP, Jones A, McKenzie W, Roberts M, Vengust D, **Laws KJ,** *Munitions Alloy Design, Processing and Field Application,* $50,000

Joseph SD, Munroe PR, *NSW Tech Voucher for TPA Partnership Ltd,* $14,957

Patrik L J, Zhang LW Y, **Laws K,** *Deep-Draw Lead-Free Brasses - Techvoucher Project,* $16,988

Sorrell CC, *Intelliparticle - NSW Tech Voucher Project*, $15,304

CSIRO PG SCHOLARSHIPS

Yap EWJ, Zhang LWY, **Daniels JE,** *CSIRO Mineral Resources Top-Up Scholarship for Thai Ly*, $47,126

Yap, EWJ, Zhang, LWY,**Daniels JE,** *Postgraduate Student Agreement for Emily Yap,* $50,375

DARPA

Bellaiche L, Sando D, **Valanoor N,** *Topological functionalization of ferroelectrics and multiferroics,* $130,000

FACULTY OF SCIENCE GRANT

Koshy P, Sorrell CC, *CRC-P Near-miss Award: Development of fine and coarse aggregates of mullite from fly ash,* $15,000

INDUSTRY

Bustamante H, Gaikwad V, **Sahajwalla VH,** You Y**, Joshi RK,** *Industrial scale use of graphene oxide membranes for water and wastewater applications,* $100,000

Bailey T, **Sahajwalla VH, Joshi RK,** *Generation of Gases from End-of life Tyres and Purification Using Novel Graphene Molecular Sieve - Scholarship for Xiaoheng Jing*, $75,000

Cain T, Dean, C, Doisy M, Kurusingal V, Pham Thi, M, Zhang, LWY, **Daniels JE,** *Exploring electro-mechanical response of textured ceramics for underwater acoustics applications - PhD student Scarlet Kong,* $29,295

Chan SLI, Chu D - Trial Production of Cost-effect and High Performance Carbon Nanotubes/Graphene Composite Thin Film Materials for Battery Electrodes (Phase 1), $126,892

2025 STRATEGY

Cheytani M, Cheytani S, **Chan SLI,** *Ongoing Performance and Durability Assessment of CP Systems,* $4,545

Cholake ST**, Pahlevani F,** *Enhancing the fire resistance of wood-based panels,* $49,403

Chu D, Li S, *Memory materials*, $860,000

Chu D, Li S, Tynan B, Zhang LWY**, Wang D,** *Pressure Sensors,* $492,207

Chu D, Wang D, Li S, *Graphene enhanced performance of transmission power cables and High performance power grid scaled graphene supercapacitors,* $2,500,000

Li S, Zhang LWL**, Chu D,** *Effect of Blend Characteristics on the High-Temperature Strength Evolution and Relevant Mechanisms in Cokes,* $770,999

Li S, *climate responsive transmission lines,* $998,400

Sorrell CC, Koshy P, *Superior Biomedical Product* , $13,688

Taherymoosavi S, **Munroe, PR,** *Analysis of zeolite-based biochars,* $2,000

Joseph SD,Taherymoosavi S, **Munroe, PR,** *Biochar analyses and statistical analyses of milk data and dung*, $11,800

Joseph SD,Taherymoosavi S, **Munroe PR,** *Analysis of Sewage Sludge Biochars, $14,966*

Munroe PR, *B.GBP.0032 Fit-for-purpose biochar to improve efficiency in ruminants,* $30,000

Hamilton, NE, Wang L, Zhang LWY, **Daniels JE,** *Multiscale Characterisation of Relaxor Ferroelectric Single Crystals,* $74,426

Sahajwalla VH,You Y, **Joshi RK,** *Enhancing the fire resistance of wood-based panels,* $49,403

Sahajwalla VH, You Y**, Joshi, RK**, *Super Desiccants for Odour Abatement in Sewer Vents,* $44,648

Zhang, LWY,**Young, DJ**,*Corrosion in CO2*, $131,001

Young, DJ, *Syngas dusting tests*, $34,465

Young, DJ, *Alternate Carburisation – Decoking Investigation*, $53,288

Xie Y,**Young, DJ,** *Metal Dusting Tests - Alloy Samples*, $36,258

Li S, Chu D, Wang D, *Transparent Conductive Ceramic Thin Films,* $577,187

Mujtaba G, **Munroe PR,** *International Research Support Initiative Program Scholarship for Ghulam Mujtaba*, $4,100

Current Research Grants

Yang R, *"Grindability" test: modelling, measurement and mill fingerprinting,* $80,000

Joseph S, Munroe PR, *Analysis of magnetic biochars*, $4,992

Yang R, *"Grindability" test: modelling, measurement and mill fingerprinting,* $80,000

Koshy P, Sorrell CC, *Tailoring an integrated solution to effectively address subsoil constraints by incorporation of chemically-balanced nano-amendments,* $15,000

Primig S, *Advancing Australian steelmaking for next generation construction applications*, $80,000

Xing X, **Ostrovski O,** *Characterisation of cokes for the blast furnace ironmaking at POSCO*, $37,327

Taherymoosavi S, **Munroe PR,** *Analysis of Biochars (With and Without Wood Vinegar)*, $9,900

Taherymoosavi S, **Munroe PR,** *Analysis of Slow Release Biochars,* $6,500

Joseph SD, **Munroe PR,** *Analysis of Biochars*, $15,000

Sahajwalla VH, You Y**, Joshi, RK,***Super Desiccants for Odour Abatement in Sewer Vents,* $44,648

Sahajwalla VH, Joshi RK, *Developing Graphene Integrated Super-Composite Materials using End-of-Life Tyres - Dali Ji and Xiaoheng Jin*, $75,000

Cazorla SC, *Rational Design of Novel Multiferroic Materials for Energy Harvesting and Energy Efficiency,* $157,500

Ostrovski O, Zhang C, **Zhang J,** *Investigation of CaO-Al203-based flux for high Al steel continuous casting of high-Al steel*, $150,000

Koshy P, Chen WF**, Sorrell CC,** *Development of Fly Ash-Based Composite Ceramics insert,* $10,581

Stanojevic A, **Primig S,** *Direct ageing plus: process design through high resolution characterisation of Alloy 718,* $353,976

Oberwinkler B, Theska F, **Primig S,** *High resolution analysis of strengthening effects in Ni-based alloys. Student Project Agreement for Felix Theska, $236,046*

Kapp M, Kleber S, Leitner T, Plesiutschnig E, Turk C, **Primig S,** *Processing-structure-property relationships of forged Ni-based superalloys,* $283,769

Schulz B, Turk C, **Primig S,** *Processing-structure-property relationships of forged Ni-based superalloys,* $249,252

Benton UK, Cholake ST, **Pahlevani F,** *Enhancing the fire resistance of wood-based panels,* $49,404

Benton UK, Cholake ST, **Pahlevani F,** *Enhancing the fire resistance of wood-based panels*, $4,400

Primig S, *Hot ductility of Ni-based alloy Rene 41,* $70,000

Primig S, *Advancing the Australian specialty alloy processing capability*, $135,000

Zhang L, **Li S,** *Isotope engineering and nuclear characterisation of novel nanoscale thin film functional materials,* $103,950

INTERNATIONAL COLLABORATIVE GRANTS

Zhang LWY, **Daniels JE,** *Advanced in situ x-ray and neutron scattering to reveal structural and microstructural response mechanisms of modern single crystal electro-mechanical materials,* $126,877

Wang K, Zhang LWY, **Daniels JE,** *Fabrication of advanced electro-ceramics for actuators and sensors,* $30,000

Herland A, Zeglio E, **Mawad D,** *Bio-functionalized Organic Electrochemical Transistors,* $34,592

Chen WF, Hanaor D, Kamutzki F, **Koshy P,** Schmidt F, Schreck L, **Sorrell CC,** *Synthesis of doped pyroxene phase change materials*, $19,500

Park ES, **Laws KJ,***The Australia-Korea Advanced Metal Alloys/Metal Technology Project*, $61,980

Chen X, **Wu T** , *Advanced Materials - Scanning Near-Field Optical Microscopy Investigation of Engineered Metal-Halide Perovskites*, $15,000

Rasse D, **Munroe PR,** *Implementing biochar-fertilizer solution in Norway for climate and food production benefits,* $32,300

SEED GRANTS

Chu D, Cazorla Sc, *Solar cooling materials*, $14,000

Chu D, Cazorla Sc, *PCI cooling materials*, $102,000

Chu D, Cazorla Sc, *Internatioanl seed fund*, $8,000

Primig S, *Advanced mechanical property testing suite,* $12,500

Wu T, *Multi-functional 3D imaging system for on-working devices*, $7,500

Yu P, **Seidel J**, *Advanced Materials - New Materials for Next Generation Information and Energy Technologies*, $15,000

Liao X, Ringer SP, **Primig S**,*Microstructure Control in Metal Additive Manufacturing,* $870,000

Chan K, Cheng S, Kourmatzis A, Zhang LWY, **Yang R**, *Development of computational models to predict delivery of inhalation drug powders: from deagglomeration in devices to deposition in airways,* $202,236

UNSW RESEARCH INFRASTRUCTURE SCHEME

Daniels JE, Hao X, **Koshy P, Laws KJ, Li S,** Peng GD, Sando D, **Wang D**, *FIP - High-precision dicing saw for microfabrication applications*, $110,000

Bilek MMM, Conibeer GJ, Gooding J, Guo ZP, Mai YW,Phillips MR, Waite TD, Xie YM, **Li S,** *Nanoimprint Systems: Expanding Research Capability of Roll to Roll Printer,* $270,000

Crosky A, Koshy P, Kruzic JJ, **Laws KJ, Sahajwalla VH, Sorrell CC,** Wang CH, **Zhang J, Primig S,** *FIP - Mechanical Characterisation (Indentation Hardness) Facility,* $100,000

Cazorla SC, Chu D, Green M, Hoffman MJ, Schoenherr P, Sharma, PK, Tretiakov O, **Wang D, Wu T**, Yun JS, **Seidel J,** *FIP - Scanning thermal microscope for nanomaterials*, $70,000

Carnt NA, Chan **SLI,** Chandrawati R, **Chu D,** Donald WA,Gu Z, **Hart J,** Kalantar ZK, Lim MTN, Liu G, Setterlund P, **Sorrell CC,** Wang A, Willcox MD, **Joshi RK**, *FIP - Advanced Electro-kinetic Analyzer (AEkiA) for Surface and Interface Analysis,* $90,000

Doolan C, Mansuri I, **Pahlevani F,** Sowmya A, **Sahajwalla VH,** *FIP - Industry-Applicable Waste Material Hyperspectral Imaging System,* $82,470

UNIVERSITIES COLLABORATIVE GRANTS

Bilek MMM, Conibeer GJ, Gooding J, Guo ZP, Ma YW, Phillips MR, Waite TD, Xie YM, **Li S,** *Nanoimprint Systems: Expanding Research Capability of Roll to Roll Printer,* $50,000

Bilek MMM, Conibeer GJ, Gooding J, Guo ZP, Mai YW, Phillips MR, Waite TD, Xie YM, **Li, S,** *Nanoimprint Systems: Expanding Research Capability of Roll to Roll Printer,* $40,000

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PUBLICATIONS: BOOK CHAPTERS

Jiang, P., Saydam, S., Ramandi, H. L., Crosky, A., & Maghrebi, M. (2019). Deep Molecular Representation in Cheminformatics. In V. Balas, S. Roy, D. Sharma, & P. Samui (Eds.), *Handbook of Deep Learning Applications - Smart Innovation, Systems and Technologies* (pp. 147-159): Springer.

Seidel, J. (2019). Functional domain walls: Concepts and perspectives. In *Solid State Physics - Advances in Research and Applications* (pp. 133-142).

PUBLICATIONS: CONFERENCE PAPERS

Chen, H., Kimyon, O., Lamei Ramandi, H., Hebblewhite, B., Manefield, M., Crosky, A., Saydam, S., Kaksonen, A.H., Morris, C. (2019). *Microbiologically induced cable bolt corrosion in underground coal mines.* Paper presented at the Ninth International Symposium on Ground Support in Mining and Underground Construction.

Chen, N., & Li, S. (2019/08/07/). *Synthesis of oxygen-deficient and monodispersed Pr doped Ce02 nanocubes with enhanced resistive switching properties.* Paper presented at the AMMM, Beijing, China.

Houang, J., Perrone, G. G., Pedrinazzi, C., Longo, L., Mawad, D., Boughton, P. C., Ruys, A.J., Lauto, A. (2019/01/01/). *A genome-wide screen for tolerance to rose bengal photodynamic therapy and its use in onychomycosis treatment*.

Sun, H; Huang, J; Yun, JS; Sun, K; Yan, C; Liu, F; Park, J; Pu, A; Seidel, J; Stride, JA; Green, M; Hao, X. (2019, 16-21 June 2019). *Solution-processed ultrathin Sn02 passivation of Absorber/Buffer Heterointerface and Grain Boundaries for High Efficiency Kesterite Cu2ZnSnS4 Solar Cells.* Paper presented at the 2019 IEEE 46th Photovoltaic Specialists Conference (PVSC).

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Adabifiroozjaei, E., Koshy, P., Emadi, F., Mofarah, S. S., Ma, H., Rastkerdar, E., Lim, S., Webster, R.F., Mitchell, D.R.G., Sorrell, C. C. (2019). Ionic interdiffusion as interaction mechanism between Al and Si_3N_4. *Journal of the American Ceramic Society, 102*(8), 4835-4847. doi:10.1111/jace.16358

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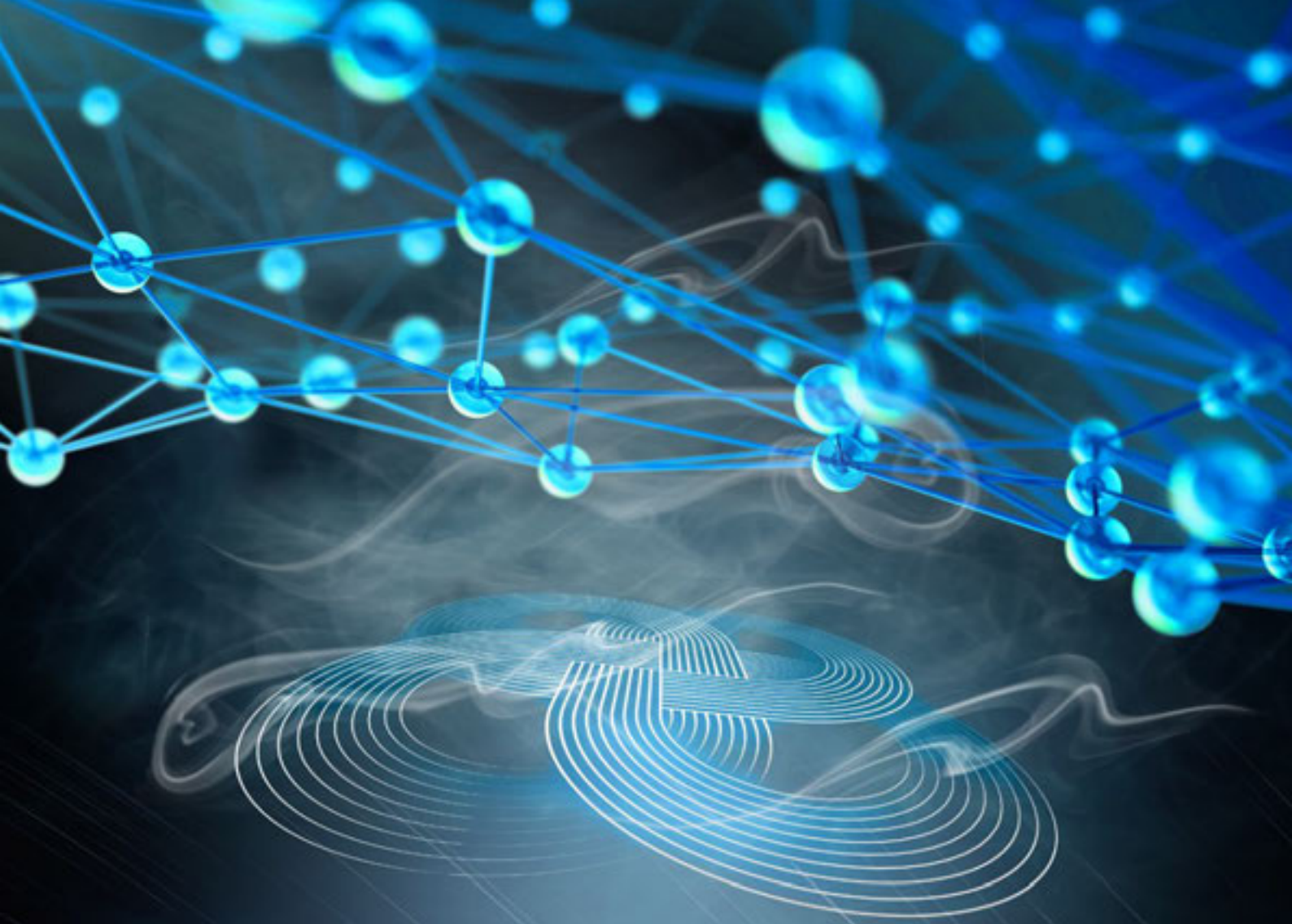

UNSW SYDNEY | Australia's Global University

UNSW Sydney - Sydney NSW 2052 Australia

Enquiries:

Phone: +61 (0)2 9385 7298

Fax: +61 (0)2 9385 6565

Email: enquiries.materials@unsw.edu.au

Web: materials.unsw.edu.au

CRICOS Provider Number: 00098G

Project Coordinator & Editor: Vanessa Jaraenroogvised

Design: Greg Hosking, Monotron Creative greg@monotron.com