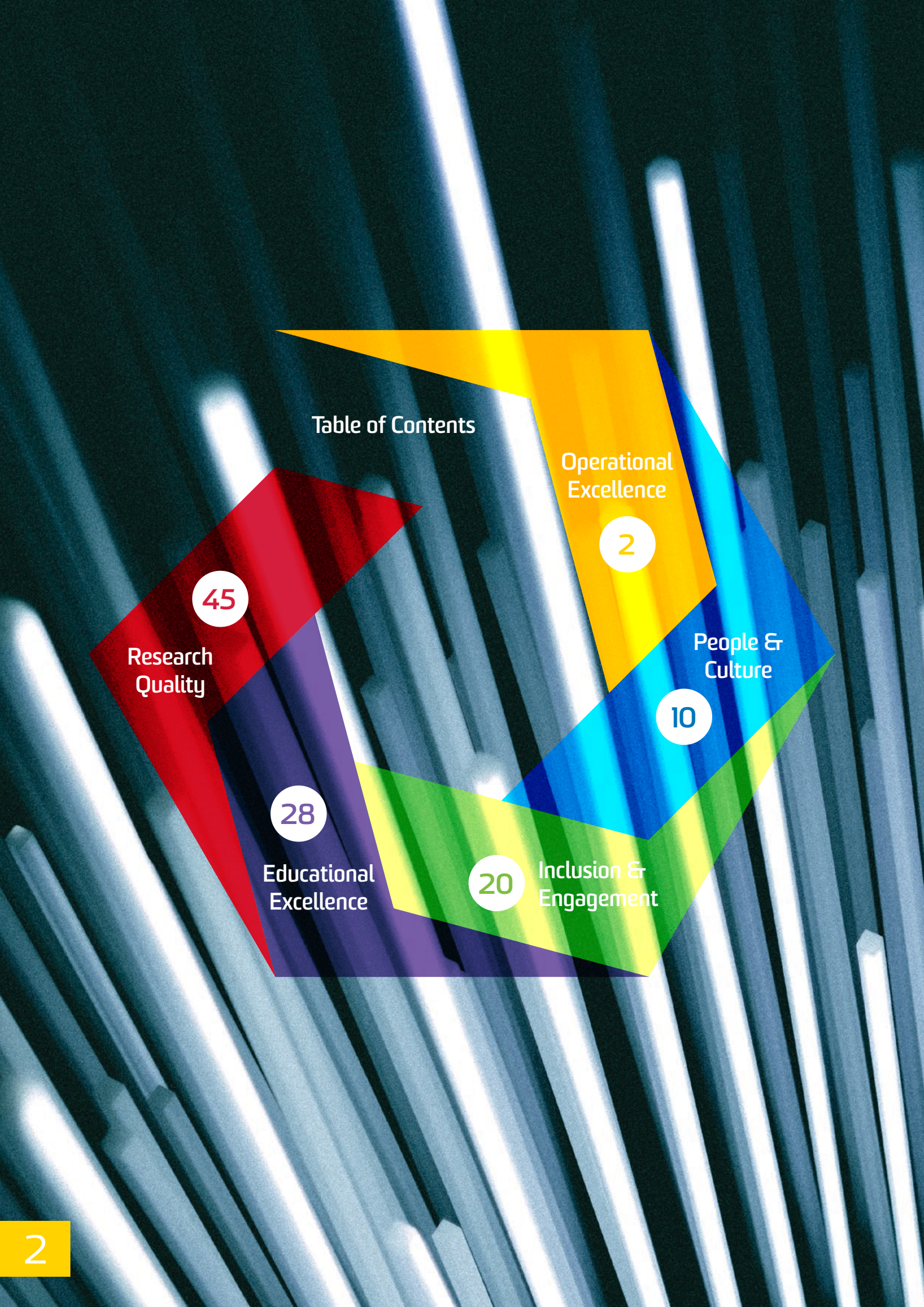
UNSW SYDNEY

Australia's Global University

School of Materials Science and Engineering

Annual Report 2017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Who we are

The development of new materials drives innovation in a wide range of fields including transportation, information technology, health science and solutions for energy security.

The School of Materials Science and Engineering at UNSW Sydney is one of the leading schools in the world in the development of novel functional materials and in devising innovative solutions for their application. Beyond this, an emerging paradigm in materials development is sustainability, such that materials can be manufactured through energetically efficient processes and then readily recycled at the end of component lifetimes.

Our research covers a wide range of areas including:

- Functional materials for next generation electronic devices
- Sustainable recycling of e-waste
- Lightweight energy efficient materials for aerospace applications
- Advanced ceramic coatings for pollution control
- Graphene-based membranes for water purification
- Conducting polymers for tissue regeneration

The School of Materials Science and Engineering is located in a new purpose-built $143M building. The building contains a suite of state-of-the-art laboratories with cutting edge facilities for processing, analysis and testing of materials. The School is located adjacent to the Mark Wainwright Analytical Centre which features an extensive range of instruments for materials characterization.

Our goal is to provide first class teaching and research training in an intellectually stimulating and creative environment, equipping our graduates with technical and generic skills at a level that will lead them into attractive and productive employment. We continue to work in close partnership with local and international industry to develop innovative advancements in materials and solve real-world problems.

Welcome

Head of School
Professor Paul Munroe

I am pleased to introduce the School of Materials Science and Engineering 2017 Annual Report.

The School continues to perform very strongly across the domains of teaching, research and social and global impact.

Enrolments across all degree programs is very strong. Our first year intake into our undergraduate programs is now routinely over one hundred. Moreover, the quality of these students continues to increase. Our coursework masters program graduated its first students in 2017 and is proving to be highly popular with international students who wish to enhance their knowledge of materials.

The cohort of students in our higher degree research programs is also amongst the largest in the university and we now regularly graduate over 40 Masters by Research and PhD students each year.

Our students receive excellent and innovative teaching from our academic staff with student evaluations of teaching evidencing that the School's academic staff deliver some of the highest quality across the entire university.

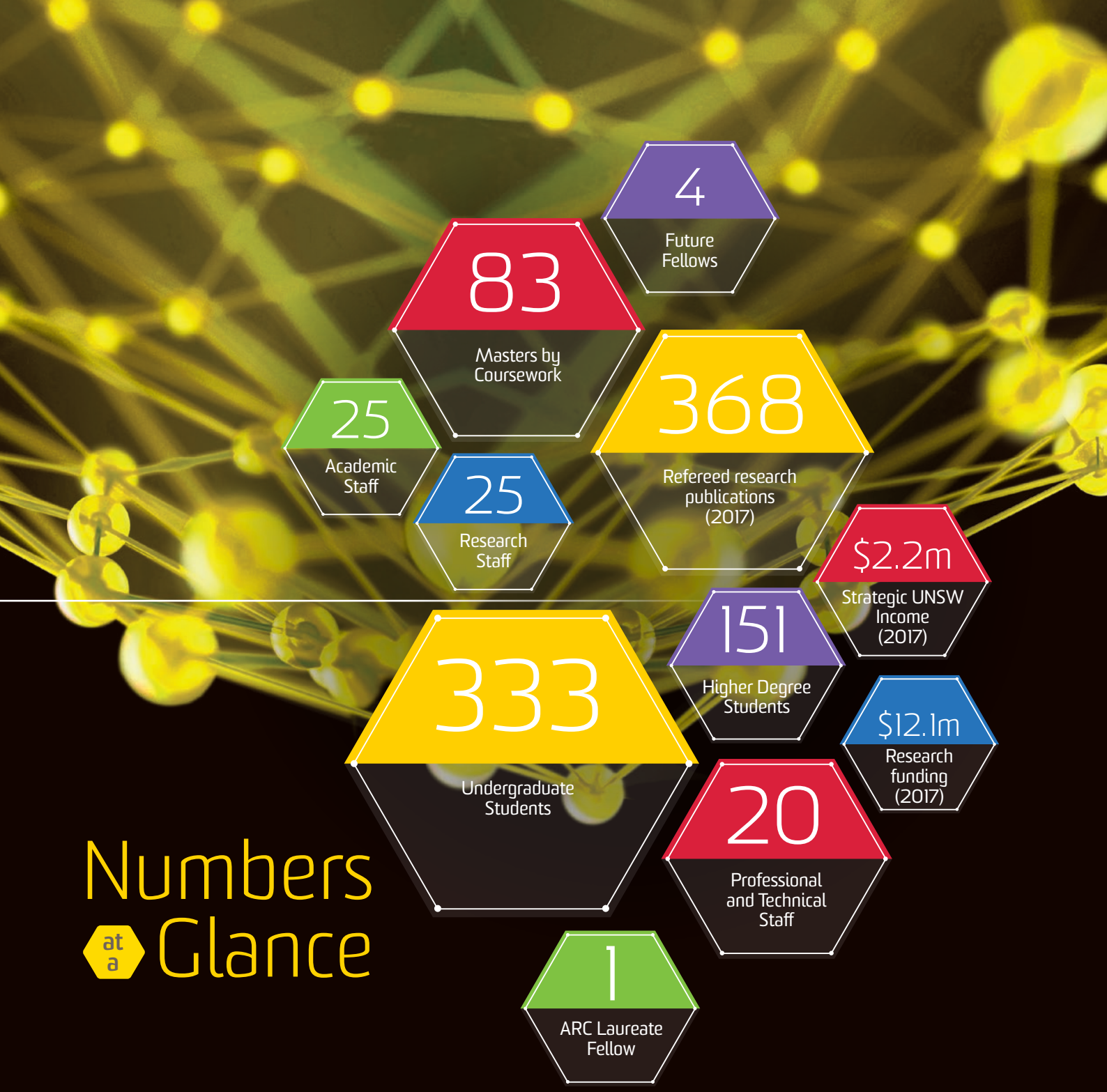
Although we are a relatively small school we have 7 winners of the Vice-Chancellor's Award for Teaching Excellence on staff. In 2017, this august group was joined by Dr Pramod Koshy who was honoured with this award in the Early Career category.

Research in the School is strong and publication quality is very high with most staff receiving funding from the Australian Research Council.

In recent years, there has been a marked increase in the number of publications generated in outlets managed by 'Nature' and 'Science'. This does much to build the reputation of the School, which for some years has been the only Materials School in Australia ranked in the top 50 in the QS rankings. The School is also the number one Materials School in the AWRU rankings. Research in the School covers both fundamental and applied aspects of materials science. In the latter category, the School continues to be successful in securing funding from Chinese corporate business through the Torch program.

The School is actively engaged in work that has both social and global impact. Veena Sahajwalla's innovative research in sustainable materials use continues to find solutions, applied worldwide, to e-waste problems. There is also excellent work in the development of next generation lightweight alloys for transportation solutions, novel biomaterials and innovative functional materials.

In 2017 the School welcomes two new staff members funded through the University's 2025 Strategy. Professor Tom Wu, formerly at King Abdullah University of Science and Technology in Saudi Arabia, comes to the School as a strategic 'SHARP' hire, who



Numbers at a Glance

will further strengthen the School's research capability in functional materials. Dr Kris Killian came to us from the University of Illinois and is a joint appointment with the School of Chemistry. His research focuses on polymeric materials for biomedical applications, an emergent area of expertise in the School.

Although the School has now settled into its new home in the Hilmer building, further construction of laboratory space is ongoing. In 2017, construction work commenced on new laboratories for the School across four floors of the building. This includes important new lab spaces for the School's research in both sustainable materials and functional materials. Beyond this, the university is constructing its new 'Science and Engineering' building on the site of our old building. This building, which will principally house the Schools of Chemistry and Chemical Engineering, will be physically joined to the Hilmer building at each level and will provide opportunities to foster greater collaboration between Materials Science and these Schools into the future.

In summary, the School is in a strong position and is delivering excellent outcomes on all fronts.

Financial Report 2017

For the 2017 financial year, budget allocations continued to be made using the existing budget methodology. The School's 2017 budget projects a position that is neutral on university's policy changes. Our student numbers have continued to grow, with a larger than ever postgraduate coursework student cohort. We had another successful year in gaining ARC grants and millions in overseas industry funds.

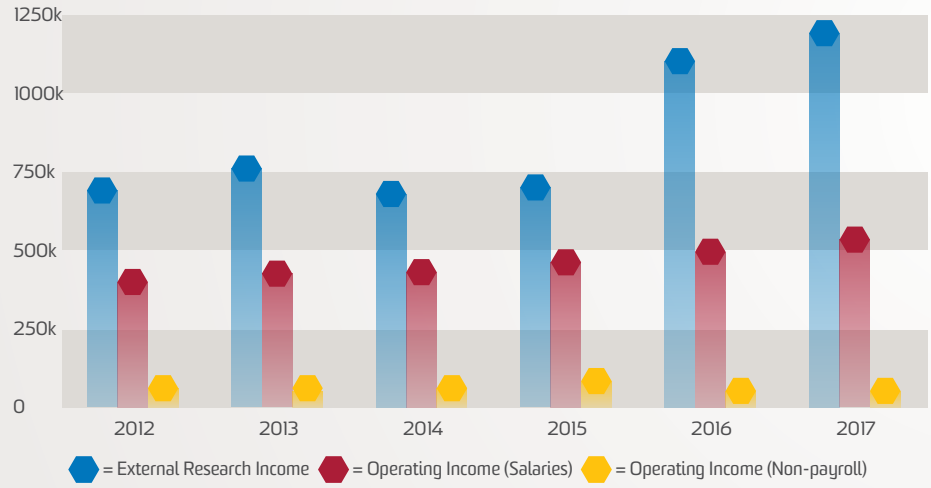
Professors Nagarajan Valanoor and Jan Seidel are leading chief investigators in the prestigious ARC Centre of Excellence in Future Low Energy Electronics Technologies led by Monash University. Their joint achievement provided them with seven years solid funding to deliver an outcome that aligns with UNSW 2025 Strategy through excellence in research, outstanding education and a commitment to advancing a just society.

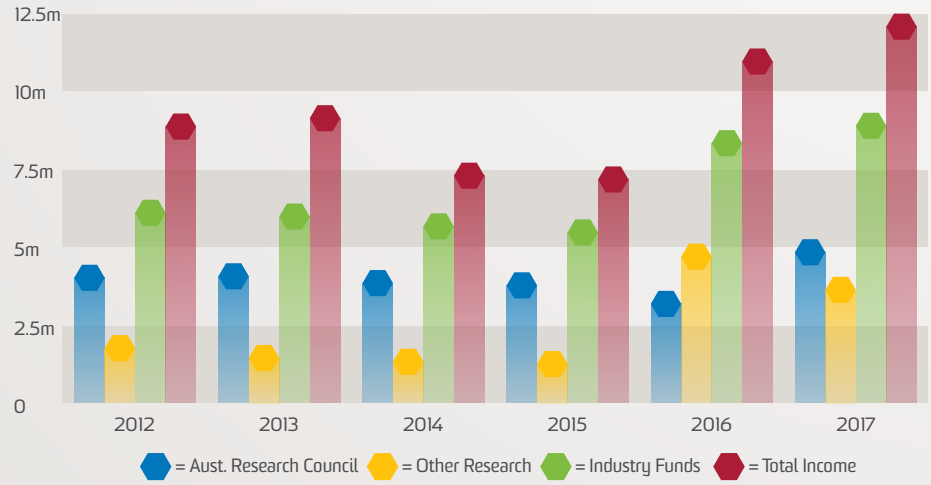
Income

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 2017 financial year, budget allocations have been made using our current budget allocation principles. It is heavily 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 income.





Operating Income

Operating income budgets have been derived from teaching revenue, research revenue from Commonwealth Government, indirect cost recoveries on contract research and other revenues projected from historical values. Our allocated operating budget primarily is used for salaries for teaching and research academics, 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.

The table below shows the breakdown of School operating income. 2017 is a year of reinforcement with great success. We secured seven ARC Discovery Projects, one Future Fellowship and being partners on four LIEF grants. We saw fruition from seeding fund and start-up funds for newer/junior academic staff starting to attract grants and higher degree research students. We also had three successful Australian Coal Research funds.

Income		
University:		
Teaching	$11,307,184	
Other	$31,553	$11,338,737
Allocation to School:		
Teaching and Research	$6,649,984	
Fellowship salary shortfalls	$78,200	
Capital equipment funding	$55,000	$6,783,184
Expenditure		
Salaries	$5,408,091	
Non-salary	$850,471	
Capital expenses	$184,660	$6,443,222
Variance		$339,962

Equipment Grants

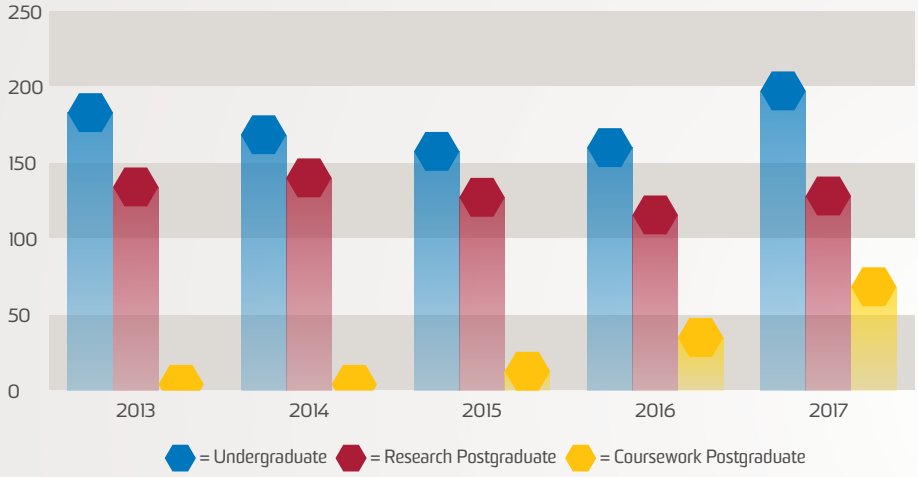
Apart from funding some essential laboratory equipment replacement, the School's Advisory Committee assessed applications for small equipment grants. The following bids were successful:

Equipment	Lead Applicants	Allocation ($)
Small precision cutting machine	Charles Sorrell/George Yang	10,000
Grinding units	Alan Crosky/George Yang	12,000
Potentiostat software	Charles Sorrell/Pramod Koshy	8,000
Gleeble calibration unit	Michael Ferry/David Miskovic	13,000
Vacuum oven	Damia Mawad	4,000
Bomb calorimeter	Veena Sahajwalla/Irshad Mansuri	6,339

Financial Report 2017

EFTSL

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 undergraduate and Coursework Postgraduate students.



UNSW Strategic Funding

The University provides central funding for a range of strategic research purposes including infrastructure, support of national initiatives and projects for early career researchers. There are also strategic funds based on performance by high degree research student's completions, quality authorships, and grant income over the previous 3 years. From 2025 Strategy Initiatives, School has received funding to attract a Scientia Fellow, Senior Lecturer Kristopher Kilian and a Sharp Fellow Professor Tom Wu. Both outstanding researchers in their fields.

In 2017, these included:

Project Name	Project Manager	Amount ($)
SHARP hire	Tom Wu	425,000
Research Support	Mark Hoffman	40,000
Research Support	Sean Li	400,000
SPF3 Strategic Hire	Rakesh Joshi	155,101
Bridging Support	Jiabao Yi	90,550
Urban Mining Support	Veena Sahajwalla	46,703
Green Manufacturing	Veena Sahajwalla	65,000
Laureate Postdoc Support	Veena Sahajwalla	71,000
Intelligent E-Waste	Veena Sahajwalla	58,300
High Temp E-Waste Investigations	Veena Sahajwalla	431,752
SPF02 Materials	Various	213,200
SPF04 Materials	Various	210,426
Total:		2,207,032

Lead Chief Investigator	Project Title	Grant ($)
Sean Li	Specialised glove box workstation for synthesis of atmosphere-sensitive materials for 3D and thin film printing	100,000
John Daniels	Particle size analyser with wet and dry dispersion units	90,900
Michael Ferry	Technical support engineer	91,190
Jan Seidel	Flexible modular multilayer sputtering system	77,760

Research Infrastructure Scheme

The University receives a Research Infrastructure Block Grant. With this funding, it provides UNSW with a world-class research environment to attract and retain a critical mass of research excellence. In 2017, the School was awarded the major items in the table:

Item	Amount ($)
Student Research Allocations	100,000
Undergraduate scholarships	70,000
Publications allocation	100,000
Teaching laboratories	65,750
Safety	10,000
School Office	35,000
Staff Start Up	160,000
Marketing	30,000
Repair, Maintenance & building utilities	50,000
International recruitment	35,000
Undergraduates association support	4,000
Postgraduates association support	7,000

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 shows the School's main expenditure items in 2017.

Research Income

The School's research income comprises the largest fraction of the overall income of the School. We had a fantastic outcome this year, winning about 1% of the ARC grants nationally and large amount from overseas industries. The School experienced a very high performing research year.

Academic Staff

ARC Future Fellow & 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.

Professor Alan Crosky

Alan's research focuses on the effect of structure (both micro and macro) on mechanical behavior. 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 Sammy Lap Ip Chan

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

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.

ARC Future Fellow, **Associate Professor Dewei Chu**

Dewei's research interests include ionic conductive oxide-based nanomaterials and their applications in nanodevices, including resistive random access memory, transparent thin film transistors, supercapacitors, electric double layer transistors, and artificial synapses, etc. He is also interested in functional ceramics for energy harvesting applications.

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.

Scientia Fellow **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.

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.

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.

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.

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.

Lecturer **Dr Rakesh Joshi**

Rakesh is currently focusing on developing methods to prepare high value carbon materials such as graphene and fullerene from waste materials. He has developed experimental methods to prepare graphene and carbon nanotubes for various applications. His areas of interest include sustainable materials, 2D Materials-graphene and metal chalcogenides, nanomaterials and thin films. Dr Joshi is leading many industrial projects on the application of graphene and graphene supercomposites.

Lecturer **Dr Damia Mawad**

Damia's research interests are in tissue engineering/regenerative medicine. Her contributions in the field focus on development of advanced functional biomaterials with tailored properties. These include flexible bioelectronics with enhanced electronic stability, conjugated nanoparticles for photo-thermal therapy and on-demand drug delivery, and 3D printing of bioactive scaffolds.

Academic Staff

Head of School
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.

ARC Laureate Fellow **Scientia**
Professor Veena Sahajwalla

Veena's research interests include sustainability of materials and processes with emphasis on environmental benefits. She has a deep knowledge of industrial processes. Veena invented an environmentally friendly process for recycling plastics and rubber into electric arc furnace steelmaking. As Director of SMaRT she provides leadership in research programs on sustainable materials.

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.

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.

Senior Lecturer
Dr Sophie Primig

Sophie's research interests are in advanced property-structure relationships in structural metallic materials such as advanced steels, nickel-based alloys and refractory metals. She combines state-of-the-art experimental techniques such as electron microscopy, atom probe tomography and thermal analysis with mechanical testing and contemporary modeling approaches. Her research philosophy is to achieve a balance between fundamental discovery and industrial application.

Professor Chris Sorrell

The main focus of Chris' research has been the processing of ceramics, including fabricaiton, forming and densification of bulk materials, thick films and thin films. Main research areas include phase equilibria, crystal growth, high-temperature superconductivity, bioceramics, microwave heating of ceramics, gas sensors and fuel cells and photocatalytic titania.

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.

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 behavior of particles through rigorous modelling and simulation at microscopic and macroscopic levels. This knowledge is then applied to solving problems in various industrial applications.

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.

ARC Future Fellow & Senior Lecturer **Dr Jiabao Yi**

Jiabao's most significant contributions are in the field of diluted magnetic semiconductors, based on oxide semiconductors, magnetic materials, nonstructural, oxide electronics and spintronics materials.

Senior Lecturer **Dr Danyang Wang**

Danyang's most significant contribution is in the field of growth and characterization of functional oxide thin films for ferroelectric, piezoelectric, electro-optic and dielectric applications. Areas of research include thin film technology and physics, functional materials and devices, micro/nanofabrication techniques, structural analysis and x-ray physics.

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 Tom Wu

Tom's research focuses on the vapor- 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 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.

More detailed information about our Academic Staff can be found on the School website: **www.materials.unsw.edu.au**

School Committees

School Advisory Committee

Paul Munroe *(Chair)*
Owen Standard
Dewei Chu
Pramod Koshy
Laura McNally
Lucy Zhang

Research Committee

Nagy Valanoor *(Chair)*
Paul Munroe
Veena Sahajwalla
Sean Li

Teaching and Learning Committee

Sammy Lap Ip Chan *(Chair)*
Alan Crosky
Owen Standard
Danyang Wang
Judy Hart
Paul Munroe

OHS Committee

Owen Standard *(Chair)*
Anthony Zhang
Paul Munroe
Rakesh Joshi
Rahmat Kartono
Anne Aylmer
Scott Gleason (Student Rep)

Equity and Diversity Committee

Paul Munroe *(Chair)*
Damia Mawad
Owen Standard
Joanne Hallis
Lucy Zhang
Gita Naidu *(UG Rep)*
Carina Ledermüeller *(PG Rep)*

School Scholarship Committee

Veena Sahajwalla *(Chair)*
Owen Standard

School Co-op Scholarship Representative

Owen Standard

Postgraduate Coordinators

John Daniels

Sophie Primig

Overseas Degree Programs / Asia Engagement

Sammy Lap Ip Chan

Undergraduate Program Coordinator

Owen Standard

Women in MS&E

Judy Hart

Honours Projects Coordinator

Kevin Laws

Faculty Board Representative

Jan Seidel

Master by Coursework Coordinator

Danyang Wang

Seminar Coordinators

Claudio Cazorla

John Daniels

Misconduct and Grievance Officer

Owen Standard

Faculty Undergraduate Assessment

Owen Standard

Sammy Lap Ip Chan

School Staff

School Administration

Head of School	Paul Munroe
Deputy Head of School	Owen Standard
School Manager	Lucy Zhang
Projects Coordinator / Executive Assistant to Head of School	Joanne Hallis
Undergraduate and Postgraduate Student Advisor	Laura McNally
Outreach and Student Liaison Officer	Juanita Vargas
Administrative Officers	Anne Aylmer Alan Chow Qing Xia
Manager, Operations and Business Strategy, SMaRT	Uttra Benton
Research and Administrative Assistant, SMaRT	Nahid Sultana

Research Staff

Research Associate	Esmaeil Adabifiroozjaei
Postdoctoral Fellow	Joseph Arsecularatne
Research Associate	Wen Fan Chen
Research Associate	Rifat Farzana
Research Associate	Nicholas Hamilton
Senior Research Fellow	Pramod Koshy
Research Associate	Nitish Kumar
Postdoctoral Fellow	Hamid Lashgari
Research Associate	Qianru Lin
Research Associate	Reza Mahjoub
Research Associate	Samane Maroufi
Research Associate	Suk Chun Moon
Postdoctoral Fellow	Thuan Dinh Nguyen
Senior Research Fellow	Farshid Pahlevani
Research Associate	Ravindra Rajarao
Postdoctoral Fellow	Daniel Sando
Research Associate	Pankaj Sharma
Postdoctoral Fellow	Sagar Shirsath
Senior Research Scientist	Thiam Teck (TT) Tan
DECRA Fellow	Chunguang Tang
Postdoctoral Fellow	Xing Xing
Lecturer	Wanqiang (Martin) Xu
Research Associate	Jiao Jiao Yi
Postdoctoral Fellow	Adnan Younis
Senior Research Fellow	Rong Zeng
Postdoctoral Fellow/Technical Officer	Qi (Peggy) Zhang

Industry Advisory Board

Technical Staff

Technical Officer	Soo Woon Chong
Research Assistant	Vaibhav Gaikwad
ITC Support Officer	Jane Gao
Research Support Engineer	William (Bill) Joe
Technical Officer	Rahmat Kartono
ITC Support Officer	Danny Kim
Research Assistant	Irshad Mansuri
Technical Officer	David Miskovic
Research Assistant	John Sharp
Technical Officer	George Yang
Safety Officer	Anthony Zhang

Name	Organisation
Mr Roger Leigh (Chair)	*Cochlear Limited*
Mr Adam Berkovich	*Pacific Aluminium*
Professor Lyndon Edwards	*ANSTO*
Dr Catherine Foley	*CSIRO*
Mr Michiel Freislich	*HATCH*
Mr Michael Gow	*PGH Bricks & Pavers*
Dr Edward Humphries	*Weir Minerals*
Mrs Cathy Inglis	*Brickworks*
UNSW Adjunct Professor Dr George Melhem	*Perfect Engineering Pty Ltd*
Dr David Nolan	*Bluescope Research*
Mr Andrew Petersen	*Sustainable Business Australia*
Professor Emma Johnston	*Dean of Science, UNSW Sydney*
Professor Paul Munroe	*School of Materials Science and Engineering, UNSW Sydney*
Dr Owen Standard	*School of Materials Science and Engineering, UNSW Sydney*
Ms Lucy Zhang	*School of Materials Science and Engineering, UNSW Sydney*

Staff Awards & Achievements

End of an Era

2017 saw lots of staffing changes in the School. We farewelled Executive Assistant to Head of School, Joanne Hallis as she returned home to Perth to care for her aging parents, and former Student Advisor Laura McNally stepped up to the role.

Operational Excellence ushered Marketing and Outreach Officer Juanita Vargas and Administrative Assistants Alan Chow and Anne Aylmer from the building – whose presence and expertise is missed greatly.

Purchases Officer Qing Xia moved to work with the SMaRT centre and we welcomed Michael Lai to the Student Advisor role and Administrative Assistant Helena Zou to the team.

Towards the end of 2017, we welcomed Professor Tom Wu and Dr Kris Killian to the Academic Staff.

UNSW Science Staff Excellence Award for Excellence in Education

Laura McNally received this award in recognition of her outstanding work over the past few years in supporting our undergraduates and postgraduates.

New Columbo Plan

Sam Chan and John Daniels were awarded, $141K from the 'New Columbo Plan' through the Department of Foreign Affairs and Trade. The funds will be used to support undergraduates visit universities and institutes in Taiwan, Singapore and China over the next few years.

Queen's Birthday Honour

Professor Stephen Joseph, who has been a visiting academic in the School for over 10 years, was awarded the Member of the Order of Australia (AM) in the 2017 Queen's Birthday Honours List.

MSE Family News

In February, Dr Claudio Cazorla and his wife welcomed their second child, a son Nico.

Citation for Outstanding Contributions to Student Learning

Dr Pramod Koshy was one of only 87 recipients nation-wide to receive this prestigious award from the Federal Government in recognition of his outstanding teaching in higher education.

PLuS Alliance Prize for Research Innovation

ARC Laureate Fellow Professor Veena Sahajwalla was the recipient of this inaugural award for her work over the past several years in green manufacturing.

Arc Postgraduate Council (PGC) Supervisor Award

Dr Dewei Chu received this award which is granted to higher degree research supervisors, who have been nominated by their candidate(s), for 'exemplary, engaging and inspiring supervision'.









AUSTRALIAN
AWARDS
for University
Teaching


UNSW

Equity, Diversity, & Inclusion

The School of Materials Science and Engineering 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 Committee leads and inspires this diversity agenda through events including "R U OK? Day" and "International Women's Day".

In March, staff and students in the School came together to celebrate "Harmony Day". The message of Harmony Day is Everyone Belongs and the aim is to celebrate cultural and religious diversity and foster a sense of belonging for everyone. In a curious twist, our School colour Orange is also the colour for Harmony Day as it signifies social communication and meaningful conversations.

We had a great turnout of staff, postgrad and undergrad students who enjoyed the multicultural feast, some of which was catered and some of which was made by people in the School who proudly showed off their own traditional cooking. The feast was followed by an international trivia competition, which was won by a group of our very smart postgrads, and a fiendishly difficult flag competition, set by Dr Owen Standard and won convincingly by visiting fellow, Dorian Hanaor.

Work Health & Safety

The School of Materials Science and Engineering is committed to providing a safe work environment for all staff, students, and visitors in compliance with the Australian Federal *Work Health and Safety Act 2011*. This is implemented by the University through the *UNSW Work Health and Safety Policy* which, at the School level, is managed by the School Work Health and Safety Committee.

In 2017, the School Work Health and Safety Committee was comprised of Owen Standard (chairperson and elected academic staff representative), Anthony Zhang (School Safety Officer), Rakesh Joshi (elected research-only staff representative), Rahmat Kartono (elected technical staff representative), Anne Aylmer (elected administrative staff representative), and Scott Gleason (elected postgraduate student representative), Paul Munroe (management representative), and Lance Islip (WHS Coordinator, Faculty of Science). Anne departed the Committee and the School in October 2017 and the School gratefully acknowledges her contribution to the Committee. The Committee met quarterly to discuss, monitor, and implement WHS policy and procedures, investigated hazards and incidents, and provided ongoing consultation to staff and students for WHS matters.

All staff and students in the School are thanked for their ongoing cooperation and compliance with WHS requirements and procedures.

Dr Owen Standard
WHS Chairperson

WHS activities in the School during 2017 included:

- Quarterly laboratory safety inspections and implementation of corrective actions;
- University supervisor training course for all staff who supervise staff/students;
- Mandatory School WHS information sessions throughout the year for new research staff, postgraduate students, and Honours students;
- Refresher safety training courses for staff including first aid training, evacuation warden training, forklift training, and electrical testing and tagging;
- Various laboratory training courses including: hazardous substances training, hydrofluoric acid training, risk management documentation (SafeSys) training, chemical purchasing and inventory (Jagger) training; handling and safety of gases and cryogenics (by Supagas Australia); and spill response training (by Argyle Commercial).
- Electrical tagging and testing of all single-phase equipment and appliances in the School;
- Implementation of revised UNSW engagement and documentation process for engagement of external contractors;
- Purchase of new manual handling equipment for laboratories;
- Purchase of new Metrel electrical testing and tagging PAT unit;
- Completion of annual emergency evacuation drill for the entire building;
- Installation of a new automated external defibrillator (AED) in the building.
- Participation of some School staff in the Global Corporate Challenge, a workplace health and engagement program designed to improve the health and performance of employees.
- Completion of the University WHS self-audit tool for which the School received a compliance rating of 95%.

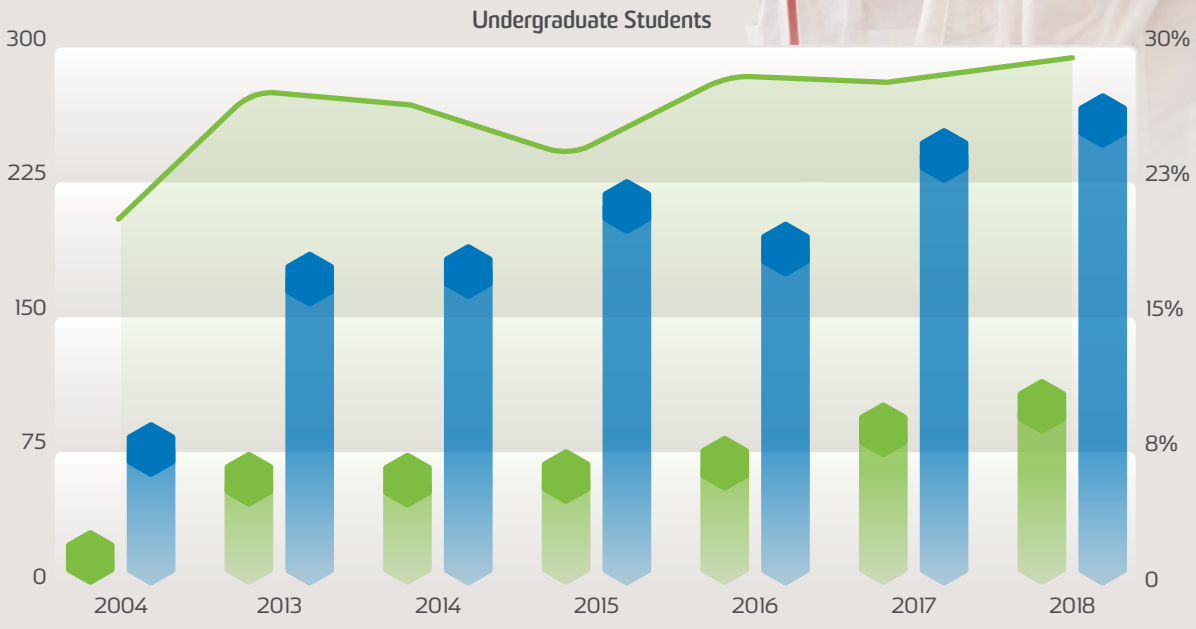
Women in Materials

The School can proudly boast gender balance in its new combined degree!

This year, activities of the "Women in Materials" group which was established in 2014, continued with the School taking measures to increase the participation of women, both in its academic programs and more broadly across the profession.

The Faculty's "Science 50:50 – Inspiring Young Women into Science" program, led by the School's ARC Laureate Fellow Professor Veena Sahajwalla, aims to inspire young women to pursue degrees and careers in science and technology.

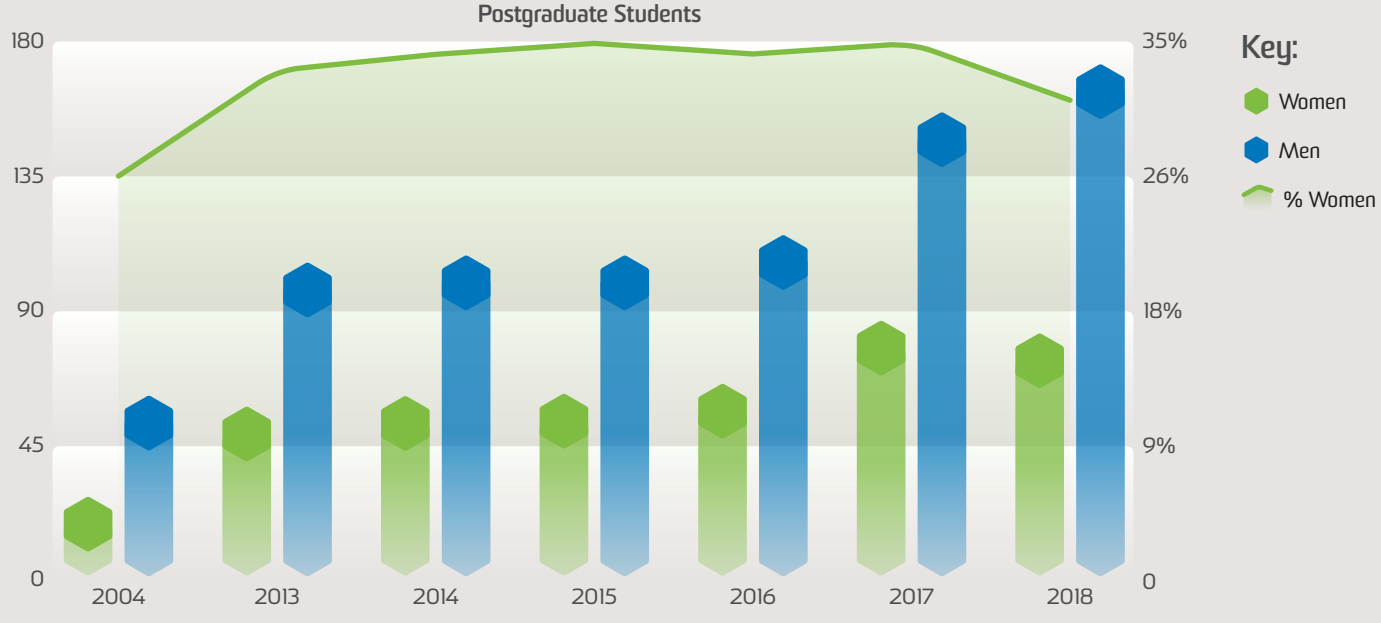
In 2017, Dr Damia Mawad and Dr Judy Hart both spoke to visiting groups of female high school students with an interest in science careers as part of the L'Oreal Girls in Science Forum.



The proportion of female students in the School has held strong around 30% for several years, while the total student body has increased. Additionally, female undergraduate student numbers have steadily increased since 2015.

The combined degree in Materials Science and Engineering and Biomedical Engineering has consistently attracted over 40% female students for a number of years.

The School can proudly boast gender balance in its new combined Bachelor of Materials Science and Engineering and Bachelor of Engineering Science in Chemical Engineering program!



Marketing Outreach Report

Digital Natives

It is increasingly challenging to reach and engage with today's youth audiences. As digital natives, there are innumerable channels, products, activities and education services competing for their attention. Youth are also invariably incredibly optimistic, fun and authentic in their quest to identify and pursue their passion or purpose.

For the past 5 years, the School's Marketing strategy has focused on making Materials Science and Engineering (MSE) fun, relevant and accessible to young people.

Through unique content, digital campaigns, outreach events and enthusiastic staff and student volunteers, our School has engaged thousands of school students, their parents and science teachers inspiring the next generation of Materials Scientists and Engineers.

Since 2012, our School has not only doubled its undergraduate cohort from 250 to over 500, but it has become a vibrant and collegial community that actively supports and engages its students. Below are some of this year's School marketing highlights.

Open Day

Over the past five years, the School has consistently excelled at Open Day by showcasing one of the most vibrant and engaging tents, and this year did not disappoint! With over 70 staff and student volunteers, a dozen exciting interactive demonstrations and hundreds of competitions and prizes, the MSE tent attracted over 3000 prospective students and visitors.

Peer Mentoring

During early 2017, the School introduced Design Thinking to find better ways to help new students transition to university. This involved interviewing a group of school leavers and current students to understand the inherent challenges young people face during this testing time.

The interviews were followed by a half-a-day workshop where select School academic and professional staff worked collaboratively with undergraduate student representatives to discover unmet needs and to turn these insights into opportunities to generate creative ideas.

Resultant solutions were refined and implemented by Peer Mentors during the first six weeks of semester 1 2017 and included; introducing science challenges, sporting activities and a WeChat group to give international students the opportunity to meet locals in a fun and structured way. These solutions were instrumental in increasing the positive participation of new international students in the School's engagement activities during 2017.

STEM Engagement Day

The School ran its first STEM Engagement Day and welcomed 80 year-five students from Randwick Primary School for a Materials Science and Engineering extravaganza.

"Think about all of the different stuff you use during the day, like your toothbrush, your clothes, your toys... you use a lot of stuff, right? Well, materials science is all about the study of 'stuff'!"

This interactive session explained the role of MSE in the world of technology development through some of our most popular hands-on demonstrations including the magnetic levitating train, non-Newtonian fluid and the hydrophobic materials.

Industry Careers Night

This interactive networking event provided undergraduate students the opportunity to hear about the challenges and opportunities alumni and industry guest speakers experienced transitioning from university to industry/research.

The line-up of speakers included four of our very own alumni Steven Kennedy (Cochlear), Cathy Liu (Reserve Bank), Daniel Miles (Independent Business Consultant) and Paul Pulic (Tech Start-up). The event attracted a record number of 80 undergraduate students who submitted a range of questions and had the opportunity to network with the speakers.

A big thanks to all the staff and student volunteers that gave their time during 2017 to educate school students and the general public about this fascinating interdisciplinary field and by inspiring future discoveries that will shape the technology of the future!

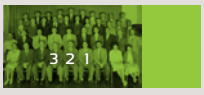

Superconductors
UNSW SCIENCE
LEARN. EXPLORE. DISCOVER.
Chemical


nts of the idea do you like (pink)
nges might we face (blue)
t we build on this concept (green)

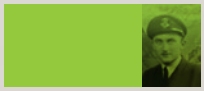

UNSW SCIENCE
LEARN. EXPLORE. DISCOVER.
UNSW
Swords

A Tribute to Alex Jenkins & Greig Wallwork:

Article by:
Dr J Bruce See
Prof Phillip J Mackey
Prof David G C Robertson



Staff of the School of Metallurgy in 1959. Alex Jenkins (1) is in the front row to the right of Professor Rupert Myers (2) and Greig Wallwork (3) is standing in the second row immediately to the left of Professor Myers.



Professor Alex Jenkins as a Pilot Officer in 460 Squadron of RAF Bomber Command in World War II. (Photo Courtesy of Central Western Daily 19 June 2017)

Early in 2017 the three of us were saddened to learn of the passing of two outstanding academics from the earliest years of the UNSW School of Metallurgy: Emeritus Professor Alex Jenkins and Professor Greig Wallwork.

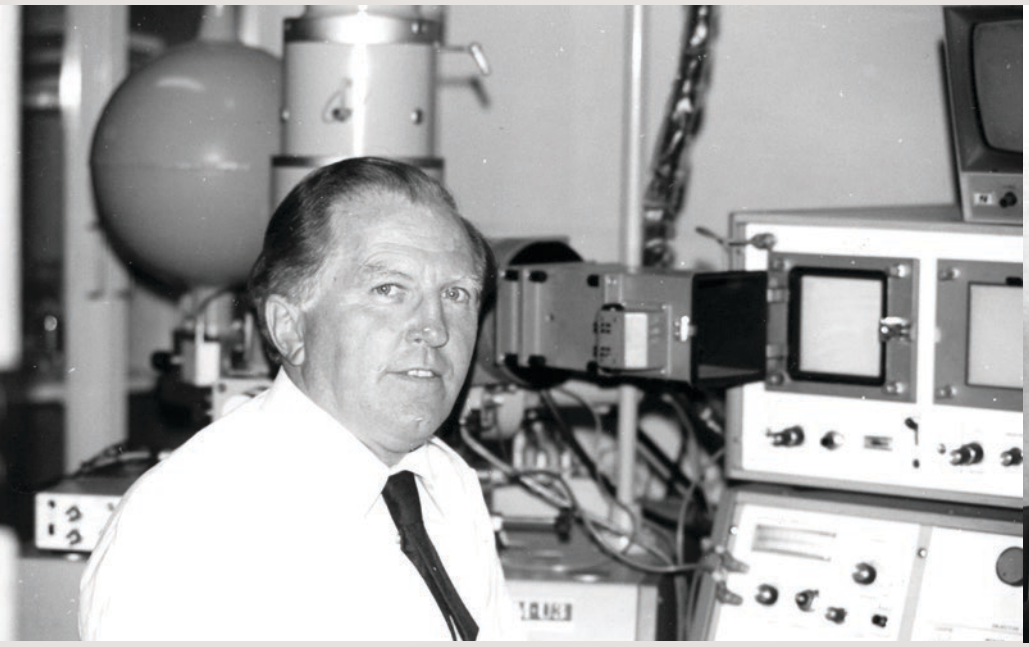
The School of Metallurgy was created with the appointment of Professor Rupert Myers as Head of School in 1952. At the time there was a significant post-war boom in mining and metallurgy in Australia – and an exciting environment for the School. Professors Jenkins and Wallwork were amongst the academic staff recruited to the School. Both quickly helped to build the research effort within the School because of their common interest in the high temperature oxidation of metals. This is evidenced by a number of joint publications in the 1950s and 1960s and the School soon became internationally well known for its expertise in these fields.

Emeritus Professor Alexander Elliott Jenkins (29/10/1924 – 14/03/2017)

Alex Jenkins spent his early childhood in Toorak, Victoria. Being academically gifted he entered the University of Melbourne as a metallurgy student in 1940. Alex's studies at university were short lived as he joined the RAAF on his 18th birthday in 1942. He then spent the next four years in the RAAF ending with a stint as a commissioned pilot.

He returned to his studies after the war and completed his BMetE and MEngSci degrees at the University of Melbourne before joining CSIRO as a Research Officer in 1949. He subsequently worked on the physical metallurgy and extraction of titanium at the Baillieu Laboratory and completed his Cambridge-supervised doctorate in 1951. Appointed as a Senior Lecturer in the School of Metallurgy in 1954, Alex became an Associate Professor in 1960 and was then given a Personal Chair in Chemical and Extractive Metallurgy in 1965. In 1970 Alex left UNSW and joined the International Nickel Company of Canada (INCO) as Manager of Operations and Process Technology in their Pacific Division until 1974 when he was appointed to the Chair of Materials and Mining Engineering at the University of Sydney. He subsequently retired at the end of 1984 and was honoured with the title of Emeritus Professor. During the 1950s and 1960s Alex was a key figure in the group of academics and postgraduate students in the School who specialised in chemical metallurgy and pyrometallurgical processing.

Alex's life is especially interesting because of his experiences during his wartime service. He was a pilot in RAF Bomber Command in World War II. A group that suffered a horrendous casualty rate. Out of a total of 125,000 aircrew 55,573 were killed (a casualty rate of 44.4%) and a further 8,403 were wounded in action. Alex was assigned to 460 Squadron of Bomber Command in January 1945 and piloted both Wellington and Lancaster bombers. During an operation to Dortmund on 20 February 1945 he narrowly escaped death when on the return

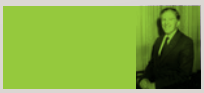


Pioneers in the School Of Metallurgy

journey his Lancaster was attacked at an altitude of ~ 4,000 m. The starboard petrol tank caught on fire, there was an explosion, the aircraft turned on its back, the starboard wing broke off and the Lancaster went into a spin. All of Alex's crew were killed in action, but by luck Alex was able to escape the aircraft and he landed safely and unhurt in the Belgian village of Lummen. He was captured and treated for injuries in a German field hospital. Canadian troops advanced and captured the German medical personnel whilst simultaneously releasing Alex. In recognition of his bravery there is now a street (AlexJenkins Straat) in Lummen named after Alex.

Professor Greig Wallwork in his laboratory.

Professor Greig Richard Wallwork (27/06/1924 – 28/02/2017)



Professor Greig Wallwork, DSc in 1978 (Photo courtesy of UNSW Archives)

Greig was born in Maclean, New South Wales in 1924. After attending Gosford High School, he obtained a position as a trainee at Commonwealth Steel in Newcastle. Greig enlisted in the RAAF in 1944 and was discharged in July 1945 from the Elementary Flying School, Temora.

After obtaining a Credit Diploma in metallurgy from Newcastle Technical College in 1948 he left Newcastle in 1950 and spent two years at the Rocket Research Establishment in the UK. Returning to Australia he spent a year at the Weapons Research Establishment at Salisbury before moving to the Defence Standards Laboratories in Sydney and then becoming a Lecturer in the School of Metallurgy in August 1957.

In 1960 Greig was the first graduate and metallurgist from the School to gain his PhD for his doctoral thesis 'Solid-Gas Reactions at High Temperature with particular reference to the Oxidation of Metals'.

Greig was promoted to Senior Lecturer in 1960 and to Associate Professor in 1968 and was Acting Head or Head of the School of Metallurgy for lengthy periods from 1984 to July 1986 when he took retirement from the university. He took an active interest in university affairs and was a member of the University Council from 1973-5.

In April 1978 Greig was honoured by the award of the DSc degree from UNSW. Professor Wallwork's research on high temperature oxidation underpinned the development of supersonic flight and nuclear power generation.

Professors Alex Jenkins and Greig Wallwork will be remembered as early pioneers in the former School of Metallurgy.

Interestingly, Alex and Greig were both born in the same year (1924), both experienced wartime service, both were colleagues at the former School of Metallurgy throughout the 1950s and 1960s and they both died in the same year (2017).

Undergraduate Studies

Dr Owen Standard Undergraduate Coordinator

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 Law, 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.

Revision of Undergraduate Programs

As part of its UNSW 2025 Strategic Plan, the University's academic year structure will change from two 12-week semesters (maximum of 4 courses each semester) to three 10-week trimesters (maximum of 3 courses each semester) from 2019. The School commenced revision of its BEHons and related programs in 2017, to fit the trimester model. This involved fitting and optimising the sequence of courses over the trimesters and required only minimal changes to the content of the courses themselves. The trimester structure offers three formal options for the structure of each program: standard structure in which students complete 8 courses per year; structure involving 9 courses per year with the third trimester in Year 3 available to be taken for industrial training; structure for first year students to enter into the third trimester of each calendar year.

In 2017, a new academic major of Functional Materials in the BEHons program was developed by the School and approved by the University. This major is intended to offer identifiable undergraduate training in metallic, ceramic, and polymeric materials that possess highly-specific native properties and functions (such as ferroelectricity, piezoelectricity, magnetism and energy storage) and which offer strategic technological applications in areas such as electromagnetic devices, energy generation, electro- and magneto-caloric materials for energy storage, solar harvesting functions, and semiconductor logic and memory technology. Similar to the structure of the existing academic majors, study of Functional Materials is done in Stages 3 and 4 of the BEHons program by means of a number of specific professional electives and a substantial thesis project.

New Enrollment

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. International students comprised just under one third of the 2017 student intake and the gender balance was 76% male to 24% female which is very good for an engineering discipline. The School continues to have the largest undergraduate program in the discipline nationwide by a considerable margin.

Table 1: First Year Intake (2013–2017)

Program	2013	2014	2015	2016	2017
3131 BE(Materials Sci. & Eng.)	46 (11)	44 (15)	63 (26)	43 (10)	97 (41)
3132 BE(Materials Sci. & Eng.)/BEngSci.	13 (4)	7 (0)	9 (2)	5 (0)	3 (0)
3133 BE(Materials Sci. & Eng.)/MBiomedE	20 (2)	16 (0)	16 (5)	19 (2)	7 (0)
3136 BE(Materials Sci. & Eng.)/BCom	3 (1)	7 (0)	9 (3)	3 (0)	5 (1)
Total:	82 (18)	74 (15)	97 (36)	70 (12)	112 (42)

Overall Program Enrolment

The numbers of students in each program and year of the particular program for 2017 are listed in Table 2. The number in each year of study is dependent on the number of students who entered that cohort initially (i.e., in Year 1) as well as the number of students who transferred into or out of the cohort in subsequent years. Furthermore, the number of students in a particular year of study includes students who are deemed by the University's enrolment system to have not yet completed that year of study (owing to failed courses and/or courses not yet undertaken). In addition to the School's own undergraduate cohort, a significant number of undergraduate students from other schools enrol in the School's courses, the majority being Engineering students who enrol in a first year introductory materials course. Also, there are approximately 20-30 students undertaking the Materials Science major of the BSc program but reliable data is difficult to obtain because many students do not declare their major until late in their program.

Table 2: 2017 Program Enrolment

Program	Year 1	Year 2	Year 3	Year 4	Total
3131/3135 BE(Materials Sci. & Eng.)	103	39	21	16	179
3132/3137 BE(Materials Sci. & Eng.)/BE(ChemEng)	4	3	7	16	30
3133/3138 BE(Materials Sci. & Eng.)/MBiomedE	8	19	11	27	65
3134/3136 BE(Materials Sci. & Eng.)/BCom	5	2	2	4	13
Total:	120	63	41	63	287

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 bythe awarding of the University medal. A total of 25 students graduated in 2017 (nb. programs are those prior to revision)with classifications as listed in Table 3.

Table 3: 2017 Program Enrolment

Program	H1 + Medal	H1	H2/1	H2/2	Pass	Total
3135 BE(Materials Sci & Eng)	1	2	3	3	3	12
3136 BE(Materials Sci & Eng)/BCom	-	-	-	-	-	0
3137 BE(Materials Sci & Eng)/BE(ChemEng)	-	4	-	-	-	4
3138 BE(Materials Sci & Eng)/MBiomedE	-	5	1	2	-	8
3972 BAdvSci(Materials Sci)	-	1	-	-	-	1
Total:	1	12	4	5	3	25

Co-op Scholarship Program

Dr Owen Standard Academic Coordinator Co-op Program in Materials Science and Engineering www.coop.unsw.edu.au

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 127 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 2017, a total of 2 scholarships (Table 1) were provided by two industrial sponsors – Pacific Aluminium (Rio Tinto) and Weir Minerals. The School takes this opportunity to thank these sponsors for their support and commitment to the Co-op program. The attraction of new scholarships remains a challenge owing to business pressures on traditional Australian manufacturing industries and Pacific Aluminium (Rio Tinto) and Weir Minerals have agreed to sponsor two new Scholarships for students commencing in 2018.

For an engineering discipline. The School continues to have the largest undergraduate program in the discipline nationwide by a considerable margin.

Table 1: Statistics of Co-op Program in Materials Science and Engineering – (2013 to 2017)

Program	2013	2014	2015	2016	2017	Total
Current Year of Degree	4	3 (IT)	3	2	1	
Number of Scholars						
Ceramic Eng.	-	-	-	-	-	0
Materials Eng.	-	-	1	-	-	1
Physical Met.	1	-	-	-	-	1
Process Me.	-	-	-	-	-	0
Total:	1	-	1	-	-	2

Co-op Scholars complete 68 weeks of structured and highly relevant industrial training with the sponsor companies – 10 weeks at the end of year 1, 10 weeks at the end of year 2, and two 24 week placements at the end of Year 3. 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). The scholar and sponsor also provide written appraisals of the placement. Each scholar is required to give a short presentation to industry sponsors and fellow Co-op students summarising their IT work and, importantly, the technical and professional benefit they obtained from the placement. Industry sponsors articulate 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 that differentiate them from other students and make a smooth transition to the workplace. The Co-op Program provides scholars with access to a range of support networks and an academic mentor is assigned to each program cohort to offer specific program advice and guidance. Workshops and training activities are offered throughout 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. 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 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. The School takes this opportunity to again thank its Co-op sponsors for efforts applied to 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.

Postgraduate Degree Programs

The School of Materials Science and Engineering has one of the largest and most active programs in postgraduate research in Australia. **The School's staff normally lead UNSW** in research grant success, journal publication rates, and postgraduate supervision/graduation rates.

Master of Materials Technology (Coursework)

The Master of Materials Technology program consists of 2 years of full-time or equivalent study comprising coursework in materials processing, materials design, materials technology and materials industry management. It is designed for graduates wishing to acquire expertise in the design, selection, use and performance of modern materials. It also includes a component of experimental and/or design project work, and an original research project is also undertaken in a chosen area.

Materials Science and Engineering – Master of Science (Research) Master of Engineering (Research)

A Master by Research degree requires completion of an original piece of research, more limited in scope and nature than that required for a PhD. Candidates develop mastery of appropriate methodology and they present their findings in the wider context of their discipline.

There is the opportunity for graduates of either the Master of Science or Master of Engineering program to progress to PhD study.

Materials Science and Engineering – Master of Philosophy (Research)

The M.Phil degree involves minimum of 1.5 years full time study during which students undertake supervised research leading to the production of a thesis. The program is designed to provide an alternative to the honours program for students who have previously completed a BSc and wish to proceed to a research degree.

There is the opportunity for graduates of the Master of Philosophy program to progress to PhD study.

Materials Science and Engineering – PhD

A PhD degree requires completion of a piece of research that demands a significant and original contribution to knowledge in the field of study. Candidates acquire advanced specialist research training and produce a thesis that summarises the research and provides evidence of independent thought and critical analysis, effective communication and expert knowledge of the discipline in the international context.

For an engineering discipline. The School continues to have the largest undergraduate program in the discipline nationwide by a considerable margin.

Table 1: Statistics of Co-op Program in Materials Science and Engineering – (2013 to 2017)

Program	Mode	UNSW Program Code	Length of Study	Minimum Units of Credit
Materials Technology -Masters Degree (Coursework)	Campus, Directed Research, Independent Research	8717	2 years full-time	96
Materials Science Engineering -Master of Science (Research)	Directed Research, Independent Research	2055	2 years full-time	96
Materials Science Engineering -Master of Engineering (Research)	Directed Research, Independent Research	2175	2 years full-time	96
Materials Science Engineering -Master of Philosophy (Research)	Directed Research, Independent Research	2475	1.5 years full-time	72
Materials Science and Engineering - PhD	Directed Research, Independent Research	1045	3 years full-time	144

Yiren Wang

Pietro & Georgia Bergamaschi with Paul Munroe & Lorenzo Travaglini

Gaurav Vats

Patrick Tung

Student Awards & Achievements

UNSW Science Postgraduate Research Competition

Gaurav Vats took out the win in 2017 for his presentation *"Magnetic skyrmions: Towards a universal memory"*.

Materials Australia Undergraduate Student Presentation

IEEE Ultrasonics, Ferroelectrics and Frequency Control (UFFC)'s

Stuart Burns was appointed as a representative on this committee, which is responsible for the organisation of a number of student-led activities run under the auspices of the UFFC.

Stuart Burns

Materials Australia Undergraduate Student Presentation

Ben Fishburn was awarded second prize for his presentation *"Development of Industrially-Viable Geopolymer Compositions"* and Scarlet Kong was awarded third prize for her talk entitled *"Characterisation of Anomalous Surface Structure in Ferroelectric Bi0.5Na0.5TiO3 - 6%BaTiO3"*.

Philanthropic Alumni

Returning in a philanthropic capacity after completing his PhD in the School in the 1970's **Pietro Bergamaschi** and his wife **Georgia** have generously donated tuition fee sponsorship for a second postgraduate research student in the School.

ICDD Ludo Frevel Scholarship

Patrick Tung was awarded the Ludo Frevel Scholarship from the International Centre for Diffraction Data. Its purpose is to support the education and research program of promising graduate students in crystallography-related fields, and Patrick won the scholarship for his work, *"Diffuse Scattering: The Role of Local Disorder in Environmentally-Friendly Piezoelectric Na0.5Bi0.5TiO3- x%BaTiO3"*.

Chinese Government Award

Yiren Wang was honoured with the Chinese Government Award for Outstanding Self-Financed Students, after rigorous judging based on publications and other academic accomplishments. Currently this prestigious award is presented to 500 students worldwide each year and is highly competitive, as more than half a million Chinese students study abroad each year.

In our Graduating Class of 2017, the following prizes were awarded:

The prestigious Hugh Muir Prize for the student, who, in the opinion of the Head of School, has contributed most to the corporate life of the School of Materials Science and Engineering was awarded to Scarlet Kong.

Recipients of the Perfect Engineering awards for the best final year projects were Kevin Pei (Process Metallurgy), Richard Chen (Ceramics) and Cerys Edwards (Physical Metallurgy).

Xia Ping Lee not only received the final Perfect Engineering award for best final year project in Materials Engineering but was also awarded a University Medal for substantial academic achievements throughout her degree. The University Medal is the most distinguished award that UNSW bestows on an undergraduate student.

Mia Maric also had a terrific year, receiving both the Pacific Aluminium Prize for the best performance in MATS3007 Materials Industry Management and the Australasian Corrosion Association Prize for the best performance in MATS4007 Engineered Surfaces to Resist Corrosion and Wear.

The Wallarah Minerals Prize for best performance in an honours thesis in the BE Ceramic Engineering program was awarded to Luisa Schreck

Yan Ngiam was awarded the Max Hatherly Prize for the best performance in MATS4001 Secondary Processing of Metals.

The Cochlear Prize for the highest overall WAM at the end of Year 3 was awarded to Vicki Zhong.

And finally, the Sir Rupert Myers Prize for the best performance in MATS3001 Micromechanisms of Mechanical Behaviour of Metals was awarded to Alan Cen.

Congratulations to these students and to the entire graduating class of 2017. We wish them great success in the future.

Industrial Training: Poster Competition Winners

In March, the School held its annual Industrial Training Placement Evening.

Each of our bachelor degree programs contains a requirement for students to complete a minimum of 60 days industrial training, aimed at preparing them for future employment in their chosen engineering discipline.

Industrial training enhances the academic materials studies and allows students to practice what they have learned, while developing key professional attributes.

Around 34 undergraduate students presented posters and a brief oral summary outlining their experiences during the industrial training.

The quality of the presentations was extremely high and clearly many students found their IT placements to be a very valuable learning experience. We were very pleased to welcome George Melhem from Perfect Engineering and Taka Numata from Austral Bricks as our judges for the evening.

This year's winners for best presentations were:

1st Prize	Charlotte Dawes	*Optimization of Iridium Thin Film Deposition via DC Magnetron Sputtering*
2nd Prize	Mia Maric	*Simulations of Self Assembly of Amphiphilic DNA Materials*
3rd Prize	Shantan Kandukuri	*EOS Defence Systems*

We congratulate Charlotte, Mia & Shantan for their outstanding, and importantly, highly reflective presentations.

1st Prize **Charlotte Dawes**

2nd Prize **Mia Maric**

3rd Prize **Shantan Kandukuri**

Industrial Training: Charlotte's Experience

Charlotte Dawes

Over the 2016/2017 vacation period I was lucky enough to be selected to take part in the North Carolina State University Research Exchange program, where I was able to travel to the United States and work in a university research environment.

I was incredibly excited about the opportunity as I had always wanted the international exchange experience and was looking forward to working in a research position for the first time. I was told I would be working with Professor Jon-Paul Maria, who has had decades of research experience and has worked on many projects for the US Department of Defence.

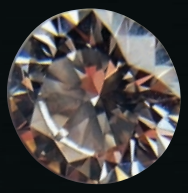
When I arrived at NC State University, I discussed my project options with Professor Maria and I was eventually given the task of investigating how to create high quality thin films of iridium. This research was done to aid the work of researchers as part of a collaborative project between NCSU and the University of Virginia, who are investigating iridium as a potential transducer in time domain reflectivity measurements. These measurements help us to determine thermal properties such as the thermal conductivity of materials at high temperatures. We were interested in investigating iridium due to its resistance to oxidation at high temperatures and its high melting point, which are problems associated with other commonly used transducer materials when used at elevated temperatures.

I created the iridium thin films via DC magnetron sputtering, which was an ideal method of deposition for a refractory material like iridium because other physical vapor deposition methods involve melting the metal target prior to deposition. I altered several conditions within the sputtering chamber such as temperature of the substrate during deposition as well as chamber pressure for each sample. I eventually studied the properties of these samples by x-ray diffraction to view the peaks produced by the samples, x-ray reflectivity to determine the thickness and deposition rate as well as a 4-point probe to determine the conductivity of the sample. I also learned how to use atomic force microscopy (AFM) to study the textures of the thin films and evaluate the smoothness of the film, with these images displayed in my poster. The properties of each of the samples were compared to determine what parameters resulted in the smoothest, most stable and conductive sample, as explained in my poster.

However, things didn't always run smoothly in the lab. As I was new to using all of the equipment, there were some occasions where things didn't work as I expected, which required a lot of thought or even asking for help. This seemed really daunting at first but I think it was really important for me to ask questions to ensure I understood everything that was going on and to prevent me from making mistakes later.

I can honestly say that completing this internship was one of the greatest things I have done since starting my university studies. I learned so much during my time at NCSU, whether it was from reading textbooks about vacuum chamber operation or learning how to operate laboratory equipment. I also got plenty of practice in communicating my research as I created my first research poster, which I was quite proud of. The exchange also provided me with the opportunity to go travelling and I was able to see many of the great things that the US has to offer, such as the amazing art galleries and architecture in Los Angeles, the lights in New York City at Christmas and a few days of snow in Raleigh, which felt like my second home. However, it is the wonderful people I met while completing this program that I will miss the most. It was an experience I will never forget and I encourage all materials science students to apply for this amazing program – you won't regret it!

Diamonds from the Sky



On a mission to chemically grow physically identical diamonds to those coming from the ground, School alumni Mana Ohori has established Australia's first ethical and sustainable lab-grown diamond start-up.

As I worked in the Jewellery manufacturing industry with precious metal casting, my interest in synthetic gemstones developed. Since I am personally an enthusiast for environmental sustainability and social justice, the conventional mining method of diamonds seemed far from ethical and I wondered if there was a way to fabricate them. I soon came across an article about CVD (Chemical Vapour Deposition) used to synthesise diamonds. Until now there was no company that was producing CVD diamonds for gemstones in Australia, which led me to start-up my own business.

The fact I am excited about is that the raw material you need to grow diamond is gases that are rich in carbon, which are greenhouse gases – this is where the company name "Diamonds from the sky" came from! Those gases are abundant resources on this planet and unlike mining where you had to have a mine site full of diamonds, this enables us to create diamonds regardless of where you are.

Until I get enough funding, I'm importing CVD diamonds from the US to create custom made engagement/wedding rings but I really hope to establish a lab here in Australia to grow diamonds on my own. My goal is to create an industry just like IT that doesn't rely on location and geological benefits and bring back manufacturing to Australia.

I believe that "ethical" doesn't mean sacrificing the beautiful things that have become so symbolic in our society but it does mean changing the way we acquire them. I also believe diamonds don't have to be just a "girl's" best friend anymore either! No more worrying about people risking their lives for not enough money in dangerous mining conditions overseas somewhere and vulnerable ecosystems been destroyed, you can get the shine on your finger.

Mana Ohori

MATSOC Report

Our goal in 2017 was to build a warm and welcoming school wide community for our students and to provide more opportunities for our undergraduate students to interact with the Materials industry.

What a year 2017 was for MATSOC. We started the year off by collaborating with one of the School's industry partners, Cochlear to aid our student's professional development. We held an Industry Discussion Panel in April, and a Speed Networking Evening in August with representatives from over 10 different companies with materials alumni.

As per tradition, we had our annual Liquid Nitrogen Ice Cream Stall during O-week, but it was bigger than ever, running over 3 days, which created a large exposure for Materials and MATSOC to the wider UNSW community. We also ran our annual school wide Trivia Night with PGSOC, creating a fun and relaxing night with lots of food and drinks, and learning interesting facts.

For the first time, we held a School wide Sports Day, in collaboration with PGSOC. The undergrads, postgrads and staff competed in a friendly soccer tournament while enjoying the sun and BBQ. The postgraduate students may have come out on top this year, but the undergrads are already training to claim next year's prize!

Continuing with our long-standing alliance with the Chemical Engineering Undergraduate Society, we also ran a joint First Year Camp, Cruise and End of Year Ball.

As the 2017 president, I could not have been prouder of the executive team, for their tireless effort and hard work to achieve the goals we set making this year the most successful to date. These successes could not have been possible without the support from Arc and the generous sponsorship from Cochlear and the School of Materials Science and Engineering. Thank you for your believing in us and helping us to achieve our goals.

First Year Camp Reviews

I have never been to such a wonderful camp in China. It was a completely new and exciting experience for me. As an international student at UNSW, it is worth attending the first year camp! Group games, night parties and awesome friends...Well for me, it wasn't just to have fun and make new friends, it was also learning about the Australian culture and adapting to a new environment. I would like to encourage more international students to get involved with school activities as it can also help improve your social and communication skills. My advice to all new students is to try to make as many friends as possible, they are kind and willing to chat with you!

Guangyu (Leon) Hu
(MATSOC International Students Representative)

From building the world's tallest newspaper tower to dancing the night away, 1st year camp was such a great experience in so many ways! It's such a good feeling to know that I can now walk into pretty much any lecture and have new friends to sit with - I went in only knowing a handful of people and before I even got on the bus, I'd met a solid group of friends. The parties were awesome, with the leaders doing a great job running everything, the DJ killing it and the dance shack buzzing.

For us, the key highlights were all the team games and activities throughout camp, helping us form amazing bonds with our camp "families". Through building paper towers, strutting our stuff on the catwalk with a newspaper fashion show, and putting our world-class engineering skills to the test with an egg drop challenge - it was all the fun games like these that made camp truly an eggcellent time as a whole. The competitive atmosphere and everyone joking together meant everyone always had a smile on their face!

Overall I think this camp was a truly unforgettable experience, delivering sore throats from all the shouting and laughing, sore legs from all the dancing and partying, great memories, amazing friends and a little bit of vomit... 10/10 start to the year, definitely not to be missed!

Bernadette Puadadera and Bryson Klein
(MATSOC First Year Students Representatives)

Practicum Exchange

Amanda Chen

During the Summer holidays, I was lucky enough to participate in a research exchange with the Biomedical Engineering department at National Yang-Ming University (NYMU), Taipei, Taiwan. The students at NYMU were very welcoming and helped us settle in.

After the first few days, we began our research projects and saw just how rewarding research life could be. My research project looked at increasing the efficacy of radiotherapy with AuNP@SiO2. I fabricated many batches of gold nanoparticles and coated them in SiO2. Unfortunately, many of the samples were low quality as the nanoparticles became agglomerated. The Master students in my research group were very experienced in this project and after they fabricated the nanoparticles, they tested their effectiveness in human cancer cells and if the nanoparticles were successful, in rats.

I also worked on synthesising water-soluble derivatives of chitosan and testing their antibacterial properties. I was able to learn many lab and characterisation techniques including: pipetting, dynamic light scattering (DLS), zeta sizer, animal handling, streak-plating bacterial cultures, anti-bacterial tests and Fourier-transform infrared spectroscopy (FTIR). I really enjoyed working in the laboratory and admire the organisation of my supervisor and the other students at NYMU. My supervisor, Professor Liu, encouraged us to focus on making plans and making realisations via self-management and good communication. This motivated me to work harder and helped me become a better researcher.

The daily walk up the mountain to the research building was very good exercise and the views of Taipei from the top of the mountain were spectacular! Each day, I worked in the lab from 10am until about 6pm, then headed off campus to explore the neighbourhood.

Each week we explored a different part of Taiwan. From letting off lanterns at Shifen to eating street food at Shilin Night Market, we experienced so much of Taiwanese culture. My favourite place was

Tamsui where we visited the little stalls along Old Street for food and souvenirs. There was also a beautiful bridge and we walked along the wharf and admired the sea.

I had a lot of fun times with the lab students and especially liked the Taiwanese tradition of Christmas gift exchange. In my research group, we each bought a present that fit the theme, for a randomly-picked giftee. We opened the gifts at the Christmas party where the students from our lab prepared activities and food for us. They also arranged some games which used English just for us!

I thoroughly enjoyed my exchange at Yang-Ming University – I gained research experience in an international environment, met new people and experienced a new culture and perspective. My experience in Taiwan was unforgettable and I will cherish the memories I made with the students there.

Alumni Profile

Name:	Muhammad Mahfuzur Rahman
Current Role:	Rolling Mill Metallurgist
Current Employer:	Moly-Cop
Graduating Year:	2010
Highest Qualification:	PhD

■ What did you study (include your major)?

I have studied Materials Science and Engineering.

■ Why did you choose to do a Materials Science degree?

I had a passion for recycling materials

■ What was your experience being a Materials Science student?

My experience was great as a Materials Science Student. My Supervisor was very helpful and knowledgeable in the field and help me a great deal to achieve my goal.

■ Where are you working now and what is your role?

Currently I am working at Moly-Cop Altasteel as a Rolling Mill Metallurgist.

■ What does your current role involve?

Generally my current role involve maintaining rolling recipes, confirm physical properties of the rolled products, continuous improvement projects, provide direction on product quality and set standards for various rolled products.

■ After graduating, how did your career path evolve?

After my graduation, I joined OneSteel graduate program and move around different plants. I was working to various metallurgical projects on different site and at the same time had chance to work with many great metallurgist.

■ Do you have any advice for school leavers considering studying Materials Science at UNSW Sydney?

Look for opportunities which are available and also search for opportunities through your professional network. It's a great way to introduce with different level of professionals. Also be prepared to work anywhere. The first step is to put your foot on the job and have fun.

■ Please share any fond memories you have of your time studying Materials Science at UNSW Sydney.

I miss badminton sessions with my friends at university gym. We used to get together every week and play badminton. It was also our get-away from study - relaxation and socializing.

PGSOC Report

Student Welcome

The year kicked off with an ice-breaking pizza party to welcome new students to the School. The event also allowed new postgrads to get to know their fellow peers as well as academics and staff during the lunch break.

Peer Mentoring

For the first time, postgraduate coursework students combined with research students, to create one epic support group within the Peer Mentoring program. Seventeen Peer Mentors were appointed to nurture the new expanded cohort at events including a tea party, Botany Bay National Park walk and BBQ at the Domain.

A feast was served at the latter and Emily guided students around the Royal Botanic Garden and Circular Quay. After a fun day with the mentors, the new students expressed readiness to embark in their program of study.

Friday Social

To end a busy, productive week, students gather to socialise and enjoy a well-earned break from their studies. Friday Socials continue to bridge the gap between students and staff, bringing the School together with themed nights, board games, snacks and mini-events held throughout the year.

A themed social takes place each month, for a festival or special occasion, including Chinese New Year and St Patrick's Day. PGSOC organise theme-specific snacks and games to really get in the spirit!

Sports Day and BBQ

Our first collaboration with MATSOC was a huge success as we hosted a mini-Sports day with a BBQ. Undergrads, postgrads and School staff tussled it out in the soccer tournament, but we rightfully came out on top!

Baking Competition

The annual baking competition was a resounding success as students and staff showcased their culinary talents, while raising money for Cancer Council Australia. Daniel Sando took out the top prize, but after spending the morning tasting delicious, home-made offerings everyone left feeling like winners!

Poster Competition

The poster competition is one of the biggest events on PGSOC's calendar. A highly regarded professional development event, entrants must condense large amounts of data, produce beautiful figures and eloquently convey complex ideas to a broad audience. We had a record number of entrants and congratulate all the participants, in particular the winners: Yun Xie, Fred Marlton, Christian Legerer, Sukriti Mantri and Ralph Bulanadi.

Special thanks to the judges: John F Kell, Dr. Bernd Gludovatz and Dr. Yijiao Jiang for their insightful judging on the day.

Joint Trivia night w/ MATSOC

In August, PGSOC teamed up with MATSOC for the annual Trivia night in the Greenhouse. Mixed teams of undergrads, postgrads and staff battled it out as the Quizmaster challenged each team with tricky (and sometimes cheeky) questions!

The night was finally decided in an exciting dual in which every team reproduced the Sydney Harbour Bridge with play dough.

New PGSOC Committee

The Annual General Meeting (AGM) was held in October at which the new PGSOC committee for 2018 was elected; Collin Park (President), Joel Shenoy (Vice President), Cesar Menendez Muniz (Treasurer), Xi Shi (Secretary), Kristina Fidanovski (Arc Delegate), Yiyao Wang (Coursework Representative).

The PGSOC team is very thankful for the work done by the outgoing PGSOC team and the continued support from both the School and the postgraduate students themselves.

See you in Sydney this September!

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IMC19

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OPAL PARTNERS: JEOL, ZEISS

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BRONZE PARTNERS: BRUKER, OXFORD INSTRUMENTS, NanoMEGAS

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- PHYSICAL SCIENCES
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Plenary Speakers

PROF DAN SHECHTMAN

Nobel Prize Winner, Technion - Israel Institute of Technology

A/PROF JENNIFER DIONNE

Stanford University, USA

PROF ZHIWEI SHAN

Xi'an Jiaotong University (XJTU), China

DR MISTY JENKINS

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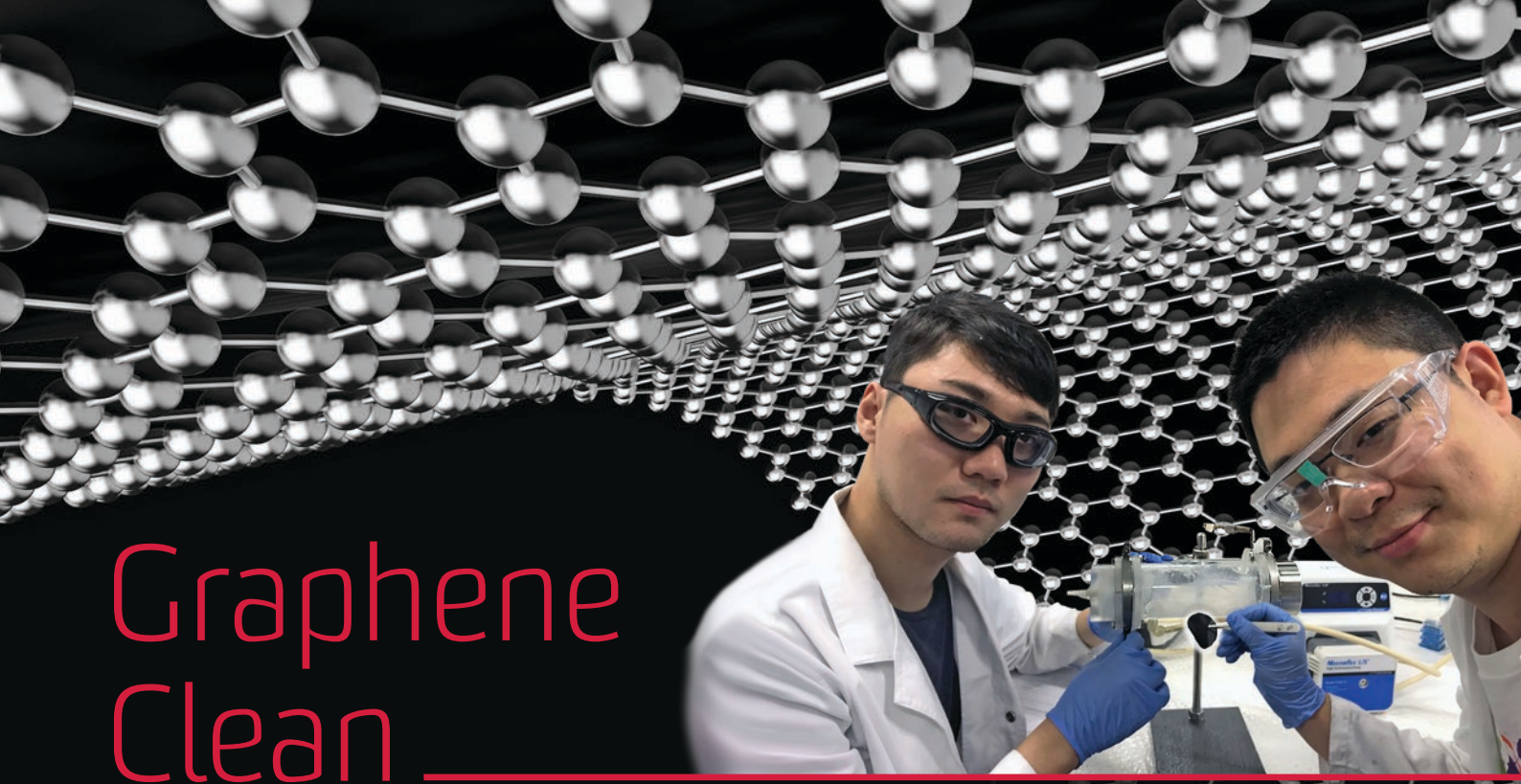
MICROSCOPY: BRIDGING THE SCIENCES



Graphene Clean

Dr. Rakesh Joshi and his team at UNSW are working on using graphene oxide membranes for filtration and water purification.

The University of New South Wales (UNSW) and Sydney Water (SW) have developed a laboratory scale process using graphene oxide (GO) membranes to remove natural organic matter (NOM) from filtered water that the standard coagulation process could not.

Graphene Oxide-based membranes can reject more that 99% of natural organic matter while maintaining a high-water flux almost at atmospheric pressure.

Graphene is a "super strong" material that can be used in micrometer thick resulting in large flows. The research identified the main factors that determine the performance of GO membranes. Results indicate that it is possible to develop a graphene oxide-based technology which could be retrofitted in water treatment plants to manage NOMs. Their research findings are far-reaching, and graphene oxide membranes can become industrial alternatives requiring a fraction of the energy that standard nanofiltration with polymeric membranes which operate at >20-30 atmospheres.

By reducing the NOM, the possibility of exceeding limits in disinfection by-products that affect public health is eliminated. NOM is increasing in water that reaches SW's water treatment plants, particularly after heavy rain events. Conventional coagulation-based treatment only removes around 30% NOM. Without a solution, Sydney Water could face upgrades to the treatment processes at filtration plants costing hundreds of millions of dollars over the next decade.

The GO membrane-based technology is being developed for retrofitting into Sydney Water's existing billion-dollar infrastructure to provide alternatives for NOM management at the plants and minimize disinfection byproducts formation. The research will continue. They have built a small-scale rig with tubular membranes, enabling the development and installation of a GO pilot plant for results validation in full-scale water treatment plants.

The fact that graphene oxide membranes can be mechanically strong at a few microns thickness makes it a "game changer" in the water industry. In addition to NOM rejection, there are many other applications such as the removal of chemicals of concern in wastewater treatment effluents. A promising cost-effective new technology with potential well beyond NOMs removal. As their new GO membrane is tuneable, it can be developed to precisely target contaminants in water, such as pharmaceuticals in wastewater treatment effluents.

Worldwide, the water treatment market was valued at USD 145 billion in 2015 and is forecast to reach $192 billion by 2022, as global growing demands for potable water coincide with shrinking supplies of clean raw water. A new membrane technology that can operate at low pressures and capable of addressing a range of issues in the water industry is potentially transformative.

SMaRT Report

3D printed products from waste plastics: A step towards a sustainable future using microfactory technology

In a breakthrough in recycling technology invented at Centre for Sustainable Materials Research & Technology, SMaRT centre, a simple replica of Mahatma Gandhi's spectacles has been created using common waste plastics from electronic goods that we usually throw away. The waste plastics have been recycled into plastic filaments, enabling the glasses to be 'printed out', as well as other potential products in the future made from composite waste. This latest research represents a remarkable step towards a sustainable future using microfactory to produce value-added green materials and products that are made from 100 per cent waste materials.

This unique UNSW microfactory technology brings the solution to the problem. A microfactory is a custom designed small scale solution set up to transform waste into valuable resources. SMaRT Centre researchers have developed these cost-effective solutions that can be located almost anywhere. UNSW's microfactory technology offers new opportunities to generate income from waste and to create local jobs, while delivering local and global environmental benefits.

The technology is the result of research funded by ARC and industry partners and led by Scientia Professor Veena Sahajwalla, an ARC Georgina Sweet Australian Laureate Fellow and Director of ARC's Industrial Transformation Research Hub for Transforming Waste Directly in Cost-effective Green Manufacturing—a unique collaboration between researchers and industries that is transforming all types of waste into valuable resources.

Researchers at the ARC Research Hub, which hosted at Professor Sahajwalla's Centre of Sustainable Materials Research and Technology (SMaRT) at UNSW, invented this new technology as part of a ground-breaking microfactory solution.

The replica 'Gandhi glasses' were presented to the Indian Prime Minister, Narendra Modi, by Australian Prime Minister, Malcolm Turnbull, as a memento of the Australia-India bilateral relationship during an Australia-India Skills Conference held in India in April 2017.

The SMaRT team created a replica of Mahatma Gandhi's spectacles using e-waste plastic.

The replica 'Gandhi glasses' were presented to the Indian Prime Minister, Narendra Modi, by Australian Prime Minister, Malcolm Turnbull, as a memento of the Australia-India bilateral relationship during an Australia-India Skills Conference held in India in April 2017

(Image © Hindustan Times)

2017 PLuS Alliance Prize for Innovation in Research

The PLuS (Phoenix-London-Sydney) Alliance – Arizona State University, King's College London, and UNSW Sydney – is a unique partnership between three leading international universities. Launched in February 2016, the PLuS Alliance enables research-led solutions to global challenges while expanding access to world-class learning.

Professor Veena Sahajwalla was awarded the PLuS Alliance Prize for Research Innovation for her project 'The new science of green manufacturing'. She is reimaging the global supply chain by demonstrating the viability of 'mining overburdened landfills for resources.

Jubilee Professorship

Professor Veena Sahajwalla, was awarded the prestigious Jubilee Professorship by the Indian Academy of Sciences in 2017. Veena is the first female scientist to receive this prestigious accolade.

The Indian Academy of Sciences, founded in 1934 by Nobel Prize winning physicist, Sir C.V. Raman, instituted the Jubilee Professorship during the Platinum Jubilee Year of the Academy in 2009. The Professorships offers the holder an opportunity for interactions and exchanges with students, researchers and teachers across India and takes forward the Academy's aim of promoting progress and upholding the cause of science throughout the country.

The Jubilee Professor may pursue any scientific activity during the year - Veena's focus will be the omnipresent crisis of e-waste in India. She is piloting micro-factories to turn unwanted electronics into valuable metal alloys, promising a safe new way for poor communities in India to generate an income from the production of metal alloys.

As part of this award Professor Sahajwalla was invited by the Indian Academy of Sciences to tour India. Tour was between 11- 29 August, she visited 9 cities, namely New Delhi, Bhubaneswar, Varanasi, Chennai, Mumbai, Khopoli, Pune, Bangalore, and Hyderabad. Veena presented at numerous academic institutes and interacted with senior academic, researchers and students. Veena met with relevant industries during the tour as well.

In New Delhi, Professor Sahajwalla held meetings with the Australian High Commissioner, Ms Harinder Sidhu, and the president of the Indian Academy of Sciences Dr Ramakrishna Ramaswamy.

In Bhubaneshwar, the visit was hosted by Dr S. K. Biswal Chief Scientist, CSIR-Institute of Minerals and Materials Technology, where Veena presented on Green Steel and Microfactory technologies.

In Varanasi, Veena presented at IIT-BHU where the visit was hosted by Professor Dhananjai Pandey.

In Madras, Veena visited IIT-Madras, was hosted by Dr Murty, where she presented and held discussions with staff and students.

In Khopoli, Professor Sahajwalla visited Mahendra-Sanyo steel plant and held discussions with senior executives. Followed by visit to TCS (Tata Consultancy Services) in Pune and held discussions with their R&D team where both sides presented their work for potential collaborations.

In Bangalore, at Indian Science Academy, Veena met multiple faculty staff and students. Then to Hyderabad, where she had a meeting with CSIR-Indian Institute of Chemical Technology regarding Microfactories. Finally, to the Indira Gandhi Technical University for Women in New Delhi. She was very warmly received and had a robust interaction with the students.

Torch

Torch Partnership

Part of the Torch innovation partnership between UNSW and China, the research collaboration between UNSW Science and Chinese company WeTouch aims to develop new types of touchscreens that are not only robust, but also sensitive enough to detect ten fingers at once.

The UNSW project with WeTouch to develop new piezoelectric-based screens that overcome the drawbacks of current screen technologies is led by the School's Professor Sean Li, Dr Danyang Wang and Dr Dewei Chu.

At the special launch event, the Faculty of Science Dean, Professor Emma Johnston commended the School for its leading role in;

"developing new touchscreens that are highly sensitive, accurate, low cost and made from readily available technologies, that could have a global impact."

First generation touchscreens use a resistive technology which relies on pressure on flexible layers of material. This approach is robust but energy expensive, single-touch and subject to rapid ageing.

Most of WeTouch's screens rely on capacitive sensing, where touch is detected by a change in the capacitance when a conducting object like a finger is placed on the screen. This approach allows for multi-touch capability and is energy efficient but can be inaccurate.

Chairman of WeTouch Australia Dr Peter French said the new technology using piezoelectric materials was aimed at delivering a robust yet precise, multi-touch screen, with the added benefit that "typing with all ten fingers is possible".

"As chairman of WeTouch Australia, I am very pleased to be part of this very exciting program of research that can showcase Australian innovation generally and that of UNSW in particular... to enhance and improve all our lives," he said.

WeTouch, which is based in Sichuan Province, has grown rapidly since it was founded in 2011 and now produces medium to large-scale touchscreens for a variety of industries, including retail, finance, gaming, health and the automotive industry, for customers including Siemens, Schneider Electric and Canon.

(Credit: UNSW Science media officer Deborah Smith)

WeTouch

This project aims to develop highly sensitive and transparent piezoelectric pressure sensors using a low-cost method for next generation touch screens. To date, large-scale highly transparent piezoelectric films were successfully grown on ITO coated glass substrates using RF sputtering. Strong piezoelectric response of the as-deposited films was confirmed. These films also exhibited excellent temperature stability of ferroelectric/piezoelectric properties from room temperature up to 100 °C.

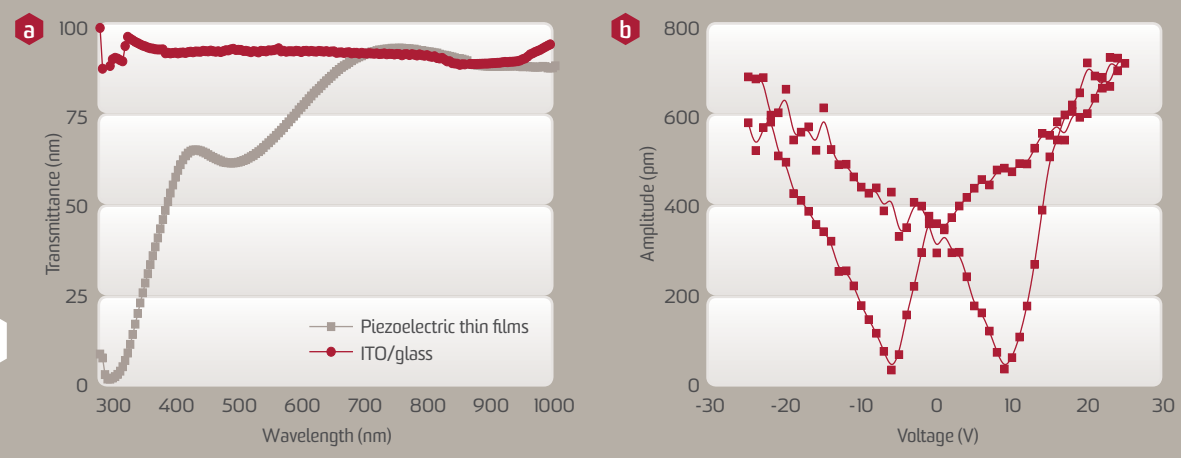
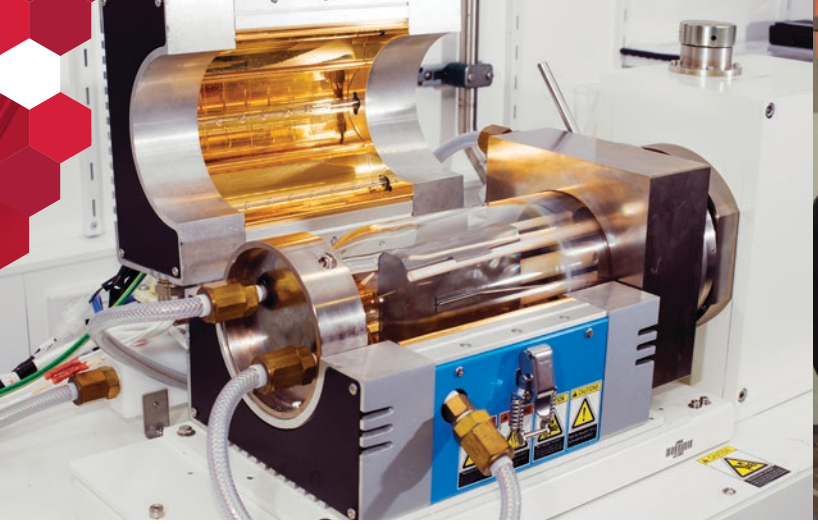


Fig 2. (a) UV-visible transmission spectrum of the piezoelectric film deposited on ITO/glass. (b) Local piezoresponse amplitude-voltage butterfly loop of the as-deposited piezoelectric film. The piezoelectric coefficient (d33) is estimated to be ~120 pm/V.



Landerful

Background

Fe-based amorphous/nanocrystalline alloys have been widely used in transformers, ground fault protection devices and high frequency cores. To increase the saturation magnetization (Bs) further, it is necessary to anneal the amorphous alloys at temperatures near or above the first crystallization peak corresponding to the crystallisation of a-Fe (bcc), but this could affect the mechanical properties and in particular the ductility, leading to brittleness. To date, most of the attention in Fe-based metallic glass systems has been devoted to designing new alloying systems or investigating the effects of different alloying elements on the magnetic, thermal stability, glass forming ability and the grain size. However, it was unclear how and to what extent this nanocrystallization would have affected the mechanical integrity and ductility of the amorphous/nanocrystalline ribbon.

Aims and Methodology

In our previous study, we have developed a new technology, stress-relaxation treatment, being a thermal treatment carried out at temperature below the glass transition temperature (T < Tg), which have been employed to eliminate the residual microstress trapped inside the amorphous ribbon (due to the high cooling rate during the melt-spinning process) without affecting the microstructure significantly and with a minimum impact on the ductility.

In this project, we aimed to examine the effect of stress-relaxation treatment at different temperatures below the crystallization peak in an FeSiBNb alloy on the magnetic texture, mechanical properties and variation of defects using a combination of Mössbauer spectroscopy, nanoindentation, and positron annihilation lifetime spectroscopy (PALS). In addition, dynamic mechanical analysis (DMA) was used to study the viscoelastic behaviour of the amorphous ribbon during heating.

Highlights of Achievements

- Stress-relaxation improved the magnetic texture by 6%.
- Extremely fine grains (3–5 nm in size) were obtained after thermal annealing below Tg.
- Two lifetimes (τ1 and τ2) were observed, corresponding to interstitial defects and free-volume.
- Hardness and reduced modulus increased after stress-relaxation treatment.
- MD simulation has been sucesfully used to simulate the stress-relaxation treatment and nanoindentation.

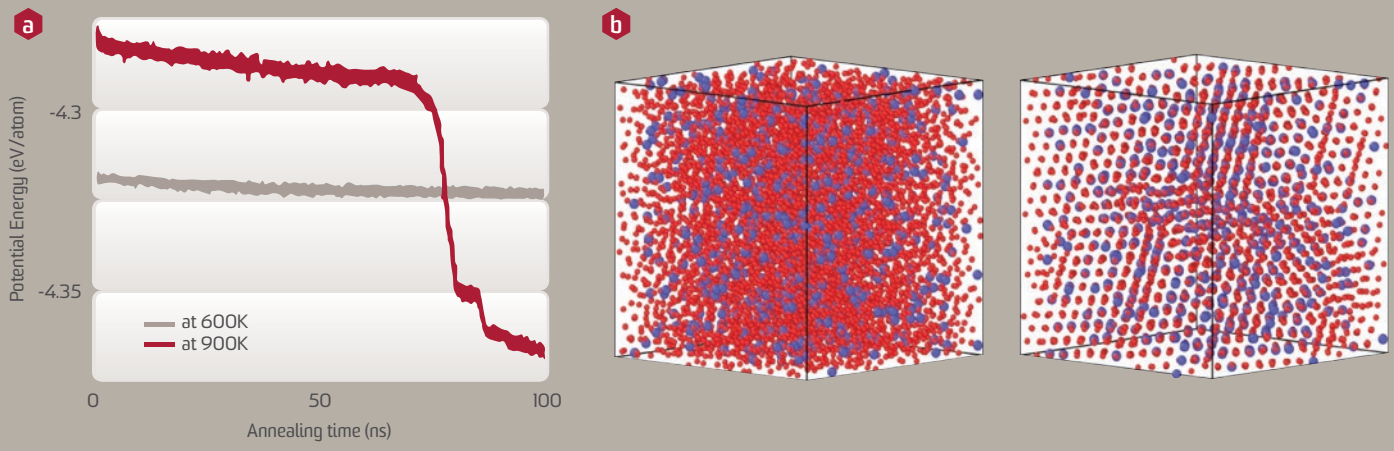


Fig 1. (a) Potential energy vs. time for annealing at two temperatures below T_g, and (b) atomic structures in as-quenched state (left) and after annealing at 900 K for 100 ns.

Current Research Grants

ACARP Competitive Grant Funding	**Koshy, P.**, Drew, M., **Chen, W.-F.**, Lomas, H., **Gupta, S.**, **Sorrell, C.**, *In-Situ High Temperature Strength of Low CSR Cokes - Stage II*, $60,000
ACARP Competitive Grant Funding	**Koshy, P.**, Drew, M., **Gupta, S.**, **Sorrell, C.**, *In-Situ High Temperature Strength of Low CSR Cokes - Stage I*, $44,000
ACARP Competitive Grant Funding	**Koshy, P.**, Drew, M., **Xing, X.**, **Chen, W.-F.**, Lomas, H., **Gupta, S.**, **Sorrell, C.**, *In-Situ High Temperature Strength of Low CSR Cokes - Stage III*, $86,000
AINSE	**Faraji Ouch Hesar, N.**, Gilbert, E., **Seidel, J.**, *Skyrmion system in a chiral multiferroelectric thin film of Cu_2OSeO_3. PGRA for Nastaran Faraji Ouch Hesar*, $9,375
AINSE	**Kong, S.**, **Daniels, J.**, *Dynamics at the morphotropic phase boundary of lead-free ferroelectrics*, $5,000
ARC Centre of Excellence	**Seidel, J.**, **Valanoor, N.**, *ARC Centre of Excellence in Future Low-Energy Electronics Technologies FLEET*, $3,425,687
ARC DECRA	**Primig, S.**, *Engineering hierarchical microstructures in high strength low alloy steels*, $368,446
ARC DECRA	**Tang, C.**, *Materials Design for Self-toughening Bulk Metallic Glasses*, $368,000
ARC Discovery Project	**Ferry, M.**, *A new crystallographic approach to deformation and annealing of metals*, $425,500
ARC Discovery Project	**Ferry, M.**, **Laws, K.**, Birbilis, N., *Ultra-lightweight alloys with unique multi-dimensional property profiles*, $355,100
ARC Discovery Project	**Hart, J.**, Hermawan, M., Iwase, A., Moore, V., Scott, J., Ng, Y., *Advanced anodisation methods and materials for solar water splitting*, $315,000
ARC Discovery Project	**Li, S.**, Koumoto, K., *Beyond Phononic Crystals-Building New Concepts to Enhance Thermoelectricity*, $384,700
ARC Discovery Project	**Li, S.**, Koumoto, K., *High Performance Complex Oxide Heterostructures for Nanoelectronic Devices*, $373,500
ARC Discovery Project	**Munroe, P.**, **Valanoor, N.**, Morozovska, A., Weyland, M., *'Designer defects' - A new approach to functional oxide interfaces*, $473,900
ARC Discovery Project	**Munroe, P.**, Xie, Z., Xu, J., *Design of Tough, Durable and Corrosion-resistant Coatings*, $325,500
ARC Discovery Project	**Sahajwalla, V.**, **Joshi, R.**, *Thermal isolation: a novel pathway to transforming complex waste*, $267,804
ARC Discovery Project	**Seidel, J.**, Manske, D. Rubhausen, M., Ulrich, C., *Topological spin systems as basis for novel multifunctional materials*, $355,000
ARC Discovery Project	**Sorrell, C.**, **Hart, J.**, **Koshy, P.**, *Engineering Quantum-Size Bioceramics: Photocatalytic / Sonocatalytic Ceria*, $301,500
ARC Discovery Project	**Valanoor, N.**, Morozovska, A., *Engineered control of polarization rotation in ferroelectric bilayers*, $400,500
ARC Discovery Project	**Wang, D.**, Dai, J., Tan, X., *Lead-free oxide perovskites for highly efficient solar cells*, $300,000
ARC Discovery Project	**Young, D.**, **Zhang, J.**, *Controlling nickel-base alloy high temperature corrosion in CO_2-rich gases*, $399,500
ARC Future Fellowship	**Cazorla Silva, C.**, *Rational Design of Novel Multiferroic Materials for Energy Harvesting and Energy Efficiency*, $621,374
ARC Future Fellowship	**Chu, D.**, *Building Novel Solid State Electric Double Layer Transistors with Interface Engineering of Ionic Conductive Oxide Superlattices*, $735,144
ARC Future Fellowship	**Yi, J.**, *Enhance ferromagnetic ordering by exchange coupling and defect engineering*, $776,000
ARC Industrial Transformation Research Hub	**Ostrovski, O.**, Zhang, C., **Zhang, J.**, *Investigation of CaO-Al_2O_3-based mould fluxes for the continuous casting of high-Al steel*, $150,000
ARC Industrial Transformation Research Hub	**Sahajwalla, V.**, **Ostrovski, O.**, Dippenaar, R., Douglas, A., Fernandes, M., Lloyd, S., Prusty, G., Rasmussen, K., Singh, R., Tooze, I., *Transforming Waste Directly in Cost-effective Green Manufacturing*, $4,496,756

ARC Industrial Transformation Research Hub	**Yang, R.**, *"Grindability" test: modelling, measurement and mill fingerprinting*, $50,000
ARC Laureate Fellowship / Georgina Sweet Award	**Sahajwalla, V.**, *Fundamental high temperature e-waste investigations for high-value products*, $4,592,747
ARC LIEF Grant	Anderson, I., Andrew, R., Cairns, M., **Ferry, M.**, Ford, M., Kennedy, E., King, G., Lee, S., Lewis, G., Muller, D., Radom, L., Samali, B., Smith, B., Unmack, P., Wilkins, M., Hawkes, E., *Maintaining Intersect member access to the NCI peak supercomputing facility*, $900,000
ARC LIEF Grant	Anderson, I., Cairns, M., **Ferry, M.**, Ford, M., Kennedy, E., King, G., Lee, S., Lewis, G., Muller, D., Radom, L., Samali, B., Smith, B., Unmack, P., Wilkins, M., Hawkes, E., *Maintaining Intersect member access to the NCI peak supercomputing facility*, $310,000
ARC LIEF Grant	Bradby, J., Cairney, J., Hao, X., **Li, S.**, Liao, X., Loehr, S., Ma, Q., **Munroe, P.**, Pereloma, E., Saunders, M., Sun, B., Tieu, K., Zhang, L., Zheng, R., Tilley, R., *Plasma Focused Ion Beam for Nanoscale Characterisation of Materials*, $2,130,000
ARC LIEF Grant	**Daniels, J.**, Donne, S., Guo, Z., Kennedy, B., Kepert, C., Kisi, E., Ling, C., O'Connor, J., Schmid, S., Wang, D., Wang, J., Sharma, N., *Instrumentation for Powder X-ray Diffraction under Extreme Conditions*, $42,000
ARC LIEF Grant	Hamilton, A., McKenzie, D., Micolich, A., Ulrich, C., **Valanoor, N.**, **Seidel, J.**, *Next-Generation Electronic and Magnetic Materials Characterisation Facility*, $40,000
ARC LIEF Grant	Tilley, R., **Munroe, P.**, *Next generation, ultrahigh resolution TEM for the characterisation of matter in space and time*, $75,000
ARC Linkage Project	Byrnes, R., Craig, P., **Crosky, A.**, Hagan, P., Hebblewhite, B., Johnson, R., McCowan, B., Sheffield, P., Timms, W., Saydam, S., *Avoiding catastrophic failure of cable bolts in underground mines*, $240,000
ARC Linkage Project	**Crosky, A.**, Georogiadis, S., Gosse, J., Prusty, G., Pearce, G., *Onset Theory: Pushing the design envelope for textile composite structures*, $510,000
ARC Linkage Project	**Ferry, M.**, **Laws, K.**, Patel, Y., *Reducing the environmental impact of passenger vehicles by the design of lightweight alloy components*, $727,000
ARC Linkage Project	Huang, H., Jiang, Z., Wang, L., **Zhang, J.**, *Understanding the role of nanoparticles in water-based lubrication*, $45,000
ARC Linkage Project	**Sahajwalla, V.**, Bhushan, B., Freislich, M., **Khanna, R.**, *Lower temperature ironmaking:macro and atomic-level understanding of accelerated carburisation of reduced iron*, $330,000
ARC Linkage Project	**Sorrell, C.**, **Koshy, P.**, *Fibre-Reinforced Composites: Single-Crystal Mullite Fibres from Topaz*, $195,000
ARC Linkage Project	**Sorrell, C.**, **Koshy, P.**, *Fibre-Reinforced Composites: Single-Crystal Mullite Fibres from Topaz*, $340,480
ARC Linkage Project	**Sorrell, C.**, **Koshy, P.**, Pandolfelli, V., da Luz, A., *New Paradigm for Materials Technology for AZS Glassmaking Refractories*, $340,000
ARC Linkage Project	**Yang, R.**, Shen, Y., *Preparation and use of lignite-iron ore composite briquettes for ironmaking*, $694,000
ARC Research Hub	Chu, K., Curtis, J., Dong, K., Evans, T., Fan, L., Guo, B., Hapgood, K., Hu, D., Jiang, X., Kuang, S., Li, J., Luding, S., Mao, X., Pan, R., Rudman, M., Selomulya, C., Shen, Y., Song, S., Strezov, V., Wang, G., Williams, R., Yan, W., Yu, A., Zeng, Q., Zhao, B., Zhou, D., Zhou, Z., Zhu, H., Zhu, J., Zou, R., **Yang, R.**, *ARC Research Hub for Computational Particle Technology*, $125,000
ARC Research Hub	**Crosky, A.**, Georogiadis, S., Gosse, J., Prusty, G., Pearce, Garth, M., *Onset Theory: Pushing the design envelope for textile composite structures*, $10,000
Australia-Germany Joint Research Cooperation (DAAD)	**Chen, W.-F.**, **Koshy, P.**, **Sorrell, C.**,*Synthesis of Doped Pyroxene Phase Change Materials*, $19,500
CRC for Low Carbon Living	Amin, S., Bartesaghi Koc, C., Bruce, A., Craft, W., Diaz Sandoval, C., Fiorito, F., **Heriyanto.**, Hodge, T., Irger, M., Karim, S., Macgill, I., Marzban, S., Osmond, P., Peters, A., Prasad, D., Roberts, M., **Sahajwalla, V.**, Sanchez Gomez, A., Sproul, A., Thompson, S., Timchenko, V., Williams, P., Yang, S., Ding, L., *CRC LCL Node of Excellence in High Performance Architecture*, $39,000
CRC For Low Carbon Living	**Sahajwalla, V.**, Douglas, A., Gaikwad, V., Ghose, A., **Pahlevani, F.**, *Prototyping, testing, optimising and demonstrating the industrial scale production of composite engineered stone from reclaimed glass*, $70,000

Current Research Grants

CRC For Low Carbon Living	**Sahajwalla, V.**, **Heriyanto.**, *Glass recycling for waste reduction in built environments - Scholarship for Heriyanto*, $105,000
CSIRO PG Scholarship	**Sahajwalla, V.**, Cole, I., Saha-Chaudhury, N., **Shokri, A.**, *Recycling rare earth bearing waste products into value added alloy*, $21,000
CSIRO PG Scholarship	**Sahajwalla, V.**, **Ganly, B.**, *Advanced X-Ray Fluorescence Methods for Mineral Samples*, $39,000
CSIRO PG Scholarship	**Yap, E.**, **Daniels, J.**, *Postgraduate Student Agreement*, $39,000
Industry	**Laws, K.**, Park, E., *The Australia-Korea Advanced Metal Alloys/Metal Technology Project*, $61,980
Industry	**Chan, S.**, Jonsson, C., Yao, Y., *A Study on the Microstructure and Wear Properties of Ferrous Alloys Reinforced with In-Situ Formed (V, W)C*, $12,997
Industry	**Chu, D.**, **Li, S.**, *Development of RRAM*, $593,266
Industry	**Daniels, J.**, **Ly, T.**, Miljak, D., *CSIRO Mineral Resources*, $51,000
Industry	**Joshi, R.**, **Sahajwalla, V.**, *Developing Graphene Integrated Super-Composite Materials using End-of-Life Tyres - PhD Scholarship Yi You*, $75,000
Industry	**Joshi, R.**, **Sahajwalla, V.**, *Graphene Oxide Project*, $205,000
Industry	**Koshy, P.**, **Gupta, S.**, Lambert, N., Ata, S., *Effect of Flotation Water Chemistry on Coal Chemistry, Fluidity, and Coke Quality*, $150,000
Industry	**Koshy, P.**, **Gupta, S.**, **Sorrell, C.**, *Characterization of Anthracite/Thermal Coal Grain Interfaces in Cokes and Determination of their Implications on the Evolution of High-Temperature Mechanical Strength*, $76,090
Industry	**Li, S.**, **Chu, D.**, **Wang, D.**, *Graphene enhanced performance of transmission power cables and High performance power grid scaled graphene supercapacitors*, $2,500,000
Industry	**Li, S.**, **Chu, D.**, **Wang, D.**, *Pressure Sensors*, $1,084,640
Industry	**Li, S.**, Ionescu, M., Klose, F., *Isotope Engineering and Nuclear Characterisation of Novel Nanoscale Thin Film Functional Materials*, $217,530
Industry	**Li, S.**, **Zhang, J.**, *Isotope engineering and nuclear characterisation of novel nanoscale thin film functional materials*, $103,950
Industry	**Mawad, D.**, *Development of injectable conductive hydrogel*, $26,677
Industry	**Ostrovski, O.**, **Sharp, J.**, **Xing, X.**, Zulli, P., *Degradation studies of additional BHP Billiton's pilot oven cokes*, $26,500
Industry	**Ostrovski, O.**, **Xing, X.**, Mahoney, M., Monaghan, B., Rogers, H., **Sharp, J.**, Zhang, G., Zulli, P., *Characterising the degradation of cokes made from Australian coals and subjected to simulated blast furnace operating conditions*, $362,620
Industry	**Pahlevani, F.**, **Cholake, S.**, Haque, E., *Textile waste: a cost effective component for building materials*, $49,983
Industry	**Pahlevani, F.**, *Vinyl commercial flooring - recycling and reprocessing trials with partners in the supply chain*, $57,600
Industry	**Primig, S.**, *20cent coin LOM and SEM with hardness mapping; Precious metals analysis*, $11,000
Industry	**Primig, S.**, Filzwieser, A., **Legerer, C.**, *Potential of Ionic Liquids as New Heat Treatment Medium in Metallurgy Scholarship for Christian Legerer*, $77,614
Industry	**Primig, S.**, *High security safety feature*, $6,000
Industry	**Primig, S.**, Oberwinkler, B., **Theska, F.**, *High resolution analysis of strengthening effects in Ni-based alloys*, $236,046
Industry	**Primig, S.**, *Precious metals analysis*, $8,500
Industry	**Sahajwalla, V.**, **Pahlevani, F.**, Richardson, M., *Advertising banner reprocessing and design project*, $30,000
Industry	**Sahajwalla, V.**, *Research component for 3D plastic filament microfactory*, $450,000

Industry	**Seidel, J.**, *PFM measurements on GaN samples*, $13,000
Industry	**Sorrell, C.**, **Koshy, P.**, Chavara, D., Drew, M., **Gupta, S.**, **Toppler, K.**, *In-Situ High Temperature Strength of Low CSR Cokes*, $104,000
Industry	**Sorrell, C.**, **Koshy, P.**, *Mullite Fibre Template Fabrication & Mullite Fibre Formation from Topaz*, $50,189
Industry	**Sorrell, C.**, **Koshy, P.**, *UV Visualisation by Avian Fauna*, $7,700
Industry	**Sorrell, C.**, **Ukritnukun, S.**, **Koshy, P.**, *Development of Novel Geopolymer Compositions - Stage I; Investigation of Potential for Use of Metakaolin from Top Tung Deposit - Stage 2*, $11,526
Industry	**Young, D.**, *Corrosion in CO_2*, $103,562
NSW Dept of Industry	Lambropoulous, N., **Sorrell, C.**, **Koshy, P.**, *Detector for Asbestos Fibre Identification*, $15,000
RIS	Aguey-Zinsou, K., Amal, R., Castel, A., Hook, J., **Koshy, P.**, Ng, Yun H., **Pahlevani, F.**, **Sahajwalla, V.**, Scott, J., Sharma, N., **Sorrell, C.**, Stenzel, M., Van Kranendonk, M., Wang, D., Rawal, A., *MWAC: A Low Gamma NMR Probe for characterization of anti-cancer drugs, catalysts, geopolymers and energy storage materials*, $160,000
RIS	Boyer, C., **Cazorla, C.**, Dutta, R., Ng, Y., Taylor, R., Wang, D., Zhao, C., Aguey-Zinsou, K., *Faculty Infrastructure Project: A fuel cell tester to strengthen capability energy storage*, $85,668
RIS	**Chan, S.**, Hamed, E., Hazell, P., Pearce, G., Wang, C., Zhang, L., Prusty, G., *Faculty Infrastructure Project: Low to High Frequency Axial-Torsion Fatigue Test Machine*, $245,288
RIS	Chapman, R., Gooding, J., Lu, H., Marquis, C., **Mawad, D.**, Thordarson, P., Xiao, P., Stenzel, M., *Faculty Infrastructure Project: Nanoparticle characterization*, $105,920
RIS	Chen, S., Gooding, J., Stride, J., **Wang, D.**, Zhao, C., *Faculty Infrastructure Project: Hyphenated Nanocarbon Fabrication and Characterisation Facilities*, $98,884
RIS	Cheong, S., **Ferry, M.**, **Laws, K.**, **Primig, S.**, Walsh, W., Wang, C., Kruzic, J., *Faculty Infrastructure Project: Acquisition of a Mechanical Testing Stage for use in an Environmental Scanning Electron Microscope*, $37,875
RIS	**Chu, D.**, **Ferry, M.**, **Sorrell, C.C.**, **Standard, O.**, Uddin, A., Walsh, W., **Li, S.**, *Faculty Infrastructure Project: Specialized Glove Box Workstation for Synthesis of Atmosphere-Sensitive Materials for 3D and Thin Film Printing*, $100,000
RIS	**Ferry, M.**, Green, M., Hao, X., Kong, C., Lennon, A., **Li, S.**, **Munroe, P.**, **Sahajwalla, V.**, Thomas, T., Tilley, R., Zhang, J., Cheong Tilley, S., *MWAC: Low-energy argon milling system for TEM specimen preparation*, $272,697
RIS	**Ferry, M.**, Kruzic, J., **Laws, K.**, **Primig, S.**, *Network Lab: Technical Support Engineer*, $180,008
RIS	**Ferry, M.**, **Laws, K.**, **Primig, S.**, **Chu, D.**, **Zhang, J.**, Li, X., Gludovatz, B., Aguey-Zinsou, K., Obbard, E, *High Temperature, High Purity Atmosphere, Thermal Treatment Facility*, $159,697
RIS	Hamilton, A., **Joshi, R.**, Sharma, N., Ulrich, C., **Seidel, J.**, *Faculty Infrastructure Project: Flexible modular multilayer sputtering system*, $77,760
RIS	Hamilton, A., **Seidel, J.**, Srinivasan, A., **Valanoor, N.**, Wang, Q., Klochan, O., *Faculty Infrastructure Project: Atomic layer deposition system for dielectric and ferroelectric film growth over an extended temperature range*, $100,000
RIS	**Joshi, R.**, **Pahlevani, F.**, Prasad, D., **Rajarao, R.**, **Sahajwalla, V.**, *Faculty Infrastructure Project: Hyphenated Thermal Analyzer*, $54,960
RIS	**Li, S.**, **Munroe, P.**, **Sorrell, C.C.**, **Primig, S.**, Tilley, R., Liangchi, Z., Li, X., Cheong, S., Kong, C., Green, M., Hao, X., Lennon, A., *EBSD and EDS systems for PFIB*, $184,390
RIS	**Sorrell, C.**, Ulrich, C., **Wang, D.**, **Yang, R.**, **Daniels, J.**, *Faculty Infrastructure Project: Particle Size Analyser with wet and dry dispersion units*, $90,900
Torch Project	**Chu, D.**, **Li, S.**, **Lashgari, H.**, *High performance Fe-based Nanocrystalline Alloys*, $501,401
Torch Project	**Li, S.**, **Chu, D.**, **Wang, D.**, *Climate Responsive Transmission Lines*, $998,400

2017 Publications

Journal Papers

Mahjoub R, Xu W, Laws KJ, Ferry M, *Ab initio study of the likely orientation relationships of interphase and homophase interfaces in a two-phase HCP + BCC Mg-Li alloy,* Computational Materials Science, No. 139C, pp 406-4011, 2017

Vögler M, Daniels J, Webber KG, Rödel J, *Absence of toughening behavior in 0.94($Na_{1/2}Bi_{1/2}$)TiO_3-0.06$BaTiO_3$ relaxor ceramic,* Scripta Materialia, Vol. 136, pp 115-119, 2017

Mahjoub R, Laws KJ, Ferry M, *Amorphous phase stability and the interplay between electronic structure and topology*, Acta Materialia, Vol. 131, pp 131-140, 2017

Adabifiroozjaei E, Ma H, Koshy P, Sorrell CC, *Anorthite ($CaAl_2Si_2O_8$)–aluminum interface: kinetics of high-temperature interactions*, Journal of Materials Science Vol. 52, No. 11, pp 6767-6777, 2017

Channei D, Phanichphant S, Nakaruk A, Mofarah S, Koshy P, Sorrell, CC, *Aqueous and Surface Chemistries of Photocatalytic Fe-Doped CeO_2 Nanoparticles*, Catalysts, Vol. 7, No. 2, p 45, 2017

Muránsky O, Tran M, Hamelin C, Shrestha S, Bhattacharyya D, *Assessment of welding-induced plasticity via electron backscatter diffraction*, International Journal of Pressure Vessels and Piping, Vol. 164, pp 32-38, 2017

Turk C, Leitner H, Schemmel I, Clemens H, Primig S, *Atom probe study of B2 order and A2 disorder of the FeCo matrix in an Fe-Co-Mo-alloy*, Micron, Vol. 98, pp 24-33, 2017

Zheng Y, Zhou, T, Zhao X, Pang W, Gao H, Li S, Zhou Z, Liu H, Guo Z, *Atomic Interface Engineering and Electric-Field Effect in Ultrathin Bi_2MoO_6 Nanosheets for Superior Lithium Ion Storage,* Advanced Materials, Vol. 29, No. 26, 2017

Khanna R, Sahajwalla V, Seetharaman S, *Atomistic Monte Carlo Simulations on the Melting Transition of Iron at Ambient Pressure*, Research and Reports on Metals, Vol. 1, No. 2, pp 1-8, 2017

Vandermaat D, Saydam S, Hagan P, Crosky A, *Back-calculation of failure stress of rockbolts affected by Stress Corrosion Cracking in underground coal mines*, International Journal of Rock Mechanics and Mining Sciences Vol. 100, pp 310-317, 2017

Hamilton N, Mahjoub R, Laws KJ, Ferry M, *A blended NPT/NVT scheme for simulating metallic glasses*, Computational Materials Science, Vol. 130, pp 130-137, 2017

Young D, Gong Y, Kontis P, Chiu Y, Larsson H, Shin A, Pearson J, Moody M, Reed R, *Breakaway oxidation of Fe9Cr1Si steel in CO_2: characterisation and modelling*, Acta Materialia, 2017

Meng F, Gupta S, French D, Koshy P, Sorrell CC, Shen Y, *Characterization of microstructure and strength of coke particles and their dependence on coal properties*, Powder Technology, Vol. 320, pp 249-256, 2017

Taherymoosavi S, Verheyen V, Munroe P, Joseph S, Reynolds A, *Characterization of organic compounds in biochars derived from municipal solid waste*, Waste Management, Vol. 67, pp 131-142, 2017

Debnath J, Wang J, Zeng R, *Charge ordering and exchange bias behaviors in Co_3O_4 porous nanoplatelets and nanorings,* Journal of Magnetism and Magnetic Materials, Vol. 421, pp 422-427, 2017

Ye J, Joseph S, Ji M, Nielsen S, Mitchell D, Donne S, Horvat J, Wang J, Munroe P, Thomas T, *Chemolithotrophic processes in the bacterial communities on the surface of mineral-enriched biochars*, ISME Journal, Vol. 11, No. 5, pp 1087-1101, 2017

Kumar U, Maroufi S, Rajarao R, Mayyas M, Mansuri I, Joshi RK, Sahajwalla V, *Cleaner Production of Iron by using Waste Macadamia Biomass as a Carbon Resource*, Journal of Cleaner Production, Vol. 158, pp 218-224, 2017

Ragger K, Primig S, Daniel R, Kaiser R, Paal J, Mitterer C, Buchmayr B, *Cold pilgering of duplex steel tubes: The response of austenite and ferrite to excessive cold deformation up to high strains*, Materials Characterization, Vol. 128, pp 257-268, 2017

Ardi E, Dong K, Yu A, Yang R, *A combined experimental and DEM approach to determine the breakage of particles in an impact mill*, Powder Technology, Vol. 318, pp 543-548, 2017

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Cholake S, Rajarao R, Henderson P, Rajagopal R, Sahajwalla V, *Composite panels obtained from automotive waste plastics and agricultural macadamia shell waste*, Journal of Cleaner Production, No. 151, pp 163-171, 2017

Hamilton N, Howard B, Diesendorf M, Wiedmann T, *Computing life-cycle emissions from transitioning the electricity sector using a discrete numerical approach*, Energy, Vol. 137, pp 314-324, 2017

Ma Y, Bian Y, Liu Y, Zhu A, Wu H, Cui H, Chu D, Pan J, *Construction of Z-scheme System for Enhanced Photocatalytic H_2 Evolution Based on CdS Quantum Dots/CeO_2 Nanorods Heterojunction,* ACS Sustainable Chemistry & Engineering, Vol. 6, No. 2, pp2552-2562, 2017

Breen A, Babinsky K, Day A, Eder K, Oakman C, Trimby P, Primig S, Cairney J, Ringer S, *Correlating Atom Probe Crystallographic Measurements with Transmission Kikuchi Diffraction Data,* Microscopy and Microanalysis, Vol. 23, No. 2, pp 279-290, 2017

Handoko W, Pahlevani F, Sahajwalla V, *Corrosion behaviour of dual-phase high carbon steel – Microstructure influence*, Journal of Manufacturing and Materials Processing, Vol. 1, No. 21, p 21, 2017

Yu C, Zhang J, Young D, *Corrosion Behaviour of Fe–Cr–(Mn, Si) Ferritic Alloys in Wet and Dry CO_2–SO_2 Atmospheres at 650°C,* Oxidation of Metals, 2017

Nguyen T, Peng X, Zhang J, Young D, *Corrosion resistance of chromised and aluminised coatings in wet CO_2 gas at 650° C,* Surface and Coatings Technology, Vol. 316, pp 226-238, 2017

Mawad D, Figtree G, Gentile C, *Current Technologies Based on the Knowledge of the Stem Cells Microenvironments*, Advances in Experimental Medicine and Biology, Vol. 1041, pp 245-262, 2017

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Wang Y, Tseng L, Murmu P, Bao N, Kennedy J, Ionesc M, Ding J, Suzuki K, Li S, Yi J, *Defects engineering induced room temperature ferromagnetism in transition metal doped MoS_2*, Materials & Design, Vol. 121, pp 77-84, 2017

He Y, Evans T, Yu A, Yang R, *DEM investigation of the role of friction in mechanical response of powder compact*, Powder Technology, Vol. 319, pp 183-190, 2017

Du H, Wang Y, Arandiyan H, Younis A, Scott J, Qu B, Wan T, Lin X, Chen J, Chu D, *Design and synthesis of CeO_2 nanowire/MnO_2 nanosheet heterogeneous structure for enhanced catalytic properties*, Materials Today Communications, Vol. 11, pp 103-111, 2017

Wang Z, Song J, Gao F, Su R, Zhang D, Liu Y, Xu C, Lou X, Yang Y, *Developing a ferroelectric nanohybrid for enhanced photocatalysis*, Chemical Communications, Vol. 53, No. 54, pp 7596-7599, 2017

Wright S, Sun S, Jahanshahi S, *Development of a Suitable Slag Practice for Valorization of Fluorine-Containing Slags*, Journal of Sustainable Metallurgy, Vol. 3, No. 3, pp 515-527, 2017

Guan P, Sun Y, Wan T, Lin X, Xu Z, Chu D, *Development of ferroelectric oxides based resistive switching materials*, Materials Science and Technology (United Kingdom), Vol. 33, No. 17, pp 2010-2023, 2017

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