

A full-page photograph of a male scientist with dark hair, wearing safety glasses and a light blue lab coat over a striped shirt. He is wearing a white glove on his right hand and is holding a small, thin, reddish-brown object, possibly a microchip or a small component, between his fingers. He is looking down at the object with a focused expression. The background is a laboratory setting with blurred equipment and windows. The entire image has a blue color cast.

ANNUAL
REPORT
2015

New Dimensions



ARC Centre of Excellence for
Electromaterials
Science



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ACES- THE NEW DIMENSIONS

Welcome

Our Vision is to be the pre-eminent world centre for research in the field of electromaterials science and integrated device assembly.

We completed our first full year of operations during 2015.

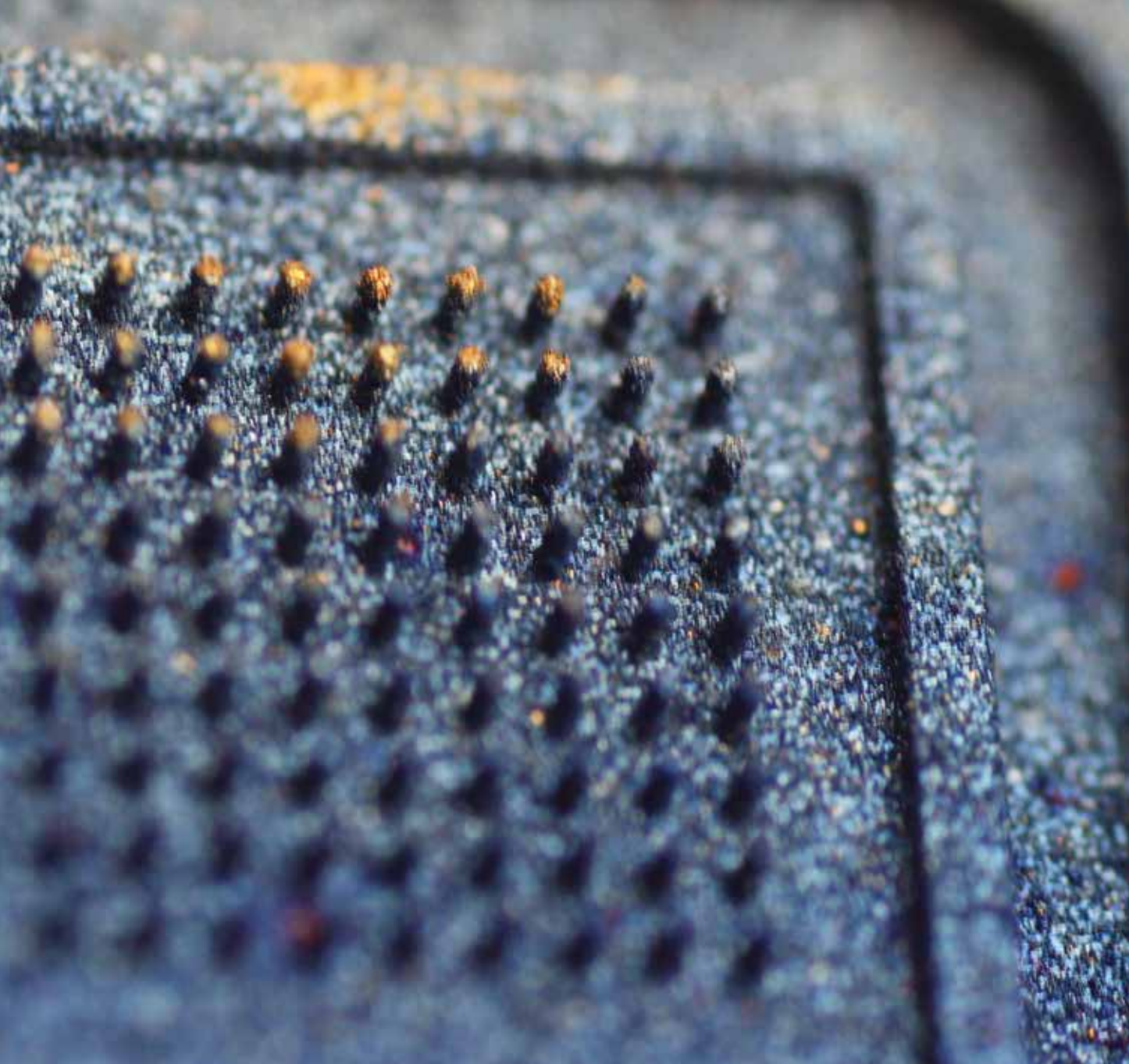
We have developed the ACES 2014-2020 Strategic plan; reconfirming our commitment to be the pre-eminent world centre for research in the field of electromaterials science and integrated device assembly.

This report shows how we have addressed our goals:

- To use our research into advanced materials to deliver innovative device solutions for clean energy and medical bionics.
- To deliver research programs that produce world-class graduates with not only exceptional technical skills, but skills in science communication, research management, commercialisation, and an awareness of the impact of their research.
- To realise commercial opportunities for our research through delivery of step-change technologies that positively impact on quality-of-life issues for the global community.
- To educate, inspire and engage stakeholders and the broader community, by effectively communicating our research messages.

The ACES Partners

We have established a global network of partners that will be integral to our success in research, training, commercialisation and engagement. ACES, led by the University of Wollongong, incorporates six Australian collaborating organisations and five international partner institutions known for their expertise in materials and device fabrication.



The collaborating organisations are Deakin University, Monash University, University of Tasmania, The Australian National University and The University of Melbourne.

The international partner institutions are Dublin City University, Ireland; University of Warwick, UK; Friedrich Alexander University of Erlangen, Germany; Hanyang University, Korea and Yokohama National University, Japan.

Each node possesses key research strengths that when combined, place ACES in a powerful position to design, discover and develop new electromaterials.

Our Funding

The Australian Research Council invested \$25 million in ACES over 2014-2020 to translate our materials science knowledge into practical, game-changing devices that will have a significant impact in the areas of diagnostics, energy, health and soft robotics.

The NSW Government also invested \$500,000 through its Research Attraction and Acceleration Program (RAAP) to help us facilitate the commercialisation of our research. This will assist in developing

innovative approaches that encourage entrepreneurship and commercialisation.

As we work towards our goals, we embrace the challenge of training the next generation of multidisciplinary research leaders, and providing new manufacturing and industrial opportunities for Australia.

The challenges are numerous, but the opportunities are even greater.

The ACES team is committed to building a knowledge base in an environment that ensures effective training that will be used to deliver economic returns for Australia.



DIRECTOR'S REPORT

ACES - an Agile Research Environment

Agility is the ability to be quick and graceful.

Prime Minister Turnbull has said that in order to create an economy based on innovation, a more agile approach to business is required.

To develop ideas into industries, agility is also required in the research environment-wherein researchers can move along the commercialisation path with their concepts, and return to the idea-generating cauldron of fundamental research.

Individuals within Australian Research Council (ARC) Centres of Excellence are selected on the basis of their ability to carry out world-class research in the fundamental science underpinning that centre. This is as it should be. However, attributes around the ability to engage across traditional boundaries-with both the commercial sector and the community-are proving to be equally important.

We are fortunate to find ourselves within the ARC Centres of Excellence

program, where such engagement skills are honed. We are fortunate that we find ourselves within a national research funding environment wherein we are encouraged to undertake highly innovative and potentially transformational research that tackles important multidisciplinary problems.

The revamped ARC Linkage scheme should enable rapid deployment of resources as commercial opportunities emerge. Links with Cooperative Research Centres (CRCs) can provide effective pathways to industrial networks. At ACES, we work closely with the CRC for Polymers, HEARing CRC, Energy Pipelines CRC and more recently with the Cell Therapy Manufacturing CRC.

The National Health and Medical Research Council provides a means to build clinical networks that transcend the normal boundaries of the ARC. ACES has established a dynamic clinical network that spans Australia and is now attracting international attention.

While these schemes provide support for established and emerging industries, the quest to establish new industries and to transition existing industries is more challenging. ACES has embraced these challenges.

We are collaborating with a manufacturer of automotive components to develop opportunities in 3D bioprinting. We are partnering with a local seaweed production company to identify and extract valuable components used to synthesise new bioinks. We have worked closely with investors from the USA to see the realisation of Aquahydrex-a water splitting company based on ACES research, expertise and the ability to provide appropriately trained individuals.

While Centres of Excellence provide an agile research, development and translation capability, challenges remain in training and how our organisations deal with building new business opportunities.





Consider the idea that in the future the average length of a successful commercial venture will be considerably shortened and that successful contributions to further ventures will mean a number of 'career' changes for any individual.

We need to continue to make our training environment more agile. Australia is well known for the rigorous programs our Universities provide at the undergraduate level. We are also known for the quality of our PhD programs. These form the backbone of Australia's high international ranking in research output per capita.

Both are important components of our education program. Both take three to four years to complete. The need for a broad base education to ensure future agility means specialisation at the undergraduate level is probably not the most appropriate approach.

The PhD degree delivers highly specialised individuals. While crucial

analytical and planning skills gained are transferrable to other areas, technical skills are less readily so.

Given the lifetime of businesses will decrease, they will be hungry to rapidly acquire appropriately trained individuals from the outset; and individuals will be hungry to acquire new skills.

Graduates that are 'commercial ready' will be in high demand. Graduates with a track record showing the ability to adapt, reskill and take on new challenges will be required.

The use of training tools such as Massive Open Online Courses (MOOCs) and short courses will undoubtedly add some agility to this dimension of our work.

Agility in our commercialisation 'processes' is also essential. Routes to commercialisation that have been preordained over many years may not be the best way to ensure effective and efficient progress of opportunities arising from large-scale research

undertaken by multidisciplinary teams, across several universities.

We must be agile and address each opportunity with our eyes wide open.

ACES is a collection of dynamic, highly skilled individuals committed to making a difference, and I am confident that we will be agile-be fertile!

We have had an exciting 2015 and look forward to the challenges that we will confront in 2016!

Prof Gordon Wallace
Executive Director ACES.



IAC REPORT

High Quality Outputs Continue

The International Advisory Committee (IAC) was impressed by the increase in high quality outputs after the first full year of operations within ACES-The New Dimensions 2014-2020.

The ACES team demonstrates that the research journey is not so much about personal discoveries, but about the realisation that effective research teams bring about much, much more than the sum of their parts. ACES epitomises how valuable friendship and collaboration-building in scientific research leads to cohesion within a research team, quality research, high achievement and impact for their work.

During 2015 ACES members (twenty four Chief Investigators, five Partner Investigators, nine Research Fellows, two Engineers, fifteen Early Career Researchers and twenty seven PhD students) worked together and with collaborators to advance the ACES mission of translating fundamental materials research into the next generation of health and energy devices. In its first 18 months of operation, ACES research efforts have focused on developing and characterising new electromaterials, that retain their amazing properties found at the nanoscale, and the tools necessary to design and build devices using those tailored fabrication techniques.

The broad scope of expertise and numerous collaborations have led to outstanding research outcomes. During 2015, six book chapters and 190 papers have been published with 73% of papers published in journals with impact factor

greater than 2.95. The team have produced fundamental science that will allow them in the future years of ACES to apply these developments to new energy generation and storage devices, soft robotic systems, microfluidic devices and synthetic biosystems. As ACES members progress along this journey together, the members of their ethics, policy and public engagement themes assess the impact of these new technologies on the broader community.

ACES has established international relationships that enhance research output and assist in growing the impact of that research. ACES researchers are well connected globally within the nominated research themes. 79% (151) of the papers published by ACES members in 2015 had international co-authors from 30 countries and 135 different institutions.



During 2015 ACES identified its global links which are productive and high impact in terms of citations. ACES also recognised that select strategic partnerships with International Research Centres would provide additional benefits. That is, not only for research activities but also in the translation of the research, leading to commercialisation and educational training opportunities. Such partnerships will take a significant amount of effort and resources before becoming productive, so it is necessary to take a systematic approach to identifying and pursuing these targeted relationships, with nominated ACES members driving the effort in 2016.

Dissemination of the research efforts is effective. For their academic colleagues, ACES held ten international workshops or symposia and hosted 58 international visitors-38 to work alongside ACES members and 20 to take up the opportunity

to present their research and view ACES facilities, as a first step towards possible collaboration. Forty national academic guests were also welcomed.

The team travelled extensively visiting 66 international laboratories, giving 20 plenary or keynote addresses, 57 invited talks, 17 distinguished visitor lectures, 79 invited seminars and 47 conference presentations.

ACES research made headlines-209 online stories, 40 in print, 19 radio interviews and 12 TV appearances. The record breaking 22.4% solar-to-fuel conversion efficiency and the 4D printed valve attracted significant attention from international media outlets.

ACES has ensured that its education and training programs are high-quality and ensure graduates are equipped with the skills needed for next-generation manufacturing, coupled with an ethical awareness of the impacts of their scientific endeavours.

In 2015 ACES celebrated the commencement of the world-first Masters in Biofabrication and secured approval from two leading universities in electromaterials science to run the nation's first joint masters program on this topic. A successful pilot of a program to deliver a graduate certificate in entrepreneurship was also conducted.

ACES also encouraged the next generation to consider a career in science. A highlight was the participation and completion rates for the free online course in 3D Bioprinting, courtesy of the ACES/ANFF partnership, giving around 7,400 community members a taste of ACES research and inspiring 1,000 to fully participate in the four week program. The summer scholarship program continues and ACES is seeing the conversion of summer scholars into post graduate students. Through the Reconceptualising Maths and Science Teacher Education Program (ReMSTEP) ACES members at Deakin are assisting in giving pre-service teachers improved competence and confidence in the teaching

of science and maths. School visits by ACES members are aimed to inspire budding scientists.

'Research Labs: Open for Business' says the Director in an article penned for the ACES website in February. Ten events were held specifically to engage industry in the research in addition to 48 business briefings. Support from the NSW government allowed ACES to commission CTechBA to identify commercial opportunities and how ACES might more effectively facilitate technology transfer. 2016 will be a year where ACES will evaluate the best way forward to progress the opportunities identified. Aquahydrex, the first ACES spinout company, is enjoying ongoing success and continues to employ ACES graduates. ACES is committed to commercial engagement and activities have resulted in numerous CRC funded projects, ARC linkage projects and ARC linkage hub involvement.

In conclusion, ACES Director Prof Gordon Wallace is congratulated as he was named by the Prime Minister and Chief Scientist as a member of the Knowledge Nation 100-individuals identified as game-changers building the industries and institutions that will underwrite our nation's future prosperity.

"The Committee agreed that there has been an impressive step change in the outputs of ACES whilst it has maintained its exceptional capacity to collaborate across themes and between groups."

Dr (Dame) Bridget Ogilvie (AC, DBE, FAA, FRS, FMedSci).

Chair ACES International Advisory Committee.



ACES Strategic Plan Goal 1: Research

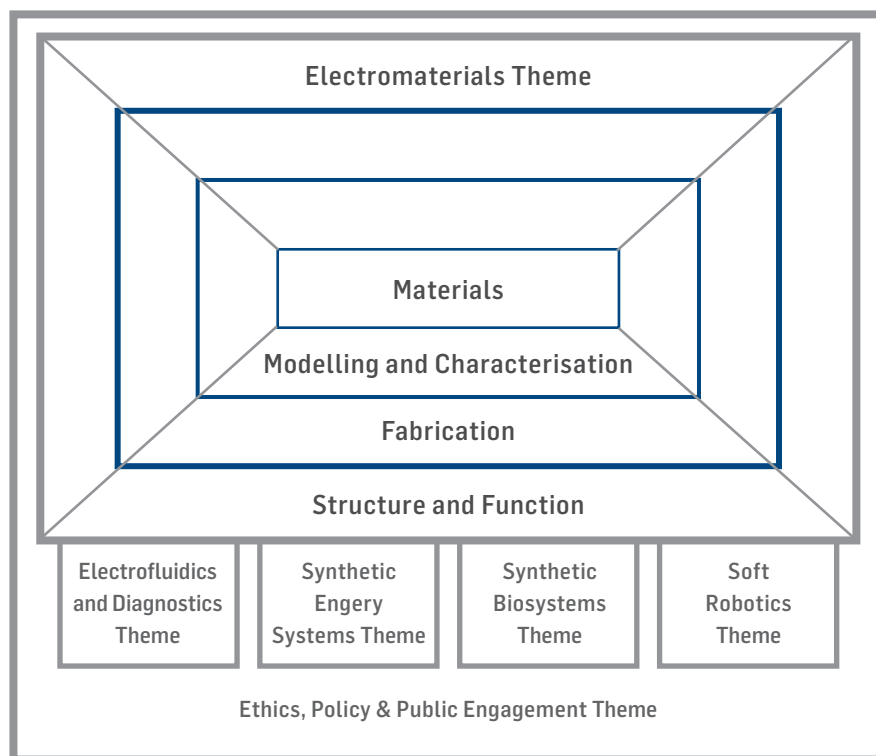
Our goal is to deliver integrated nano-assembly and fabrication technologies with the capacity to build truly biomimetic electrochemical systems by drawing on advances in materials, 3D printing and fibre spinning, characterisation and modelling.

Towards our goal

In Years 1-3, ACES research is focussed on the electromaterials and the tools necessary to design and build the next generation electrochemical devices in our theme areas - Schematic 1. The common requirement across all themes is to construct 3D structures in which the spatial distribution of the required functional elements can be controlled. Over the first 18 months of the Centre, the focus of ACES research has been to develop and characterise new electromaterials, with functionality appropriate to the theme applications that are amenable to 3D assembly using customised fabrication approaches. The effect of 3D structure on the common functions of charge transfer, reaction centres and structural support is being elucidated. Building on these advances in the core electromaterials theme, structure function studies of a significant number of materials have been undertaken within each of the technical theme areas, and in some cases devices developed.

3D Electromaterials

The key research areas comprise materials science, fabrication, modelling and characterisation. The advances made in each of these areas in 2015 have been targeted at addressing the following Electromaterial end of Year 2 milestones.



Schematic 1: The ACES Core 3D Electromaterials research theme and associated application themes.

Milestone	Year	Description
EM1	2	Supplied 1 st Generation structural, reaction centre and electromaterials for the application themes projects.
EM2	2	Developed a fully integrated multi-axial material delivery system for fabrication of core-shell structures.
EM3	2	Developed the 1 st example of a contactless characterisation probe.

Materials Science

The three categories of materials that are critical for the development of 3D structures for electrochemical devices are structural materials, reaction centres and electromaterials. The materials studied and how they have been fabricated are summarised in Table 1 and there have been significant developments in each of these areas during 2015.

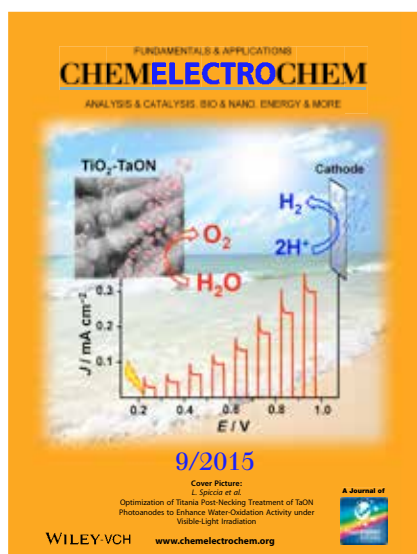
Structural materials

Structural materials provide the scaffold to support functional elements as well as overall device robustness. They may themselves act as catalysts or assist transport within the device.

Metal oxides are a common structural material particularly for energy-related

electrochemical devices. Thus, different types of titanium dioxide have been developed for energy applications (*RSC Advances* 2015, 5, 29513-29523; *Nano Energy*. Jan 2015;11:557-567; *Physical Chemistry Chemical Physics*. 2015; 17(8):5642-5649) and titanium dioxide itself has been used to optimise TaON photoanodes for solar fuel production in the Synthetic Energy System (SES) theme as highlighted on the journal inside back cover (*ChemElectrochem*. Sep 2015;2(9):1270-1278).

Nanostructured carbons such as graphene oxide or nanodiamond can also be used as structural materials, particularly as composites with polymers or other materials, as has been effectively demonstrated by SES student, Fengwang Li, for the support of a carbon dioxide (CO₂) reduction catalyst (*Energy & Environmental Science*. Nov 2015; DOI: 10.1039/c5ee02879e). Composites with carbon nanotubes and nanofibres have also been investigated (*Beilstein Journal of Nanotechnology*. Feb 2015;6:508-516; *RSC Advances*. 2015;5(25):19587-19595).



An important development is the preparation of very high surface area 3D graphene aerogels (R. Jalili, RF project) that are being explored as a structure for the placement of reaction centres such as porphyrins for CO₂ reduction (J. Choi, PhD project).

A porous flexible free-standing graphene paper has also been developed that has potential in energy applications (*Journal of Materials Chemistry A*. 2015;3(8):4428-4434).

Nanodiamond is not only proving to be an interesting structural material (*Applied Surface Science*. Dec 2015;357:397-406) but has also been shown to be the source of other nanostructured carbons such as carbon onions (*RSC Advances*. 2015;5(29):22906-22915) and hierarchical porous graphitic carbon monoliths (*Journal of Materials Science*. Oct 2015;50(19):6245-6259).

Soft structural materials are required for a number of theme applications and, in this regard, **hydrogels** are key materials. The ability to manipulate their mechanical properties, to incorporate electrolytes, as well as to tune responsiveness to environmental stimuli makes them an attractive class of materials. A focus has been on the development of tough hydrogels leading to a new PNIPAm-alginate-nanofibre hydrogel that appears to have unprecedented high strength, is conductive and able to thermally actuate (H. Warren, RF project). This is particularly promising for the Soft Robotics (SR) theme. A range of hydrogels using natural polymers, such as a locust bean gum-xanthan gum blend, cellulose and gelatin, and containing redox couples have been developed by SES researchers for use in thermocells (2015 *PCT patent appln*, PCT/

AU2015/000248). Gels based on gelatin, chitosan and collagen have also been developed for the Synthetic Biosystems (SBS) theme.

Methacrylated gelatin (GelMA) and hyaluronic acid (HAMA) have been synthesised and combined into a printable 'ink' that, once cross-linked, forms a 3D structure suitable for cell growth. Other novel hydrogel matrices (chitosan/agarose/alginate) have been developed and provide a possible new matrix for growth and differentiation of neural cell precursors in 3D.

Gellan gum, a water-soluble anionic polysaccharide, is proving a useful substrate for bio-applications, particularly as it can be readily modified with biomolecules such as peptides (*Journal of Materials Chemistry B*. 2015;3(6):1106-1115). It can also be used to form highly conducting composite hydrogels when combined with PEDOT:PSS and carbon nanofibres (*Synthetic Metals*. Aug 2015;206:61-65).

The potential of hydrogel polymers for creating 3D structures using extrusion based 3D printing has been examined (*Journal of Materials Chemistry B*. 2015;3(20):4105-4117).

A variety of other **polymers** are essential for device fabrication. Consequently, a range of commercially available engineering polymers have been evaluated for 3D fabrication.

Reaction centres

A number of key reaction centres have been identified for light harvesting and the catalysis of solar fuel production or for the stimulation of cell growth.

New light harvesting Iron (Fe) and cobalt (Co) porphyrins have been developed for carbon dioxide (CO₂)



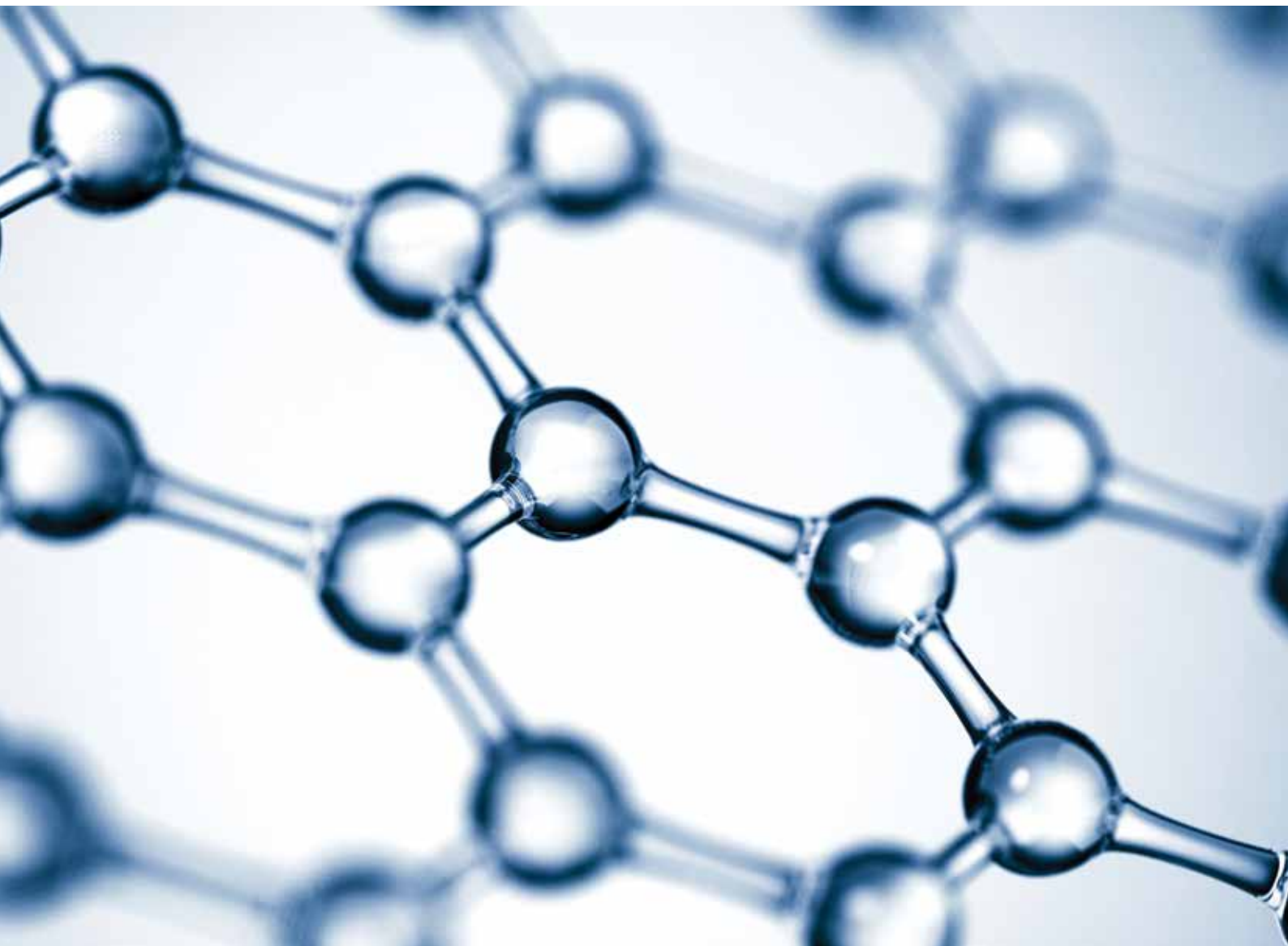
Table 1: First Generation Materials and their Mode of Fabrication				
Composition	Structural	Electromaterial	Reaction Centre	Fabrication
Titanium	✓	✓	✓ Photo catalyst	3D metal printing
Nickel	✓	✓	✓ Electro catalyst	3D metal printing
Stainless steel	✓	✓	×	3D metal printing
Liquid crystalline graphene oxide	✓	✓ (after reduction)	×	3D printable
Graphene	✓	✓	×	Film formation
Nanodiamond	✓	×	×	Film formation
Methacrylated gelatin (GelMA)	✓	×	×	Printable ink
Alginate	✓	×	×	3D printable
Conducting polymers	×	✓ Cell Growth	×	Films and fibres
Ionic liquids	×	✓	×	As part of electrolytes
Metallo-porphyrins	×	×	✓ Carbon dioxide reduction catalysts Light harvesters	Print with other structural material or electromaterial
Metal oxides	×	×	✓ Charge storage Water oxidation	Fabricate with other structural material or electromaterial
Redox couples	×	×	✓ Thermocells	As part of electrolytes
Adipose stem cells	×	×	✓	Printable with alginate

reduction (A. Walker, RF project). Fe porphyrins in particular have shown high efficiency (J. Choi, PhD project). Porphyrins with functionality that enables attachment to titanium dioxide for solar fuel production (antimony (Sb) porphyrins) have been produced. A novel covalently linked zinc (Zn) porphyrin-Zn phthalocyanine dyad that light harvests across the entire visible spectrum has been synthesised and attached to titanium dioxide for use in a dye sensitised solar cell (*Israel Journal of Chemistry*. 2015, advanced article, DOI: 10.1002/ijch.201500023).

Metal oxides have proved particularly useful as catalysts for solar fuel production. A variety of manganese oxides have been prepared and characterised, including sodium birnessite (*Australian Journal of Chemistry*. 2015;68(11):1715-1722) and nanocrystalline manganese oxide (*ChemSusChem*. Oct 2015; accepted for publication), and shown to be effective water oxidation catalysts (*Journal of Materials Chemistry A*. 2015;3(32):16642-16652; *ChemSusChem*. Mar 2015;8(5):872-877 and 8:1980-1985), the latter two papers involving associate investigator (AI) Aziz in Berlin.

Other metal oxides, such as cobalt and nickel oxides and related materials, have been shown to be useful for water oxidation (*ChemSusChem*. Apr 2015;8(8):1394-1403; *ACS Applied Materials & Interfaces*. Aug 2015;7(30):16632-16644; *ChemSusChem*. Oct 2015; accepted for publication).

Redox couples are critical to effective electrochemical device functioning and need to be tailored for the particular application. A number of $\text{Co}^{2+/3+}$ redox couples have been synthesised and characterised electrochemically in different IL/solvent mixtures, primarily



for thermochemical cells (D. Al-Masri, PhD project), and their properties studied using cyclic voltammetry (*Electrochimica Acta*. 2015;180:419-426; *Electrochimica Acta*. 2015;184:186-192).

The Seebeck coefficients, that are important for thermocells, of further $\text{Co}^{2+/3+}$ redox couples synthesised by collaborators at the University of Malaya have also been studied (*Journal of Materials Chemistry C*. 2015;3:2491-2499).

A variety of other redox couples have been made and tested including $\text{Co}^{II/III}$ (phenanthroline)₃, cobaltic acetylacetonate ($\text{Co}(\text{acac})_3$), and $\text{Co}^{II/III}$

EDTA. They were synthesised at ACES Monash node and characterised in the thermocell at ACES Deakin node.

Growth factors and cells are the key 'reaction centres' for the SBS research program. Protocols to produce Induced Pluripotent Stem Cells (iPSCs) have been established at St Vincent's Hospital, Melbourne and UOW. Early results for the induction of neural progenitor cells from human iPSCs have shown robust differentiation of iPSCs to neural precursor phenotypes and subsequently, to mature (functional) neural lineage, including neuronal and neuroglial cell types.

The fabrication and evaluation of biofunctional **3D microspheres** has entered initial stages, with the generation of cell sized (~15 μm) alginate spheres using a 3D extrusion bioprinter. These microspheres will provide control for the release of growth factors and/or other biomolecules within a 3D tissue construct.

Electromaterials

While many of the types of electromaterials that are required across the ACES theme applications are common, such as conducting polymers, ionic liquids and nanostructured

carbons, they invariably need to be tuned for inclusion into specific structures.

Conducting polymers have been used for some time as electromaterials of choice for stimulating cell growth. Now ACES researchers have shown that appropriately functionalised conducting polymers can also prevent cell growth and be used as low biofouling materials (*Biofouling*. 2015;31(6):493-502).

Varying the chemistry of conducting polymers as well as using the right fabrication techniques is enabling the effective integration of biomaterials and organic conductors (*APL Materials*. Jan 2015;3(1):12). Thus, it has been demonstrated that the use of the biopolymer dextran sulphate as a dopant affords a highly processable conductive organic biopolymer (*Acta Biomaterialia*. Mar 2015;14:33-42). The biopolymer has a significant influence on the physiochemical and electrochemical properties of the inherently conducting polymer biomaterials enabling these to be tuned (*Synthetic Metals*. Feb 2015;200:40-47).

Nanostructured carbons are highly useful electrode components. Graphene remains a major focus for electromaterials and there continues to be a need for scalable approaches to graphene synthesis, functionalisation, processing and fabrication. This was the subject of a significant graphene review by ACES researchers (*NPG Asia Materials*. Jun 2015;7:15). In addition, novel approaches to produce nitrogen-doped porous graphene (*Journal of Materials Chemistry A*. 2015;3(35):18229-18237) and N-doped pierced graphene microparticles (*2D Materials*. Jun 2015;2(2):7) have been developed.

The availability within the Centre of scalable quantities of aqueous and organic dispersed graphene has

provided the capability to create processable, biocompatible graphene/polycaprolactone composites of interest for tissue engineering (*RSC Advances*. 2015;5(56):45284-45290).

Similarly, biocompatible hydrogels have been developed with an aqueous graphene dispersion and chitosan (*J. Mater. Chem. B*. 2015;3(3):481-490; *Jom* 2015, ahead of print DOI 10.1007/s11837-015-1549-7).

While these materials show promise for cell growth and subsequent tissue development, their biodegradation is also important and has been studied (*Polymer Degradation and Stability*. Jan 2015;111:71-77).

Other carbon nanostructures such as carbon quantum dots have provided a substrate for developing heterostructures with copper oxide that allow solar driven conversion of carbon dioxide to methanol (*Advanced Energy Materials*. 2015;5(5):1401077 (1-6)). Functionalising the carbon quantum dots affords an efficient visible light switchable acid catalyst for room temperature ring opening reactions (*Angewandte Chemie-International Edition*. Jul 2015;54(29):8420-8424).

Electrolytes are an essential electromaterial component of electrochemical devices and **ionic liquids** are becoming increasingly important for a wide variety of electrolyte and electrochemical device applications (*Energy & Environmental Science*. 2014;7(1):232-250). The physical properties of a variety of ionic liquid based electrolytes have been investigated (*Physical Chemistry Chemical Physics*. 2015;17(6):4656-4663; *Australian Journal of Chemistry*. 2015;68(3):420-425; *Journal of Physical Chemistry C*. Sep 2015;119(38):21828-21839).

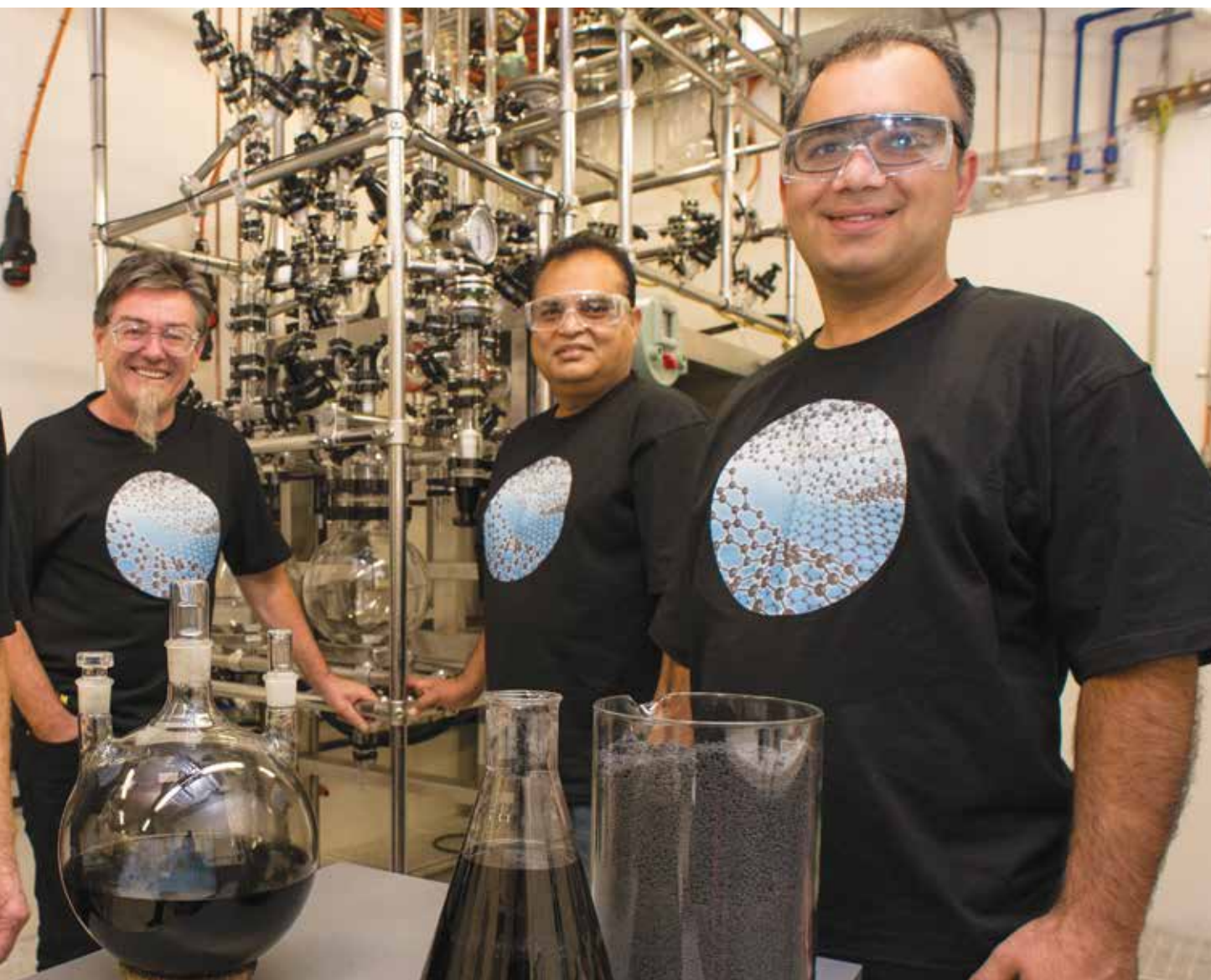
Research into the solid state equivalent



of ionic liquids, organic ionic plastic crystals, has been undertaken for applications such as batteries. Enhanced ionic mobility in organic ionic plastic crystal - dendrimer solid electrolytes has been demonstrated (*Electrochimica Acta*. Sep 2015;175:214-223) and ionic transport achieved organic ionic plastic crystal polymer nanofibre composites (*Journal of Materials Chemistry A*. 2015;3(11):6038-6052).

Fabrication

Materials as described above must be amenable to fabrication into 3D structures wherein the controlled spatial distribution of each enables 3D structure function studies to be carried out. Our



strategies include the generation of fibres that can be arranged into 3D systems, 3D printing strategies as well as 'self assembly' to achieve our goals.

Fibre fabrication created a number of highlights for ACES in 2015. Following on from the outstanding achievement of developing state-of-the-art artificial muscles from nylon fibre in 2014, flexible, stretchable and weavable piezoelectric fibers have now been developed (*Energy and Environmental Science*, (2015) 8, 3336-3344).

Fibres containing graphene composites wherein polymers of PLA, PLGA, PCL are host materials (*RSC Advances*, 2015;5:45284-45290; *Polymer Degradation and Stability*, Jan

2015;111:71-77) have been produced.

Highly stretchable organic fibres wherein polyurethane (PU) is the host and graphene provides the conducting pathway have been produced (*Advanced Functional Materials*, Jan 2015;25(1):94-104).

3D printing has provided very exciting outcomes for ACES in 2015, with a number of simple versions of 3D printing systems developed under the ACES umbrella. One of the most exciting has been the biopen (*Biofabrication*, 2016, in press).

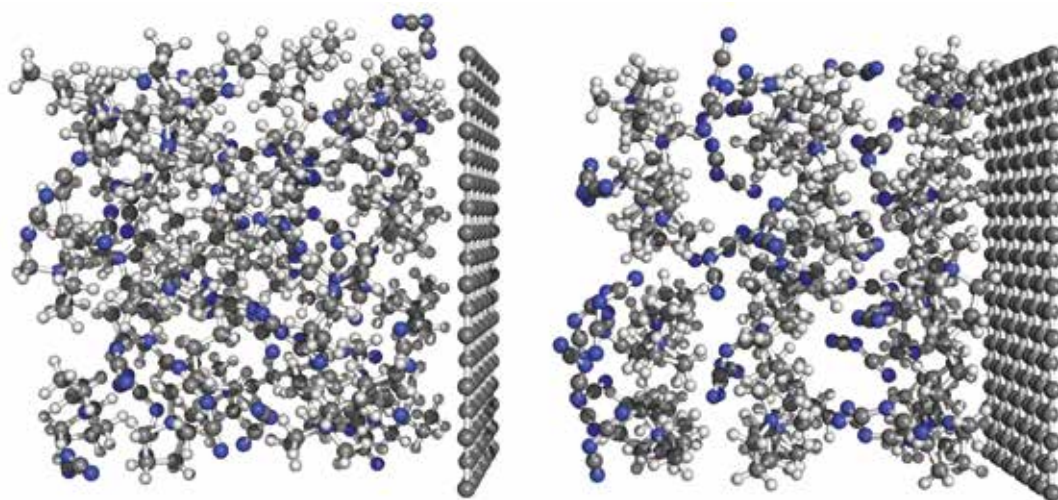
The biopen may be used as a hand-held device or as part of an automated robotic stage. Print heads that enable coaxial as well as asymmetric and side-

by-side printing have been developed.

A very simple version of the biopen enabled printing of gels containing cortical neurons, the first step towards the 'brain on a bench' project (*Biomaterials*, Oct 2015;67:264-273).

4D Printing with mechanically robust, thermally actuating hydrogels has been demonstrated (*Macromolecular Rapid Communications*, Jun 2015;36(12):1211-1217).

ACES 3D metal printing capability is providing exciting innovations in developing 3D electrodes from a range of metals including stainless steel, titanium, copper and nickel. To augment this, research into the functionalisation of metallic surfaces (including titanium) using porous polymer substrates is



Schematic 2: Examples of starting structures-ordered and disordered $[C_4mpyr][DCA]$ on graphite.

proving successful, with application to internal chemical modification of 3D printed metallic devices, channels and porous structures. Notably, 3D printed titanium micro-bore columns containing polymer monoliths for reverse phase liquid chromatography have been developed (*Analytica Chimica Acta*, Dec 2015, in press).

Composite materials for 3D printing and 3D printed microfluidics are under development (N. Macdonald, RF project). A range of test models involving pillars, cuboids, holes and channels with different materials, as shown, have been printed. This has led to the design and fabrication of a 3D printed membrane fluidic chip for Electrofluidics and Diagnostic (EFD) theme applications.

A novel fabrication method involving electrocoagulation of collagen has been established enabling formation of robust 3D structures.

Modelling

The modelling research activities are intricately connected with the various ACES themes, with the aim to

develop and benchmark theoretical methodologies for modelling 3D electromaterials.

In the electrolyte area, modelling efforts have focused on interfacial interactions of electrolytes with the electrode interface. Ionic liquid electrolytes have been shown to undergo interesting structural changes on graphite electrodes. These simulations have used both density functional theory and molecular dynamics.

Other modeling activities include the interaction of graphene oxide using an atomistic-continuum model (*RSC Advances*. 2015;5(94):77062-77070), and the design and testing of kinetic models of water electrooxidation catalysed by metal oxides.

Characterisation

The relationships between electrochemical performance and structural arrangements require innovative characterisation tools to map device charge transfer and transport processes in 3D. Towards this end, the first in-line contactless, non-destructive characterisation tools

for use during the fabrication process are under development, focusing on the conductivity of fibers and on the mechanical properties of biocomposites. Techniques considered for that purpose are contactless conductivity and ultrasound. As an indicator of the opportunities in the field, a manuscript has been prepared (*Analyst*. Feb 2016, in press). The use of a contactless conductivity detector on graphene fibres has been investigated on fibres with different composite mixtures.

Electrochemical-single cell force spectroscopy has been used for quantifying molecular-level cell adhesion on electroactive conducting polymers (*Scientific Reports*. Sep 2015;5:13).

The in-depth characterisation of plastic crystal electrolytes has been achieved using MRI imaging (*Physical Chemistry Chemical Physics*. 2015;17:18991-19000).

In a step towards the development of 3D multi electrode array (MEA) protocols, 64 channel MEA experiments have been carried out in 2D and with 3D cultures.



Application themes

Electrofluidics and Diagnostics (EFD)

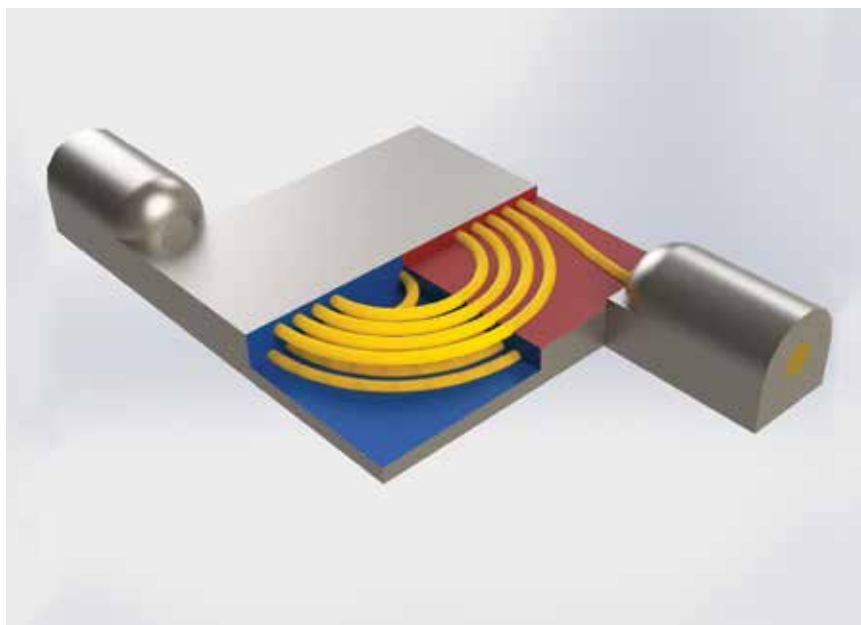
Milestone	Year	Description
EFD1	1.5	Determined the effect of distributed composition and structure on fluid flow throughout 3D structures.

The late start of staff and students means that this milestone will be not completed until June 2016. The use of different polymer 3D printing approaches to create microfluidic channels and structures has been evaluated. 3D metal printing has been used to create exquisite internal structures wherein fluid flow and chemical separations can be achieved.

Investigations into the use of thread fluidics have commenced. Here 3D structure in the micro domain involves control over the specific arrangement of fibres in order to effect fluid flow transport and mixing of chemical components.

Synthetic Biosystems (SBS)

Milestone	Year	Description
SBS1	1	Elucidated the effect of distributed 3D mechanical properties on cell behaviour.



Rendering of spiral column manufactured by selected laser melting in stainless steel 316 and titanium alloy, showing multilevel spiral fluid flow pathway.

Due to late start of staff and students this milestone will now be completed by end of June 2016. The viability and development pathways for living cells are very much affected by the mechanical properties of the surrounding environment. This can therefore be used to influence the survival and development of cells.

To date, we have devised protocols for fabricating 3D biomaterial and cell compositions using alginate, gelatin or collagen. Characterisation to optimise the compositions indicates the mechanical properties, required for cell survival and development, are typically different from the requirements for 3D structural support and integrity. Hence the above milestone will be restated as **SBS1 Year 1: Elucidated the mechanical properties of cytocompatible materials for cell survival and development within a 3D biomaterial composition.**

Synthetic Energy Systems (SES)

Milestone	Year	Description
SES1	1.5	Determined the impact of 3D architecture on catalytic activity, ionic conductivity and charge storage.

Given the delays in commencement of staff and students completion of this milestone is anticipated to be completed at the end June 2016.

In terms of catalytic activity, studies to date have focused on the creation of 3D structures in the nano-microscopic domain, in order to enhance efficiency and provide control over the nature of the products obtained from electrochemical carbon dioxide reduction.



The left two images are parametric models of rendered hands. The image on the far right is the 3D printed version of the model with a series of fine tendon cables attached.

The realisation of electrolytes with high ionic conductivity and low thermal conductivity remains a challenge for thermal energy harvesting. Some progress has made 3D structured gels based on cellulose and incorporating appropriate reactive (redox) centres.

In addition, the use of 3D printed electrode arrangements within thermocells to maximise performance is the subject of ongoing investigations. The series connection of thermocells using 3D printed structures is being used to boost voltage output.

To optimise the performance of flow batteries for energy storage, the appropriate arrangement of microfluidic channels is under investigation. Such studies are made possible by the use of 3D printing approaches for rapid prototyping.

Soft Robotics (SR)

Milestone	Year	Description
SR1	1.5	Determined the impact of composition and porosity distribution on mechanical properties.

Due to late start of staff and students this milestone will now be completed by the end June 2016.

Porosity within polymer structures has been varied by adjusting 3D printing conditions. This has provided a means of spatial control over mechanical properties (e.g. effective modulus of elasticity) through distributed porosity. This distribution in mechanical properties has been used to

provide appropriate movements in a 3D printed hand in response to an external mechanical stimulus.

To increase the inventory of stimuli responsive soft materials, heat sensitive gels have been mechanically reinforced using carbon fibres. This has had an additional impact in that the thermal mechanical response time of the gel has been improved.

Ethics, Policy and Public Engagement (EPPE)

Milestone	Year	Description
EPPE1	3	Identified the potential ethical responsibilities of manufacturers to end users for prosthetic organs.

Preliminary work has been done on pacemakers as a proxy device for assessing manufacturer responsibilities in prosthetic organs. Meetings have been held with the Therapeutic Goods Association (TGA), Health Purchasing Victoria, and device manufacturer Biotronik and presentations on the topic at ACES workshops, the Australasian Association of Philosophy (AAP) Conference and at the Centre for Applied Philosophy and Public Ethics. Al Nielsen's research on legal and intellectual property issues in medicine has contributed to early work towards potential ethical responsibilities of manufacturers to end users.

The obligations of manufacturers of proposed brain implants have been explored in a forthcoming chapter 'Predictive Brain Devices and Automated Therapeutic Activation: Ethical Problems Ahead'. The moral obligations to device manufacturers through the effects of deep brain stimulation, and neural implants more broadly, on a patient's identity have also been explored.

The industry and government engagement workshop, 'Can assessment of emerging technologies address complex impacts?' (supported by the Department of Industry) explored issues related to the military 'dual use' of technology for therapy and enhancement. Related to this is work on obsolescence and technology (*Kennedy Institute of Ethics Journal*. Sep 2015;25(3):231-260) and neural implants and identity (*Goddard thesis* 2015) exploring the implications for therapy and enhancement from arguments based on relational autonomy.

EPPE Policy Forums were held in May and June as part of its policy and

engagement activity. ACES visitor's Dr Terry Cannon, Institute of Development Studies Sussex University, paper 'Three Myths of Development, Disasters and Climate Change', drew a wide audience from four universities, government, research and NGO sectors.

In addition to progress made on the EPPE milestones, ACES EPPE members have contributed to the work in other ACES themes. For example, the ethical implications of brain implants for personal identity and autonomy supports work conducted in the SBS theme as evidenced by collaborations between Gilbert and Cook on the ethical challenges related to autonomy raised by predictive brain implants (*Bioethica Forum* 2015;8(4):121-127). Gilbert's target article (*AJOB Neurosci* 2015; 6(4):4-11) considered arguments concerning predictive brain devices and threats to autonomy.

EPPE members have considered the ethical implications of advances in 3D printing and biofabrication for medicine and the hospital of the future.

CI Hancock has worked with colleagues in the SES theme in developing outreach and community engagement on alternative energy sources.

Other Research Highlights

The broad scope of expertise in ACES and the numerous national and international interactions has led to some outstanding research outcomes in other research areas.

ACES modelling researchers at ANU worked with UOW researchers to study the effect of oriented electric fields on the kinetics and thermodynamics of chemical reactions. Initial work on

Diels-Alder reactions resulted in the first demonstration of electrostatic catalysis of a non-redox reaction, with a publication recently accepted by Nature (*Nature*. 2016, in press). Follow-up work on the effect of electric fields on spiropyran ring opening, and on harnessing electric fields to trigger polymerisation on a surface are ongoing. Initial results have shown that spiropyran can be used as hydrogen bond sensors (*Chem. Commun.* 2015;51:4815-4818).

A paper from SES researchers reporting record breaking 22.4% solar-to-fuel conversion efficiency (*Energy & Environmental Science*. 2015;8(9):2791-2796) received considerable media attention world-wide. The fuel involved in that work was simply hydrogen however the optimisation principles developed in that work point the way to other types of fuels being produced at even higher efficiencies.

A 3D printed, fully compliant and soft prosthetic hand (in the size of a child's hand) has been developed. This is a research-development platform to discuss new ideas and concepts (or what input we want from other themes) on establishing new actuation, sensing and control concepts based on new printable electromaterials or responsive materials.

Several thread-based electrofluidic platforms have been designed and used by EFD researchers to study the fibre fluidics of different materials. Several modes of operation in electrophoresis have been tested and electrophoresis has been achieved in polyester, nylon tape, silk and acrylic. Separation of compounds and 1000-fold pre-concentration (isotachophoresis) has been achieved.



ACES Strategic Plan Goal 2: Research Training

Our goal is to deliver innovative research training and mentoring programs that ensure the development of world-class graduates and early career researchers with excellent research skills as well as science communication, research management and commercialisation skills, coupled with an ethical awareness of the impacts of their scientific endeavour.

Our target audience is primarily prospective students. ACES provides an inclusive and supportive global research training opportunity; giving access to the most innovative and dynamic research training programs that are facilitated by our global connections.

Towards our goals

The ACES Research Training Group (RTG) is responsible for designing, establishing and implementing an innovative research training and career development program, including various industry and web-based programs. The highlights of the program are outlined below.

ACES Research Theme Workshops

The ACES workshop program targets the professional development of research staff and postgraduate students, as well as key areas of continuing technical and scientific education. The workshops are undertaken in the form of:

1. one full centre meeting each year
2. weekly theme meetings (18 February-14 December) between all nodes within the centre via video link
3. a number of targeted ACES research theme workshops.

Targeted research theme workshops held in 2015 included: graphene synthesis scale-up and device fabrication; modelling; carbon dioxide reduction; batteries; thermocells; bionics; applied 3D fluidics; chip and fibre based electrofluidics and ethical issues associated with maintaining synthetic organs. These workshops provide specialist research training for PhD and early career researchers, and include mentoring for research planning and positioning for career opportunities. Appendix 1 shows a summary of the workshops and the number of personnel mentored.

ACES staff and students are afforded opportunities to attend seminars delivered by numerous visitors and collaborators to the nodes throughout the year. Travel between nodes to undertake multidisciplinary research tasks is also encouraged and supported.

Implement a Masters training program in Biofabrication

ACES is focused on an approach to education and (re)training that provides a work force equipped with the skills necessary for next generation manufacturing. ACES, through IPRI at the University of Wollongong, launched the world's first Master of Philosophy in BioFabrication in collaboration with Queensland University of Technology, Utrecht University (the Netherlands) and the University of Wurzburg (Germany).

The first four Masters students commenced at UOW in July 2015. Short courses in Biofabrication, open to all ACES members, were delivered in July over five days. An Ethics course was delivered in September.

The courses featured comprehensive lectures and demonstrations on printable bioinks, stem cell biology, printing materials, developing custom bioprinting and 3D printing hardware and applications as well as ethical and regulatory issues arising from the rapid developments in 3D bioprinting.

Research projects, each involving a clinical collaborator, commenced in late 2015.

Implement a Masters training program in Electromaterials Science

University approval for the ACES 'Masters of Philosophy in Electromaterials Science' is complete. In 2016 the ACES nodes at the University of Wollongong and Deakin University will launch Australia's first joint post-graduate degree in electromaterials science, with emphasis on the use of new fabrication tools to build devices containing next generation materials. The course is designed to ensure that the students gain maximum benefit from the unique multi-disciplinary expertise in ACES.

Complete a pilot program for a Graduate Certificate in Entrepreneurship

Commercialisation training programs increase the appetite for industry engagement and help graduates understand the career options available to them. For example, as a consequence of commercialisation training programs offered within ACES prior to 2015, six



Changing mindsets:
Professor John Glynn,
Dean of the University of
Wollongong's Faculty of
Business. Picture: GREG ELLIS

Students ACE training program

GREG ELLIS

THE ARC Centre of Excellence for Electromaterials Science (ACES) and the Sydney Business School (SBS) at the University of Wollongong have come together to run an innovative business training program for researchers.

The idea grew out of awareness that ARC Centres of Excellence are like vast cauldrons of knowledge boiling over with ideas based on cutting edge research.

But researchers are not versed in the ways of business.

So to better equip and prepare them a new training initiative was piloted.

It ran for 12 months and

University of Wollongong Executive Dean (Faculty of Business) Professor John Glynn said it had such an impact it helped change graduates' mindsets. Professor Glynn said the ACES students were highly motivated and learned a great deal.

Learning about business sustainability was a key component and the course was tailor-made to help students put their doctorate in context with the business world.

They learned everything from business risk to personality profiles.

Intelligent Polymer Research Institute PhD student Leo Stevens, who completed the UOW Graduate Certificate in Innovation and Entre-

preneurship, said the course honed his ability to recognise the potential application of ideas.

Mr Stevens said the training helped make the entrepreneurial journey more tangible.

And ACES PhD student Aaron Waters said it would also help him better relate to areas such as HR, accounting and management.

IPRI and ACES director Professor Gordon Wallace believed the course would help the students create the knowledge-based industries of the future. "These will be the first graduates in the integrated course bringing scientific researchers' skills in the workplace in an integrated way."

Illawarra Mercury 14 August 2015.

former PhD graduates have joined Ernst and Young and Deloitte.

ACES developed the Graduate Certificate in Entrepreneurship to build up the business acumen of PhD and early career researchers. The pilot program, developed in partnership with the University of Wollongong's Sydney Business School, was launched in 2015. Seven graduates passed the course with distinction and high distinction averages. As a result, these participants are more aware of the potential commercialisation outcomes of their research.

The certificate will continue in 2016 as

a 'Certificate in Entrepreneurship and Innovation' with a few refinements.

Complete a Free Online Course, 'Bioprinting: 3D Printing Body Parts'

Prof Gordon Wallace and Dr Stephen Beirne designed and delivered a free online course for a general audience called Bioprinting: 3D Printing Body Parts.

The course, an introduction to commonly used biomaterials and bioprinting techniques, answered basic questions such as:

- What is 3D printing and how did it come about?
- Is it really possible to print structures that incorporate both living and artificial components?
- How long before we can print whole body organs for transplants?
- What is possible right now, and what will be possible in 20 and 50 years' time?
- What are the limitations of this technology?

Over four weeks, more than 1,000 people took the course, which was

hosted through the University of Wollongong's partnership with global online learning platform FutureLearn.

"The opportunity to share with a global learning community the impact our research has on everyday lives was an exciting extension of who we are at UOW," UOW Deputy Vice-Chancellor Academic, Prof Eeva Leinonen.

Bioprinting MOOC November 2015 Course Statistics (as of 16 January 2016)

Joiners	7,483	
Learners	3,222	43.1%
Active learners	2,436	75.6%
Fully Participating learners	1,000	31.0%

For more information visit <https://www.futurelearn.com/courses/bioprinting>. Gordon Wallace's blog on 'How is 3D printing revolutionising healthcare?' can be found at <https://about.futurelearn.com/blog/3d-printing-healthcare/>

The 3D Bioprinting course also provides a taste of what students will learn as part of undergraduate degrees at UOW in science, mechatronics and materials engineering, and later as part of the Masters degree in Biofabrication.

Summer scholarship program

The summer scholarship program is designed to encourage undergraduates into ACES post graduate programs. In 2014-15, nine undergraduate students worked at ACES as part of a 10-week summer scholarship. The students and their projects were:

- Kiera Grierson (UOW) electrical stimulation of neural stem cells

- Gwilym Price (UOW) 3D printing nickel
- Brendan Howe (UOW) 3D interdigitated electrodes
- Richard Spinks (UOW) 'Science in a Suitcase' - controlled delivery systems
- Grant Barnsley (UOW) 3D printing copper
- Grace Waring (UOW) printing bionic electrodes
- Ana Erceg (Deakin) towards reversible metal-air batteries
- Callan Young (Deakin) electrochemical harvesters
- Molly Patten (Deakin) 'Science in a Suitcase' - designing a demonstration kit to explain the research surrounding Shrilk as a potential biomimetic material for articular cartilage.

Kiera Grierson followed her summer scholarship with an honours year with ACES at UOW, graduating in December 2015.

Grant Barnsley returned to ACES in the 2015 spring semester to complete his 18 credit point final engineering project. He spent a further two weeks of professional experience with ACES (13-24 July 2015) to fulfill the university professional experience requirement for his undergraduate degree. He has been offered a PhD position in ACES/UOW in 2016.

Over the 2015-2016 summer, two undergraduate students are taking up a 10-week summer scholarship within ACES at UOW. Vincent Kershaw from James Cook University, Queensland and Grace Keidge from Griffith University, Queensland are working on 3D printing.

Workshops on Science Communication

'How best to design your research poster' and 'present your research' were two questions answered during a workshop and webinar held for 30 ACES members on 21 January 2015. The workshop included tips on poster design, information on how to access and correctly use logos, and advice on improving presentation skills.

Conduct workshops on Ethical, Social and Policy Impacts of Electromaterial Science

A session at the ACES Full Centre meeting was on Ethical Procurement in the laboratory. CI Linda Hancock spoke to Centre participants about being more aware of materials procurement for ACES projects, with a special focus on 'conflict' metals. After outlining advice set out in the literature and observing other practices overseas, Linda recommended that when making a purchase, ACES should ask companies to disclose their chain of supply and materials procurement policy; conduct on-line research to see if companies declare their interests in supplying metals; and look to see if each university has an ethical procurement policy.

As part of the Ethics, Public Policy and Engagement theme CI Linda Hancock took a contingent of ACES battery and solar researchers-CIs, ECRs, PhDs-to give them an insight on the applied contextual challenges of new energy technology providers during a visit to Hepburn windfarm on 23 April 2015. The visit took place with a view to consider:

- How does current energy policy/pricing affect wind farms and what opportunities are there for innovative battery storage solutions with economic [feed-in] benefits [e.g. short term storage for feed-in during peak load at higher rates of remuneration].
- What technical issues complicate/facilitate energy storage with wind-generated energy?
- What potential is there for testing battery storage prototypes in situ at wind farms?
- What potential is there for solar-wind co-location?
- How might a community wind farm differ from commercial operations in relation to financing and energy storage models?
- What form could a potential partnership with Hepburn Wind and ACES take?



Laboratory BioTechniques course

The ACES members at St Vincent's Hospital Bionics laboratory conducted a training course for 17 second year Medical Students from Universitas Indonesia, Indonesia, and six third year medical students from Tsinghua University, China, as part of their Advanced Medical Science (AMS) year. The 'Laboratory Techniques' course introduced the students to the theory and practice of conducting medical research.

ACES invited to deliver lectures at Hanbat University in Korea

Three ACES members A/Prof Michael

Higgins (ACES CI UOW), A/Prof Attila Mozer (ACES CI UOW) and Dr Caiyun Wang (SRF ACES UOW) gave a series of lectures (12) to post graduate students at Hanbat University in Korea in November.

These gave four lectures on organic conductors for novel energy storage applications; specifically batteries, including battery testing techniques, biobatteries, wearable/stretchable batteries and use of organic conductors in energy; two lectures on the fundamentals of solar energy conversion and solar cells and solar fuels; two lectures, as requested by our hosts, on porphyrin-sensitised solar

cells and four lectures covering Atomic Force Microscopy (AFM), fundamental surfaces forces, biological interactions and forces and an overview on the use of Bio-AFM to study protein/cell interactions with electromaterials.

Training Opportunities

ACES members, from chief investigators through to students, attended training workshops outside of ACES as part of their continuing performance development.

Prof Mark Cook, ACES CI and Synthetic Biosystems theme leader is in the process of completing the 2015 Vincent



Fairfax Fellowship™ Programme. The Fellowship™ is the flagship teaching program at the Centre for Ethical Leadership and aims to close the gap between the theories of ethics and actual practices to inspire transformational leadership.

A/Prof Jennifer Pringle, ACES CI and Director of the ACES Research Training Group, completed the 12 month 'Advanced Leadership Program MLE14', conducted by Women and Leadership Australia. Jenny also completed the Deakin University 2015 Mid-Career Researchers Professional Development series.

Other courses are listed below:

- Two UOW PhD students attended 'Thinking Ahead: Career Options & Planning for Graduate research students' at UOW 29 April.
- Two UOW PhD students attended 'Interview Techniques for graduate research students' at UOW 13 May.
- Four UOW PhD students attended 'Build your Career Network for Graduate Research Students' at UOW 20 May.
- ACES RF Niall Macdonald undertook a two day training course with engineers from Grey Innovation for the Titan 1 (DP-SLA) 3D printer at UTAS 1-2 June.
- ACES Communication Officer Natalie Foxon-Phillips attended a strategic workshop on the use of Social Media in Wollongong on 30 June.
- ACES PhD candidate Nhien Hon Le (Monash University) completed a commercialisation boot camp at Monash University 17-19 July; attended a 'Spotlight on Innovation Workshop' run by Perkin Elmer at Monash University on 28 July; presented a poster at the Monash Engineering Industry Night on 27 August; and attended a 'Soft X-ray Spectroscopy' workshop at Australian Synchrotron on 16 October.
- ACES PhD candidate Jian Fang (Deakin University) completed a two day 'Getting Funding from Industry' training course on 21-22 July; and a two day 'Introduction to Project Management' training course on 2 and 9 September.
- Six ACES PhD students, two ACES ECR and three ACES RF completed Fire Safety Training at UOW on 29 July.
- ACES UOW SRFs Pawel Wagner and Kerry Gilmore completed 'Implementing OH&S - A Guide for Supervisors' in September.

- ACES ECR Ruhamah Yunis (Deakin University) attended two Industry Training Workshops, 'Industry Engagement Skills' on 30 September and 'Consulting Skills Part 1' on 14 October.
- ACES RF Eva Tomaskovic-Crook (UOW) completed a week long SEM training course at UOW Electron Microscopy Centre in October.
- ACES ECR Ashley Walker (UOW) and the four BIOFAB masters students completed 'Biosafety' training at UOW 24 November.

2015 Graduates

Kiera Grierson (International B. Science) graduated with Honours, completing final year project in ACES UOW.

Adam Taylor (Masters) graduated having completed his final year project in 3D printing with ACES.

Eliza Goddard (PhD ACES UTAS start 2010)-Thesis '*The Bionic Self: Neural Implants and Threats to Identity*'.

Sha Li (PhD ACES UOW start 2010)-Thesis '*Biocompatible Materials for Batteries*'.

Matt Gustafson (PhD ACES Monash start 2011) - Thesis '*Investigation of photostimulated conducting polymer heterojunctions exhibiting electrocatalytic properties and their effectiveness in water oxidation*'.

Sreenu Jennepalli (PhD ACES UOW start 2010)-Thesis '*The Synthesis of an Amino Acid/Fullerene Derivative for Potential use in Organic Solar Cell Applications*'.

Liyu (Leo) Jin (PhD ACES Monash start 2011)-Thesis '*Organic Ionic Plastic Crystal Electrolytes*'.

Fengling Zhou (PhD ACES Monash start 2011)-Thesis '*Investigation of inorganic metal oxides as catalysts for photo-electrochemical water splitting*'.

Mega Kar (PhD ACES Monash start 2011)-Thesis '*Novel Ionic Liquids for Zinc-Air Rechargeable Batteries*'.



ACES Strategic Plan

Goal 3: Translation Commercialisation

Our goals are to:

- To implement strategies for effective industry engagement and knowledge transfer to industry partners.
- To utilise appropriate business tools to identify and select commercial opportunities in the early stages of ACES.
- To implement effective knowledge transfer strategies that facilitate the development of new business opportunities.

Our target audience is primarily investors. ACES can facilitate the development of technologies to create new disruptive business opportunities and to augment existing businesses.

Towards our goals

ACES is Open for Business

As discussed in the article (<http://www.electromaterials.edu.au/news/researchopenforbusiness/>) 'Research Labs: Open for business' written by ACES Director Gordon Wallace in February 2015, research laboratories are no longer occupied by the stereotypical white-coated, bespectacled, dithering individual with no social skills, poking around with test tubes just for the hell of it, but instead are modern labs occupied by dynamic and highly skilled professionals, aware of the gaps in knowledge that need to be filled to

overcome highly relevant, real-world challenges. In our ACES labs right now, researchers are turning everyday materials into intelligent materials that automatically massage swollen limbs to reduce discomfort; they're developing new energy generation systems for a green future; they're making early warning diagnostic kits that alert people of impending medical issues; and they're creating new advanced prosthetics to replace lost limbs.

It is vital that ACES continues to provide new knowledge to enable the further development of existing commercial enterprises. Where a seed is planted for the growth of new ventures, exciting opportunities often present themselves for highly skilled graduates and early career researchers.

The demise of traditional manufacturing in Australia creates an opportunity for ACES to encourage investment based on innovative manufacturing; industries that capture the extraordinary properties of new advanced materials in useful structures and devices. Next generation manufacturing requires new generation materials. For example, graphene is a recently discovered material generating excitement amongst miners, researchers and product developers alike. ACES' first foray into graphene was very much with an eye towards how we could make stuff containing this amazing material. ACES' first publication described simple chemistries that resulted in the ability to spray, print and otherwise coat graphene onto other structures. Subsequent work at ACES has developed chemistries that enable us to create stand-alone graphene structures using fabrication methods such as fibre-spinning or 3D printing. Through the development

of appropriate chemistries, we have been able to realise composites with biomaterials or other polymer hosts. The work of our team within ACES means we are well placed in this field.

The ACES team is aware that partnerships that bring business development expertise will greatly enhance the likelihood of new commercial ventures. These developments will diversify the research funding base for ACES. They will also provide an opportunity to develop a critical area currently under resourced; business development activities. These new resources are critical as commercialisation activities must not detract from its primary goal of excellence and quality in research and research training.

In an interview Prof Wallace did for the book 'Innovation: How Innovators Think, Act and Change Our World' by Kim Chandler McDonald, he points out that: "Without innovation in research we're just making incremental progress; in big areas of research, big changes in thinking are needed to solve big problems and delivering advances that have a financial return is part of that cycle. To be truly innovative we also need to be creative in how we bring people together and then how we work together as integrated teams".

ACES - Australian National Fabrication Facility (ANFF) partnership

Our continued partnership with ANFF is critical to translating our research into real-world devices.

The ANFF Materials Node is headquartered alongside ACES at the UOW

Table 2: Towards translation of ACES fundamental research

AquaHydrex Pty Ltd	ACES hydrogen-production technology is being used to produce clean energy solutions.
IMAGINE Pty Ltd (were previously NanoCarbon)	ACES graphene processing technology has been licensed to this spin-off company.
Cell Therapy Manufacturing (CTM) Cooperative Research Centre (CRC)	A new ACES collaborative effort was established in 2015 with the University of Adelaide and the CTM CRC for printing cells.
CRC for Polymers	ACES involvement in the CRC for Polymers has resulted in new solar cell technologies.
Energy Pipelines CRC	ACES involvement in the Energy Pipelines CRC, via the Deakin University node, assesses materials, coating selection and novel monitoring methodologies.
HEARing CRC	ACES involvement with HEARing CRC has produced new electrode and controlled delivery technologies relevant to the Cochlear implant.
ARC Steel Research Hub	ACES involvement in the recently established Steel Research Hub at the University of Wollongong is seeing the translation of fundamental findings into antimicrobial coatings.
ARC Research Hub for a World Class Future Fibre Industry	ACES involvement in the recently established ARC Research Hub for a World Class Future Fibre Industry at Deakin University is seeing the translation of fundamental findings into developing novel fibre technologies to facilitate more sustainable, advanced manufacturing of fibre materials and products.
NHMRC projects	ACES materials continued to be developed and used in two NHMRC projects in 2015. This assists the translation of the research by taking the <i>in vitro</i> materials work and testing those materials as well as developing techniques <i>in vivo</i> . Grant 1065463 uses conducting polymers for the treatment of schizophrenia and allied disorders focusing on neuronal outgrowth, myelination and synaptogenesis. Grant 1062569 uses ACES materials in the development of a biopolymer conduit for peripheral nerve repair.
Bill & Melinda Gates Foundation grant project	ACES' ultra tough hydrogel materials continue to be developed for use as a condom in a Bill & Melinda Gates Foundation grant project awarded to UOW to further develop a condom design. The team is partnering with Swinburne University of Technology in Melbourne, Australia, to conduct biometric testing that measures the body's response to the hydrogel materials.
Clinical collaborations at St Vincent's Hospital Melbourne	Clinical collaborations continue to develop: • with Prof Peter Choong and Dr Claudia DiBella (Orthopaedics). Two grants were awarded in 2015: (i) \$40,000 from Arthritis Australia to use the biopen developed by ACES for the treatment of early osteoarthritis and (ii) a \$20,000 St Vincent's 2015 Research Endowment Fund Grant to perform <i>in vivo</i> experiments using bioinks developed by ACES in the biopen with a view towards new cartilage formation. • with A/Prof Chris Baker (Dermatology) via a Bauer grant. ACES/IPRI and St Vincent's will jointly fund a PhD student in 2016 to work on the fabrication of a biosynthetic skin using 3D Printing. • with A/Prof Michael Coote and Prof Jonathan Crowston (Ophthalmologists) at the Glaucoma Research Unit at the Centre for Eye Research Australia (CERA) testing a 3D printed system to try to fathom why glaucoma implants sometimes fail.
Clinical collaboration in Wollongong	As a consequence of a new Garnett Passe and Rodney Williams Memorial Foundation Conjoint Grant of \$375,000 awarded 2015, work will commence 2016 with ear, nose and throat surgeon, A/Prof Stuart MacKay to combat sleep apnoea.
Collaborative research with companies/industry	In 2015 new projects were formed with Venus Shell Systems (VSS) and the Reserve Bank of Australia. The collaboration with VSS will develop new methods to enable the extraction of high quality biomaterials (ulvans) from seaweed.

Innovation campus. ANFF provides ACES researchers, external collaborators, publicly funded researchers and industries with access to fabrication capabilities and materials synthesis through state-of-the-art facilities for the production of small- to large-scale quantities of nanostructured materials (e.g., electronic polymers, conducting carbons, graphene and macromolecules) and additive manufacturing.

Industry engagement and knowledge transfer to industry partners

ACES disseminates knowledge to existing industry partners through information sessions, workshops, web-portal sessions, industry projects and involvement in ARC Linkage Hub projects and Cooperative Research Centres (CRC).

ACES has a track record of collaboration and commercialisation. The most recent are summarised in Table 2.

AquaHydrex

AquaHydrex (AH) arose from a fundamental knowledge pool in science and engineering developed by ACES. On 24 February 2015 the NSW Deputy Premier Troy Grant joined Kiama MP Gareth Ward and Liberal candidate for Wollongong Cameron Walters to announce NSW Government funding to establish a high tech development facility in Wollongong – a home for AquaHydrex. The team moved in in June, thus achieving a key milestone on their commercialisation journey.

ACES chief investigators continue to provide support to this developing venture. ACES graduates make up over 75% of the current AquaHydrex workforce. In 2015 AH recruited another ACES RF and another ACES PhD graduate is due to start early 2016.

IMAGINE

IMAGINE Pty Ltd (formerly NanoCarbon Pty Ltd) continued to license an ACES graphene processing technology. In 2015, ACES provided interactions with IMAGINE ranging from know-how process information transfer through to materials supply and materials coating via a research collaboration and materials transfer agreement executed in 2015.

ACES chief investigators continue to provide support to this developing venture.

CRC Interactions

Cooperative Research Centres bring together research partners from CSIRO and Universities to engage with industry on specific projects. ACES is involved with the following CRCs.

Hearing CRC: Projects carried out under the CRC Hearing umbrella have benefitted from fundamental research within ACES. For example our research has enabled novel drug delivery systems to be incorporated into cochlear implants. Surface modification techniques have been used to control electro-cellular interactions. New characterisation tools developed by ACES are providing new insights into electro-cellular interactions. These projects have been conducted in association with Cochlear Pty Ltd.

CRC-Polymers: The current projects within the CRC for Polymers (CRC-P) have leveraged ACES' fundamental work in a number of ways. In the solar cell program, researchers are designing new light harvesting porphyrins and other organic dyes, based on materials that were developed in ACES. New anodes and cathodes, utilising conducting materials such as PEDOT in processes initially developed for ACES projects are being pursued. Successfully fabricating and characterising dye sensitised solar cells within the CRC-P program has only been possible as a result of the equipment, skills and knowledge that have been built up within ACES.

Cell Therapy Manufacturing (CTM)

CRC: A new research collaboration was initiated in 2015 with Prof Toby Coates from the University of Adelaide and the Cell Therapy Manufacturing CRC. The project involves the printing of islet cells and endothelial progenitor cells (EPCs) within an organised 3D matrix.

Linkage Hubs

The Australian Research Council (ARC) Linkage Hub Program brings together groups from industry, research, and other participants in targeted areas for research and research training.

ACES is involved with the following Hubs.

The **Steel Research Hub (2014-2017)** at the University of Wollongong is seeing the translation of ACES fundamental findings into antimicrobial coatings. The key industry partners are: BlueScope, OneSteel (represented by Arrium), Australian Steel Institute, Bisalloy, Cox Architects and Lysaght.

The **ARC Research Hub for a World Class Future Fibre Industry (2014-2017)** at Deakin University is seeing the translation of fundamental findings into developing novel fibre technologies to facilitate more sustainable, advanced manufacturing of fibre materials and products. Activities within the hub focus on advanced carbon fibres, nanofibres and high performance novel fibres, as well as high-value added applications of fibre materials. Deakin's Australian partners in the hub are: HeiQ Australia Pty Ltd, Cytomatrix Pty Ltd, Carbon Revolution Pty Ltd, Quickstep Automotive Pty Ltd, Ear Science Institute Australia Incorporated / Ear Science Centre, Draggin Jeans Pty Ltd and CSIRO.

Industrial Transformation Training Centre

The ARC Industrial Transformation Training Centre is a scheme that fosters close partnerships between university-based researchers and other

research end-users to provide innovative Higher Degree by Research (HDR) and postdoctoral training.

ACES CI Brett Paull is involved with the **ARC Training Centre for Portable Analytical Separation Technologies (2014-2017)** at the University of Tasmania, which is seeing the translation of fundamental findings that enable analytical systems to be more selective, sensitive and specific for biological measurements, especially those that can lead to portability, miniaturisation and affordability. The industry partner is Trajan Scientific and Medical.

ACES Capability/Opportunity Audit

As part of the NSW Government Department of Trade and Investments Research Attraction and Acceleration Program (RAAP) funding, ACES contracted CTechBA in early 2015 to provide a two-stage Commercialisation Review on identifying and realising the commercial opportunities of ACES research.

The scope of the audit was determined in consultation with the ACES commercialisation development group (CDG) and the first stage report was completed in June 2015.

The report considered all the planned research under the 2014-2017 ACES program, identified a number of commercially significant projects (opportunities) and made recommendations on how we can more effectively facilitate technology transfer through those opportunities.

The initial project list shows 19 'Commercial Opportunities'. Of the 19 Opportunities, 16 can be considered applied R&D and three opportunities consistently scored 'high' by a panel of three CTechBA assessors.

The CDG and executive have recommended that CTechBA progress the evaluation of the three opportunities, in the areas of thermal

energy harvesting, tough hydrogels and biomaterials for 3D printing.

Science PhD students' perspective on commercialisation training and its value to them

ACES CI Dr Atilla Mozer, in collaboration with Elias Kyriazis and Samuel Garrett-Jones from the UOW Faculty of Business, led a study 'Mapping the ACES/IPRI student experience'. Questions were focused on determining the current attitudes and perceptions of each participant's commercialisation proficiency.

Findings included:

- Students were generally well informed about industry and the challenges of commercialising new materials research outputs in Australia, especially through small, start-up companies.
- Students were acutely aware of the performance requirements of their PhD curriculum. With very limited time left for anything which did not contribute to the completion of their thesis or related papers they saw limited value in commercialisation training, especially as they have assigned their IP to UOW.
- They are aware the commercialisation of research usually requires an extremely long timeframe, well beyond their PhD completion date, with many resources (including monetary) required.
- Students were opposed to the suggestion of being forced to undertake commercialisation training.
- Many of the students however still envisioned their future as researchers in industry (but not individual entrepreneurs); all keen to take up any opportunities to visit companies and be involved in new product teams with the proviso that it was at the start of their PhD.

- They felt this exposure would assist them to scope their own research and provide them with a base for deciding what business training would be required for them-with commercialisation training being an option.
- Students were aware that if they were to work in industry post PhD than the company would teach them what they were required to learn about commercialisation.
- Other students acknowledged the value of more extensive commercialisation training PROVIDED it led to a recognised qualification (or acceptable to industry) rather than an add-on to their existing PhD.

This study continues and will be expanded into an international benchmarking study.

End-User Information Sessions

Industry partnerships are critical in taking ACES' research into the commercial arena.

To contribute to this, ACES hosted events to raise awareness amongst end-users during 2015.

Networking breakfast: Smart materials for next generation solutions Novotel Geelong, Geelong, Victoria Wednesday 25 February 2015

Thirty attendees were there to discover opportunities to partner with ACES. Short presentations about opportunities to engage with ACES were delivered by Director Prof Gordon Wallace, Associate Director Prof Maria Forsyth and ACES CI Prof Xungai Wang.

Opening of AquaHydrex Pilot Manufacturing Facility Wollongong 23 June 2015

ACES spinout Aquahydrex moved its operations to a new site. Paul Barrett (Executive Officer Aquahydrex), Steve



Kloos (AquaHydrex Chairman and Partner True North Venture Partners) and Gordon Wallace (ACES Director) recounted for the attendees the journey from research in the lab to a new spin out company now in its third year of operation.

**IACCELERATE Entrepreneur Club
Meeting 'Disruptive Innovations' with
Steven Kloos
Innovation Campus, University of
Wollongong
Wednesday 24 June**

True North is the investment fund for the Wal-mart Family. Following an introduction from the ACES Executive Director Gordon Wallace, Steven spoke to the 100 strong audience about 'Disruptive Innovations' and 'Navigating from Startup to Success'. He spoke of TNVP's journey with ACES to form startup company AquaHydrex.

**ACES-ACRV Robotics Workshop
University of Wollongong
24 June 2015**

Fruitful collaborations between industry and ACES centred on robotics are likely to emerge following a workshop that showcased the latest robotics technology. ACES continued its drive to foster partnerships with industry by partnering with the Australian Centre for Robotic Vision (ACRV) to deliver a variety of presentations and case studies, including one on our Soft Robotics program.

Peter Mastalir's-Dynamic Efficiency CEO-business focuses on optimisation of mechanical equipment and he is keen to build a partnership with ACES to generate commercial solutions for engineering clients.

Prof Spinks said the "show and tell"

"It has proven to be an excellent forum to enable bridge building between R&D to commercialisation with profitability," Dynamic Efficiency CEO, Peter Mastalir.

session in which researchers were able to demonstrate their robotic systems- grippers, robot vision systems and easy-to-program robots-was particularly engaging and collaborations should evolve from the event.

ACES Soft Robotics theme leader Gursel Alici gave two 30 min talks at the event; (i) Robots Ready to Work and (ii) Case Study One- ACES Soft Robotics Program.



**From Ideas to Impact
Deakin University
7 August 2015**

ACES CIs Prof Xungai Wang and Patrick Howlett, based at the Institute for Frontier Materials (IFM) at Deakin, hosted a very successful Industry Day, which was attended by more than 50 industry visitors. The areas of researched showcased included: energy, electromaterials, fibres and metals. Xungai as Director of IFM welcomed everyone and gave an overview of the institute whilst Patrick delivered a talk on energy efficiency, resource and infrastructure sustainability.

**Cook Medical Sandpit Event
University of Wollongong
6 October 2015**

ACES CIs Profs Wallace and Spinks gave technical presentations, whilst

six presentations were given by Cook medical members covering their various areas of interest. 19 Cook Medical staff attended and included representatives from their strategic business unit, engineering, production engineering, research scientists as well as the director of research and development.

**Joint CRC Polymer-ACES symposium
'Growth opportunities for the printing and packaging industry: functional inks, printed electronics and sensors'
Innovation Campus, Wollongong
9 November 2015**

A joint CRC Polymer-ACES industry workshop brought together five industry representatives as well as members of Food Innovation Australia Ltd, the Printing Industries of Australia, the CRC for Polymers and ACES to discuss 'Growth opportunities for the printing and packaging industry: functional inks, printed electronics and sensors'. Four presentations were given including an overview of the ACES capabilities in printing and developing functional inks from ACES CI and CRCP Program Leader David Officer. A larger workshop is planned for March 2016 to explore future research funding in this area with other industry partners.

**Smart Coatings Symposium-
Antimicrobial Coatings: Can we outwit a
millennia of evolution?
Innovation Campus, Wollongong
10 November 2015**

The Smart Coatings Symposium, co-hosted by ACES and the ARC Steel Hub, brought together industry and research to explore advances in antifouling and antimicrobial coatings for applications including marine, steel and biomedical. Twelve invited speakers from the different sectors, including industrial, environmental and biomedical, gave presentations that explained the science

behind biofouling, the latest advances in techniques that allow us to gaze into the nanoworld to 'see' how the initial attack occurs and the materials and fabrication protocols we can now bring to bear to the battle at hand.

**Molecules from Seaweed to Fabricated
Structures
Innovation Campus, Wollongong
12 November 2015**

Venus Shell Systems and ACES have embarked on an exciting research partnership. Presenting and celebrating this new manufacturing frontier in the Illawarra/Shoalhaven, the event focused on the opportunities in a future of new polymers, including the potential applications for seaweed polymers.

A networking lunch, demonstrations and a tour of the ACES laboratories followed the presentations.

**'Regenerate yourself - the future of 3D
bioprinting and organ transplantation'
workshop
ACES joined the Cell Therapy
Manufacturing (CTM) CRC and Royal
Adelaide Hospital
14 December 2015**

Prof Gordon Wallace gave a lecture on 3D bioprinting of organs and cells for transplantation at this event in Adelaide. The event was an exciting opportunity to showcase new biomanufacturing techniques and industry for South Australia. It featured a workshop component where the custom built 3D bioprinter, developed via the ACES/ANFF partnership, demonstrated how it delivers new formulations containing living human cells.

ACES adds unique bioprinting expertise to CTM CRC's capabilities. CTM CRC presents a potential commercialisation pathway as the technology develops.



ACES joined the Cell Therapy Manufacturing (CTM) CRC for a workshop. Pictured (L to R) Prof Toby Coates (Royal Adelaide Hospital), Dr Sherry Kothari (CTM CRC CEO) and Prof Gordon Wallace (ACES Director).

Industry Representations by ACES members

Officer D.L. (2015) Graphene in Polymer Composites at the Canary Networks Graphene Educational and Investment Seminar, Shaw Stockbroking, Sydney, 4 March.

Officer D.L. (2015) Graphene Polymer Composites at Composites Australia Technology Seminar 'Graphene - the future for high performance materials', Parramatta, Sydney, 5 May.

MacFarlane, D.R. (2015) Member of the Science Advisory Panel for CAP-XX, 31 July.

Mozer, A. (2015) Showcased his ideas at a UOW-ANSTO Networking Workshop on 31 July. This event was to encourage collaborations between UOW and

ANSTO in research and education.

Forsyth, M (2015) Presented 'New breakthrough battery storage research' at the Libby Cokers Renewable Energy Summit in Torquay, Victoria on 21 September.

MacFarlane, D.R. (2015) Showcasing Collaboration: Ionic Liquids, State Government of Victoria - UTP Research Collaboration Initiative; University of Melbourne 23 November.

Wallace, G (2015) Presented on ACES/ANFF capabilities at the Factories of the Future breakfast in Parramatta, 27 November. The 2015 Manufacturers' Monthly Factory of the Future series brings together forward thinking manufacturers in a collaborative knowledge sharing environment

enabling them to learn from industry experts, academics, government agencies and colleagues on the latest industry insights and best practice. The Factory of the Future series is designed for industry executives who need to acquire knowledge and who also value the opportunities provided by inter-industry networking.

Officer D.L. (2015) '3D Printing and Polymers' presentation which described the ACES/ANFF printing facility at the Supplier Innovation Group meeting run by the Hargraves Institute at Coca Cola Amatil, North Sydney, 15 December. The meeting was attended by around 15 people, about one third from Coca Cola and the rest from a mix of industries including Selleys and Cochlear.



Visits by Industry to ACES Nodes

It is important to raise the Centre's visibility outside the academic sector, with the aim to (a) showcase ACES research skills, technologies and facilities as well as to (b) understand how ACES can better facilitate pathways and connections to maximise their research impact.

The end goal for undertaking the meetings is to work towards:

- ACES being recognised as an authority on electromaterials science
- developing more strategic research alliances with industry partners to increase research funding and licensing opportunities
- identifying funding opportunities to advance ACES technologies through the R&D pipeline to become investor ready
- identifying strategic alliances to build upon and strengthen ACES research capacity and capabilities
- negotiating collaborative and material exchange agreements to further advance the scientific discoveries.

48 business briefings were given by ACES members to personnel within the government, industry or part of the business community.



MEDIA & OUTREACH

ACES Strategic Plan Goal 4: Communications

Our goals are to:

- Develop communication skills and protocols that ensure awareness of and commitment to the ACES vision across the research, research training and commercialisation platforms within the Centre.
- Create effective interfaces that disseminate the science and promote engagement effectively targeting the

different stakeholders - in commercial sectors, healthcare, government and the community.

Our target audience is all ACES stakeholders - the global research community, students, investors, government and regulators and the community.

Towards our goals

Disseminating the science: ACES research makes international headlines

An artificial leaf and an artificial 4D printed valve fought for the top news title of 2015.

ACES media summary

209 online stories

40 print stories

19 radio interviews

12 TV appearances

Artificial leaf breaks energy records

The ACES Monash University node produced artificial leaf technology and broke a world record for energy efficiency, with 22 per cent, eclipsing the old mark of 18 per cent. Developed by the ACES Synthetic



Energy Systems theme (led by Prof Doug Macfarlane), the process splits water into hydrogen and oxygen, with the hydrogen a potential energy source for homes and cars. The advance was reported extensively, with 26 accounts noted on international websites, with a possible global audience numbering in the millions. Notable websites included Wired, Techienews, ScienceAlert, Before It's News, Virgilio, French Tribune, Mashable and The Times Kuwait. Profs MacFarlane and Spiccia were quoted in many media stories and have subsequently positioned themselves as authorities on clean energy technology.

Another article highlighting the artificial leaf technology was published in the November issue of the Royal Australian Chemical Institute's 'Chemistry in

Australia'. The article was aimed at non-scientific readers and written by Shannon Bonke and Profs MacFarlane and Spiccia (http://chemaust.raci.org.au/sites/default/files/pdf/2015/CiA_Nov2015.pdf).

4D printing

4D printing you ask? Of course, there are no 4D printers, as such. The term describes 3D printed materials that morph into new structures post production, under the influence of stimuli such as hot water or heat. The ACES soft robotics team and chief investigator Prof Marc in het Panhuis, developed a 4D printed valve that actuates in response to the temperature of the water surrounding it, demonstrating a capability that could

be exploited in medicine, construction, automation and robotics, to name a few fields of application (<http://www.electromaterials.edu.au/news/4d-printing-to-rewrite-book-on-cool-tech/>).

Media from around the globe covered the 4D printing development, including BBC Radio 4 and a plethora of websites, including Titan Wave, ARN, 3D Printer World, ScienceAlert, Science Daily, e-Wall-Streeter and Cool Gadgets, with Science Alert alone having an estimated audience of more than eight million per week. This development holds the number one viewed post on the ACES website, with more than 1300 views, more than twice that of the blog holding second position. Media covered the story for six months (April to September) and a YouTube video on the work has attracted more than 30,000 views to date.

Benchtop brain

News highlights for the ACES Synthetic Biosystems theme focused on 3D printed brain 'tissue', 3D bioprinting, and the hydrogel condom.

The benchtop 'brain tissue' development garnered substantial online coverage, including by websites Medical Xpress, nzhealthcheck, AllPsych, IndoAsian News Service, Zee News, Gizbot, Biomedical 3D printing and Science Meets Business. Gizbot, for example, reaches more than 150,000 people per month.

This work produced a six-layered 3D printed structure, incorporating neural cells delivered using a custom developed bio-ink containing naturally occurring carbohydrate materials. A bench-top brain that accurately reflects actual brain tissue would be significant for researching not only the effect of drugs, but brain disorders such as schizophrenia and degenerative brain disease.

Bioprinting

Following the medical theme, 3D bioprinting in general was well documented among media outlets, and a free online 3D bioprinting course available to the general public attracted considerable recognition.

ACES Director Prof Gordon Wallace and Australian National Fabrication Facility's Dr Stephen Beirne developed the course - Bioprinting: Printing Body Parts - which details the bioprinting revolution through case studies ranging from hip implants to facial transplants to lab-grown organs. More than 7400 people signed up to take part in the online course.

Prof Wallace was interviewed on Radio National about 3D bioprinting and ACES researchers wrote an article that appeared in *Materials Australia* – '3D Bioprinting could be the tool that brings Tissue Engineering to Fruition as a new clinical paradigm' (*Materials Australia Magazine*. 2015; July:46-48). The *Materials Australia Magazine* is the official publication of Materials Australia, a technical society of Engineers Australia that provides technical materials support to those in the materials engineering, manufacturing and research industries. Predictably, bioprinting and 3D printing in general continue to be extremely popular topics with the media and with every interview he does, Gordon further confirms his position as an authority on these topics.

Wearable technology

Wearable smart fabrics attracted significant media attention for the Electromaterials theme at ACES in 2015. Researchers have created new fibre structures using traditional knitting and



braiding techniques to introduce the ability to monitor human movement using wearable garments, and even to store the energy required to power such a function. This development was picked up by a host of websites: ABC Science Online, Nano Werk, New Electronics, John Morris Group and Silicon Angle, among others.

Ethics

The ACES theme Ethics, Policy and Public Engagement was well represented in the media, in particular by A/Prof Rob Sparrow and Dr Frederic Gilbert. A/Prof Sparrow appeared on various TV stations: Channel Ten for comment on sex education; SBS Insight and radio station

2UE to talk about robot ethics; and Sky News to discuss the ethics on drones. Both researchers were featured in an article on the Daily Bread website on the development and ethics surrounding brain implants. Dr Frederic Gilbert was also interviewed by Danielle Egan for a science media article published September 24th on Mad In America, entitled 'The Peril of Deep Brain Stimulation for Depression' (<http://www.madinamerica.com/2015/09/adverse-effects-perils-deep-brain-stimulation-depression/>).

Batteries

Coverage on ACES battery research was scattered throughout the year. The Geelong



Advertiser (readership about 75,000) featured an article quoting A/ Prof Patrick Howlett about a Deakin University/ACES project that provides back-up for parts of Melbourne's power grid. The same paper also reported on work by ACES' at Deakin University (led by Prof Maria Forsyth) about the team creating batteries of the future and Prof Forsyth was also quoted about high capacity batteries in a separate article.

A partially biodegradable battery created at ACES University of Wollongong node was reported on by The Illawarra Mercury, WIN News and websites Noodls and MDTMag. Noodls reaches more than 300,000 people per month.

Graphene

Another notable topic reported in the press was graphene, with feature articles appearing in The Australian, Reader's Digest and Cosmos, all of which quoted Prof Gordon Wallace.

Opinion pieces

ACES CI and leader of the ACES Ethics, Public Policy and Engagement research theme, Prof Susan Dodds wrote an in depth analysis and opinion piece for ABC Science online 11 February 2015 about '3D printing raises ethical issues for medicine' (<http://www.abc.net.au/science/articles/2015/02/11/4161675.htm>).

Another opinion piece was published in The Conversation in August, entitled 'From Science Fiction to Reality: The dawn of the biofabricator'. Written by Prof Gordon Wallace and Dr Cathal O'Connell, the article has been read by more than 21,000 people to date.

ACES editorial content garnered lively responses from readers. In response to Prof Gordon Wallace's blog post 'Research Labs: Open for business', former steel manufacturing professional and current PhD candidate Adrian Tootell penned a post furthering the discussion about the Australian manufacturing sector and science research.

**Excerpt 'Open Letter to
ACES Women in Science'
by ACES Associate Director
Maria Forsyth
6 March 2015.**

*My fellow ACES women in
science,*

*What a privilege it is to be a
woman in science!*

*What a privilege, to be in a
career that is not only a job, but
a hobby.*

*What a privilege, to be able to
help shape so many young lives
and minds through teaching and
research training.*

*What a privilege, to have
a career that allows us to
contribute to advancing life-
changing technologies, for
the betterment of society,
for enhancing the earth's
sustainability.*

You are a role model!

*Each and every one of you is
an important role model for
young girls contemplating
a science education. Even
today, the percentage of girls
taking the 'hard' sciences and
mathematics is significantly
lower than boys. The perception
that science is 'too hard' or
simply 'boring' is still out there
among young women.*

*The key seems to be
encouragement, encouragement
and more encouragement,
making it relevant, and making
it fun!*

*Being a woman in science also
means expanding the pool of
talent and providing a more
diverse approach to problem
solving.*

*..and I implore you to continue
to pave the way for more
women just like you.*

The following is an excerpt from
Adrian's post: *"To become more
competitive, Australian manufacturing
is in desperate need of 'new to the
world' innovation. I have had the
opportunity of visiting some research
facilities and working with some
scientists who understand the issues
facing traditional manufacturing...*

*A visit to the laboratory and meeting the
team at the ARC Centre of Excellence for
Electromaterials Science has certainly
changed my opinion on the future of
Australian manufacturing. I can now see
a potential for growth. A future that may
not be dependent on mass production.
I have also developed some great
relationships with great people...*

*One of the best investments of three
hours that I have made".*

To read the letter in its entirety visit
[http://www.electromaterials.edu.au/
news/an-opportunity-for-australian-
manufacturing/](http://www.electromaterials.edu.au/news/an-opportunity-for-australian-manufacturing/).

ACES Communication Platforms

Website

Traffic to the ACES website
electromaterials.edu.au increased from
an average of 2,500 sessions per month
in 2014, to an average of 3229 in 2015.
Content authored by senior researchers on
the website is always popular to encourage
engagement. For example, Prof Maria
Forsyth penned an inspirational open letter
to the women of science for International
Women's Day in March (see excerpt). This
remains one of the most-read pieces of
content on the ACES website and was re-
published by Deakin University.

Social Media

Facebook, Youtube and Twitter
followings have increased significantly
this year and have proven to be an
excellent tool to engage audience-

in particular, future students- with
our research and to communicate
opportunities to involve themselves
further with ACES.

Community Engagement and Social Benefits

Indicators of the social impact of
ACES can be measured through public
outreach programs, contribution to
policy development and influence on the
national research strategy.

Contribution to policy development

During 2012-2015, ACES CI Prof Susan
Dodds was a member of the Australian
Health Ethics Committee (AHEC) in
recognition of her expertise in social
science and ethics research, and her ability
to shape policy and processes relating to
emerging technologies and science.

ACES CI Prof Linda Hancock, a member
of the ACES EPPE team, was involved
in discussion with four academics-Drs
Amit Kumar; B Prasad, Vidya S Batra
and Atul Kumar - from TERI University
during an India-Australia energy policy
meeting in Delhi in September 2015. The
TERI academics are active in advising the
Indian government on energy policy. This
relationship will be developed during 2016
with a view to developing shared research.

ACES CI Prof Robert Sparrow, a member
of the ACES EPPE team, visited and had
discussions with the Therapeutics Goods
Administration (TGA) in Canberra in July.

ACES CI A/Prof Patrick Howlett was
invited to attend a Victorian Defence
Industry Strategy Workshop in Melbourne
on 22 June; the Committee for Economic
Development of Australia (CEDA) event
on 26 June which hosted the Honorable
Lily D'Ambrosio MP, the Victorian Minister
for Energy and Resources, who outlined
the government's policies, programs and
priorities for the state's energy sector
and a renewable energy summit held in



Geelong on 21 September. Patrick also gave an overview of ACES research at the ICN Victorian state government energy sector meeting in Geelong on 25 June.

Professional network engagement

In December 2015 Prof Gordon Wallace was listed in the Knowledge Nation 100 as one of Australia's best thinkers. The Knowledge Nation 100 project celebrates Australia as a knowledge rich society and illuminates those people building the knowledge economy. The Office of the Chief Scientist and Knowledge Society joined forces for this initiative as they shared a desire to lift the profile of the country's science, technology and innovation heroes.

ACES Director Prof Gordon Wallace leveraged his extensive network on the social media platform LinkedIn, by publishing seven editorials. This proved to be a good strategy for putting ACES content in front of a professional, international audience. As an example, Gordon's article 'Why would you want

to be a research scientist' in August 2015 was read by 343 people.

An ACES company page was also launched on LinkedIn in 2015 to complement Gordon's network on the platform, and to communicate key messages to a professional audience.

Public engagement

ACES researchers took part in a number of public lectures (see complete list in Table 3), media interviews and public engagement events, in which they described fundamental scientific advances, and the implications for improving health and energy technologies.

The Leon Kane-Maguire Address is an annual public evening event, hosted by ACES at the University of Wollongong. Leon Kane-Maguire, a founding ACES chief investigator, was one of Australia's leading research scientists in the specialist field of conducting organic polymers and their properties. The Address commemorates and

celebrates Leon's contribution to research, the building of research teams, the communication of science and to the mentoring of the next generations of scientists.

The 2015 the Address, on 16 February, was given by Distinguished Prof Ric Kaner from the University of California, Los Angeles. Ric is passionate about the development of new materials. An audience of one hundred guests, including former UOW Vice-Chancellor Gerard Sutton and members of the Kane-Maguire family, enjoyed the entertaining and nostalgic presentation as Ric delved into topics including the world's hardest metal and the wonder material, graphene. The Leon Kane-Maguire student prize recognises the UOW honours student with the highest mark for chemistry and nanotechnology subjects over their degree, and in 2015 was awarded to Melanie Pearsall who completed a Bachelor of Medicinal Chemistry (Honours) Degree.



UOW's newest professors, which included ACES CIs Marc in het Panhuis and Robert Kapsa, shared their potentially world-changing research at the University of Wollongong's Big Ideas Festival, attended by over 400 people, on Tuesday 25 August 2015.

Marc spoke about hydrogels and made a 3D-printed circuit of Vegemite live on stage. Marc's 'Big Ideas' presentation can be viewed in a story published by the Illawarra Mercury (<http://www.illawarramercury.com.au/story/3305142/uow-showcases-big-ideas-video/>).

Rob presented his research aspirations for the development of solutions for disease and damaged nerve and muscle tissue with his talk on 'Tendrils of human thought from within a seaweed brain?' Rob has been using seaweed products such as alginate to create small 'brain' structures from the blood of a person with a neurological disease to study the function of their own brain. In this way, seaweed is providing a helping tendril into our understanding of human brain structure,

function and disease (<http://www.uow.edu.au/research/news/bigideas2015/UOW191451.html>).

Since 2009, ACES has collaborated with the Rotary Club of Kiama to host an annual public evening lecture-the Bill Wheeler Symposium. Each year the event attracts around 100 people, who enjoy a feature presentation from a bionics expert, and a short talk from a PhD candidate who has been awarded the Bill Wheeler Student Prize. Community raised funds of \$2,000 are awarded to the winning student, to be used to facilitate the building of collaborative relationships with external research centres. The 2015 lecture was held on 8 October where ACES Associate investigator Dr Claudia DiBella from St Vincent's hospital Melbourne spoke about "The use of BIOPEN for cartilage bioprinting from the orthopaedic surgeon's perspective". Mrs Lexie Wheeler presented the 2015 Bill Wheeler Award to PhD student Xiaoteng Jia for his work on biodegradable materials for batteries towards bionic implants.

Inspiring the Next Generation of Scientists and their Teachers

Reconceptualising Maths and Science Teacher Education Programs (ReMSTEP)

ReMSTEP responds to the need for improved competence and confidence in the teaching of science and maths, as a pre-service focus, across the Australian Curriculum.

ReMSTEP involves four Victorian Universities (Deakin, Monash, Melbourne and La Trobe) and stems from Australia's Chief Scientist's desire to increase science, technology, engineering and mathematics competencies in school children. At the core of ReMSTEP initiatives is the introduction of new science and maths course electives and or student learning pathways. Equally important is the building of collaborative relationships across faculties, universities and specialist science and maths centres.

ACES researchers and students at Deakin University discussed their work on thermal energy harvesting, ionic

Table 3- Public Talks	
Leon Kane-Maguire Address, given public address by Prof Ric Kaner from UCLA.	University of Wollongong 13 February 2015
Prof Wallace featured as TEDx speaker.	Flinders University, Adelaide 27 February 2015
CI Prof Gursel Alici gave a seminar on 'How far are we from actively controlled medical robotic capsules?' to the University of the Third Age (U3A).	Kiama 16 March 2015
Prof Robert Kapsa (CI UOW/St V) gave an invited talk on 'Gene Correction for Duchenne Muscular Dystrophy' at the University of Melbourne international Masterclass series.	University of Melbourne 6 May 2015
Prof Robert Kapsa (CI UOW/St V) was an invited guest speaker for the Trinity Grammar Scientific Presentation Series where he spoke about 'Autologous Cell Replacement for Hereditary Muscle Disease'.	Hawthorn, Melbourne 14 May 2015
The Rotary Club of Kiama presentation - two previous winners of the Bill Wheeler award, PhD students Leo Stevens and Katharina Schirmer presented their research.	Terralong St, Kiama 28 May 2015
Prof Mark Cook (ACES CI and Synthetic Biosystems theme leader) gave a talk at the NHMRC Council Dinner.	Canberra 3 June 2015
ACES CI and Synthetic Energy Systems theme leader Prof Douglas MacFarlane chaired a Q&A discussion hosted by the Royal Society of Victoria on "Nuclear Energy: Should it be Included in the Mix?"	Melbourne 11 June 2015
Prof Geoffrey Spinks (CI UOW) gave an interactive workshop using artificial muscles at the Questacon Invention Convention.	UOW iC campus 29 June 2015
National Science Week Public Forum: Why would you want to be a research scientist?	Wollongong Science Centre 19 August 2015
University of Wollongong Big Ideas Festival featured two recently promoted Profs Rob Kapsa and Marc in het Panhuis, both ACES CIs.	Over 400 people 25 August 2015
Prof Mark Cook (ACES CI and Synthetic Biosystems theme leader) gave a talk "How do you fix a broken brain?" to the Hawthorn Rotary Club.	Melbourne 26 August 2015
'Hospital of the Future'. Facilitated by ABC Illawarra's Nick Rheinberger and featuring Prof Gordon Wallace, Prof Peter Choong and Dr Frederic Gilbert, discussion delved into ideas about what our hospitals of the future will be like.	Humber Bar, Wollongong 15 September
Prof Maria Forsyth spoke on energy storage for a sustainable environment as part of the ANZAAS Science talks for the general public.	Gene Technology Access Centre (GTAC), Melbourne 16th September
Prof Gordon Wallace was a panel speaker in the MINDSHIFT forum on the topic of 'The Human Machine: Technology is ever increasing and becoming part of us, how far should we push this and what are the benefits and risks this poses?' as part of the Blender festival.	Wollongong 2 October 2015
Bill Wheeler Symposium- 'The use of BIOPEN for cartilage bioprinting: the orthopaedic surgeon's perspective' by Dr Claudia Di Bella.	University of Wollongong 8 October 2015
Prof Geoffrey Spinks (CI UOW) presented on 'Artificial Muscles and Soft Robotics' to the Kiama Seaside Probus Club.	Kiama 20 October 2015
Prof Douglas MacFarlane gave talk 'Electromaterials for artificial photosynthesis - Energy technologies for the sustainoscene' as part of promoting Chemistry in Schools, run by Chemistry Education Association.	University of Melbourne 20 November 2015
A/Prof Jennifer Pringle presented on "Renewable Energy" at the Top Donor Recognition Luncheon.	Deakin Warun Ponds 20th November 2015

**Excerpts from an article
penned by ACES Director
Gordon Wallace on his
perspective to being a
research scientist**

14 August 2015.

Imagine my excitement; a young research trainee excitingly opening the reviewers comments on my first major paper submitted for publication.

Ten typed pages of reviewer's comments!

I started reading... 'More chest-beating...'

Oh. Ten pages, and hardly a compliment in sight.

Little did I know that this was a sign of things to come for the next thirty years. The excitement of research: planning, executing experiments, interpreting the data, discovering new things and presenting new knowledge was to be continually tempered by others skilled in the art of scathing personal and scientific criticism.

Little did I know the excitement of publishing a high profile discovery in Nature or Science journal would be dented by the bitter disappointment of (just) failing to secure the funding that would allow us to continue to develop our research.

The response of my supervisor to that original berating was to be cool, calm and collected. To meticulously argue the point by point criticism and we eventually had our article published.

As in sport, success comes to those who respond to disappointment in the only way you can, that is if you eventually want to win. You must train harder, become more cohesive as a team, lift the vision, build each other's confidence and try again.

liquid electrolytes, metal-air batteries, corrosion, molecular modelling and carbon dioxide separation with high school students and teachers during this program in May 2015. In November 2015 they presented to Deakin University's future high school teacher graduates.

ACES CI and Synthetic Energy Systems theme leader Prof Douglas MacFarlane gave a talk entitled 'Electromaterials for artificial photosynthesis - Energy technologies for the sustainoscene' in November at an event at that was part of promoting Chemistry in Schools run by Chemistry Education Association.

Why be a research scientist?

ACES Public Forum

Wollongong Science Centre

19 August 2015

Long hours, frustrating experiments and the uncertainty of where the next round of funding will come from - why would you want to be a research scientist?

ACES hosted a free event at the Wollongong Science Centre with the audience asked to join the discussion based around this very question. Facilitated by ABC Illawarra's Nick Rheinberger, a panel of research scientists at all different stages of their careers pondered on questions such as:

What is life as a research scientist really like?

Why is it getting harder to attract people into science?

The panel members were:

- ACES Director Prof Gordon Wallace
- Dr Tania Benedetti – visiting scientist to ACES who following her PhD in Brazil, sampled corporate life before turning back to academia in the field of electromaterials.

- Joseph Giorgio, Katharina Schirmer and Rodrigo Lozano- all three in the final year of their PhD at IPRI/ UOW. Joseph's undergraduate education was in Australia, Roderigo's in Mexico and Kati's Germany.
- Ethan Butson, a 19 year old University of Sydney Advanced Science student, prolific inventor and three times named National Australian Young Scientist.

**ACES takes part in University of
Wollongong's Learning Labs Program
19-20 January 2015**

A group of 20 students from years 9 and 10 attended a two day workshop 'The AIIM Experience' during their summer break, learning about exciting developments and methods in areas such as nanotechnology, microscopy and 3D printing.

ACES CI A/Prof Michael Higgins said "informing the students about the latest and high quality research being undertaken in their region was a key goal" of the January 2015 workshop.

**Visit by Ashwood High School
24 February 2015**

Chemistry students from Years 11-12 at Ashwood High School spent a day in the ACES labs at Deakin University.

**Visit to St Peter and Paul Primary
School, Kiama
20 May 2015**

Prof Marc in het Panhuis (ACES CI) and two PhD students visited St Peter and Paul Primary School in Kiama to give a presentation on hydrogels, volcanoes, bluebottles and 3D printing for 120 kindergarten and stage 1 children.

Interactive Workshop at Questacon Invention Convention

29 June 2015

Questacon Invention Convention is a workshop that gives secondary students a practical insight into innovation and entrepreneurship. The aim is to allow them to make stronger connections between science, technology, engineering and maths (STEM) skills. Prof Geoffrey Spinks (CI UOW) gave an interactive workshop using artificial muscles to the 15 school students from years 7 to 9 who attended UOW's Questacon Invention Convention at Innovation Campus.

Visit to Northcote High School Victoria

17 August 2015

CI Simon Moulton gave a talk on 'Stem cells, Nerve Cells and Materials' to Year 11-12 students.

Visit to Ulladulla and Milton Public Schools

19 August 2015

Prof Marc in het Panhuis (ACES CI) and two PhD students visited both Ulladulla and Milton Public Schools as part of the Scientists in Schools Program.

At Ulladulla primary school (120 children) they presented 3D printing and gels to years 4, 5 and 6. The PhD students then demonstrated gel electronics.

At Milton primary school (90 children): three year 4 classes received a presentation on 3D scanning and printing; CAD design and hands-on hydrogel experiments as well as experiments on endothermic and exothermic reactions.

Deakin University Open Day-ACES labs on show

23 August 2015

ACES students showcased their work and the labs at the University open day.

ACES hosts Ulladulla High School 8 September 2015

Interactive workshops were well received by 52 Ulladulla High School students from years 9 and 10 during a visit to ACES in Wollongong. Workshop stations included computer-aided design, 3D scanning and printing, a lab tour of the fabrication facilities and a surprise addition, edible electronics. Students helped 3D-print Vegemite onto bread, which was then hooked up to an electrical circuit, lighting a LED in a fun demonstration that resonated well with the students.

ACES hosts Ashwood Secondary College at Deakin University

9 September 2015

As part of ACES ongoing commitment to improve science education, twelve Year 12 Chemistry students from Ashwood Secondary College visited the ACES laboratories at Deakin University in Burwood. During the visit the students had a short theory lecture followed by a practical session. The students and their teacher appreciated the time committed by ACES staff and the access to the laboratory; especially enjoying the quality images and hands on experiments.

Visiting Minnamurra Vacation Care 21 September 2015

Prof Marc in het Panhuis (ACES CI) and ACES PhD student Charles Hamilton again inspired young scientists by demonstrating 3D printing of gels and Vegemite at Minnamurra vacation care.

ACES/IPRI Student Open Day University of Wollongong

25 September 2015

Prospective PhD, Master and Summer scholarship students were invited to tour the labs, meet the supervisors and learn about opportunities to study at IPRI/ACES.

Enhance cultural, creative and recreation opportunities

The ACES association with the Wollongong Science Centre over the last seven years has enhanced cultural activities within this regional area. To date this partnership has overseen the installation of an iDome, showing a virtual tour of our IPRI/ ACES laboratories; an interactive nanotechnology display giving visitors and the public a brief overview on what nanotechnology is about and where it can be used in society; as well as the 'Nanocam – a trip into biodiversity' full dome planetarium show. Taking pride of place within the existing ACES NANotechnology Exhibit is a 3D Printing demonstration and display, set up in August 2013 by the ACES/ANFF team using parts donated by Stratasyss. Two ACES PhD students worked with the science centre in 2014 developing a display introducing nanotechnology for battery use and a demonstration of a flexible electrochromic energy storage device. In 2015 ACES held a public forum 'Why be a research scientist?' during National Science Week at the Wollongong Science Centre.

Approximately 60,000 visitors enjoy the Science Centre and the ACES developed exhibit each year.



ACES Strategic Plan Goal 5: Global Engagement

We are committed to connecting with the international research community and strategically expanding our global sphere of influence by investing in partnerships which add value to ACES.

Materials research heavily underpins the scientific, technological and industrial advancements that drive advanced economies and modern societies. As an endeavour, materials research is often highly collaborative, drawing upon skills from a wide variety of scientific disciplines to design and synthesise new materials, characterise their properties, and thereafter, develop new applications and technologies. Innovation in this domain is thus strongly reliant on healthy networks and strong partnerships towards ambitious common goals.

Our target is the scientific research community.

Towards our Goals

Partner Investigators

ACES welcomed on board 5 partner investigators in 2014. The addition of the ACES partner investigators enhances the specialist expertise and ACES access to world class facilities.

Our partner investigators have been engaged with ACES through joint international workshops and embassy events as well as exchange visits in 2015.

Partner Institution	Country	Areas of Expertise
Dublin City University	Ireland	smart materials, stimuli responsive materials, sensors, health, and the environment
University of Warwick	England	electrochemistry
Friedrich Alexander University	Germany	molecular materials and nanotechnology
Hanyang University	South Korea	soft robotics and biomedical engineering
Yokohama University	Japan	ionic liquids and their electrochemical and materials applications

ACES Hanyang University

ACES welcomed five professors and four students from Hanyang University, Korea, to a two day closed joint workshop at the ACES headquarters on University of Wollongong's Innovation Campus 9-10 February 2015.

The February workshop was followed by another visit to Wollongong by ACES partner investigator Prof Seon Jeong Kim and two students from Hanyang University in July 2015. The students were partnered with ACES investigators during their 3 week stay with one student working on developing high strength composite fibres from graphene dispersions and building on our earlier work using graphene/carbon nanotube composites. The second student worked on tough hydrogels for soft robotics. The visit also provided an opportunity to advance a number of on-going research projects and joint research publications.

ACES CI Prof Spinks and PI Prof Kim met with other international collaborators in Vancouver in September 2015 to further collaborative links.

Four journal articles were published on

collaborative work between ACES and PI Kim at Hanyang University in 2015 (*Scientific Reports*. Mar 2015;5:6; *ACS Applied Materials & Interfaces*. Jul 2015;7(27):14851-14858; *Journal of Power Sources*. Jul 2015;286:103-108 and *Advanced Engineering Materials*. Sep 2015;17(9):1270-1275).

ACES Dublin City University

To celebrate and build on ACES links, ACES Partner Institution, Dublin City University, hosted a one-day invitation-only workshop entitled '**ACES: The European Dimension symposia**' on 21 May 2015. Invited guests were encouraged to participate and present their latest work that has benefitted from, or could benefit from, ACES collaborations in; research, research Training, communication or commercialisation.

New collaboration opportunities to emerge from the workshop included:

- Surrey University. Alan Dalton's presentation highlighted some great opportunities on the graphene front. Gordon Wallace followed



up this connection with a visit to Surrey in October.

- University of Manchester. Paul Viper's presentation exposed the amazing array of graphene projects at the Graphene Institute. Gordon Wallace and ACES international advisory chair Dame Bridget Ogilvie visited Manchester in October.
- UCL Institute of Neurology, UK. Louis Lemieux works on coupling electrode technologies and MRI scanners for brain mapping applications. Louis visited ACES/ UOW in August and a collaborative project is underway.

The ACES- European Dimension workshop culminated in an **ACES Research Showcase** hosted by the Australian Ambassador to Ireland, Dr Ruth Adler. This event was a huge success attended by many old and potential collaborators from across Europe. During the presentations the importance of bringing industry into these global research networks was highlighted.

Progressing DCU collaborations

In addition to co-hosted events, ACES members spent time at DCU working on projects and furthering collaborations.

Aoffie Morrin from DCU works on sensing technologies for incorporation into wound healing systems. ACES welcomed Aoffie as an associate investigator and a joint paper 'Electro-stimulated release from a reduced graphene oxide composite hydrogel' was published (*Journal of Materials Chemistry B*. 2015;3(12):2530-2537). Dr Emer Duffy, from Morrin's research group spent December 2015 at ACES University of Tasmania (UTAS) node working on sensing of skin gases.

The ACES electrofluidics and diagnostics team at UTAS worked with Dermot Brabazon from the School of Mechanical & Manufacturing Engineering at DCU on 3D printed microfluidic modules (*RSC Advances*. 2015;5(29):22906-22915 and *Journal of Materials Science*, Oct 2015;50(19):6245-6259). Prof Brabazon visited UTAS 26 August.

As a result of the successful European Union International Research Staff Exchange Scheme (IRSES) MASK project, 2011-2015, between ACES and Dublin City University research staff were awarded an ARC Discovery Project to ACES CI David Officer and PI Dermot Diamond. ACES CI Prof David Officer spent 3 months at DCU (30 June- 23 September 2015), progressing these international collaborations.

To progress as well as guide future work a mini-symposia on chemopropulsion was held on 29 July. Both CI Officer and PI Diamond were amongst the five speakers to an audience of 18 researchers from DCU, Trinity College Dublin and University of Wollongong excited by this new research area.

Other UOW researchers to visit DCU in 2015 included: Dr Pawel Wagner (30 June-5 July), Dr Klaudia Wagner (28 July-7 August), Mr Fletcher Thompson (17 May-22 May), Prof Gordon Wallace (14-22 May) and Yang Xiao (28 July-7 August). Mr Thomas Glennon and Mr Conor O'Quigley from DCU each spent 3 months at UOW.

ACES Friedrich Alexander University

Throughout 2015, ACES researchers have supplied a range of electromaterials to PI Guldi and his researchers including porphyrin dyes for use with graphene, zinc oxide and copper oxide. In addition, ACES has sent their materials to Friedrich Alexander University (FAU) for characterisation, including porphyrin-fullerene conjugates for photophysical characterisation, reduced graphene oxide (rGO) films with porphyrins for spectroscopic characterisation and graphene fibres for characterisation. Ongoing conversations about the synthesis and use of molybdenum di-sulphide 2D material developed in the ACES laboratories have also been undertaken.

A number of researcher exchanges have taken place between FAU and ACES UOW. PI Guldi visited UOW for 2 weeks from 12 - 21 February. On 6 July, ACES senior researcher, Pawel Wagner, visited PI Guldi and his research group at FAU and presented a lecture entitled "Photo- and electro- active molecules". CI Officer and ACES Director Wallace both visited FAU in August and September, respectively, to discuss ACES research. A three month research visit (October-December) to ACES Wollongong was made by Erlangen FAU student researcher, Annkatrin Lennert, who investigated the potential in solid state electrolytes of new organic ionic plastic crystals produced by ACES Deakin University researchers.

Markus Pfau, the first joint ACES/FAU PhD student co-supervised by CIs Officer and Wallace, and PI Guldi, returned to ACES UOW in the latter part of the year to complete his research associated with porphyrin dyes.

ACES Warwick University

Dr Jie Zhang (ACES CI) and Prof Pat Unwin (ACES PI) have three student projects underway in collaboration with University of Warwick. Jie is currently hosting a joint Monash-Warwick University PhD student for 12 months at the ACES Monash node and this involves the

determination of electron transfer kinetics. A further student project is underway and the third student's joint research on fundamental studies of electron transfer processes has been published (*Analytical Chemistry* 2015;87(16):8387-8393 and *J. Phys. Chem.C* 2015, 119(22), 12464-12472). In addition, Warwick University undergraduate student Erin Bullions visited for 14 weeks, as part of the Warwick-Monash alliance.

CIs Prof Maria Forsyth and A/Prof Patrick Howlett from Deakin University visited Oxford and Warwick Universities in September 2015, meeting up with PI Prof Pat Unwin to discuss potential ACES projects and exchanges.

ACES Yokohama University

Profs Mahito Atobe and Junji Fukuda from Yokohama National University (YNU) joined ACES as Associate Investigators in 2015. Over the next 12 months ACES PI Prof Watanabe along with ACES CI Prof Douglas MacFarlane will refine further participation from YNU in ACES research projects relating to conducting polymers within the ACES Synthetic Energy Systems theme.

Current ACES International Partnerships

ACES enjoyed connections with 23 countries through 100 collaborators in 2015, as reported by the 23 ACES Chief Investigators.

ACES published **190** Journal articles in 2015 that contained ARC Centre of Excellence for Electromaterials Science in the address line.



- **151 (79%)** of 2015 ACES publications were published with international co-authors, from **30** countries and **135** different institutions
- **63 (33%)** of 2015 ACES publications were published with national co-authors, from **6** states and **49** different research groups.

Between **2014-2015** ACES has produced **328 publications**, with 52.4% published in top 10% journals, and those publications have **1,341 citations**. **297** or 90.5% of these were in the top **10% most cited** and **17** or 5.2% were in the **top 1% most cited** (Source: SciVal, based on Scopus data from 25 January 2016; Table 4).

The Field Weighted Citation Impact (FWCI) World Average is 1.00. ACES FWCI is 1.81 and that increases to 1.99 when only considering articles published in the field of Materials Science (165) and 2.04 in the field of Engineering (75).



Belgium

- Ghent University

Canada

- Uni British Columbia
- Dalhousie Uni
- Uni Toronto
- Cytec

China

- Chinese Academy Sci (CAS)

Estonia

- Uni of Tartu

Finland

- Uni of Tampere
- ABO Akademia Uni

France

- CRPP
- Montpellier Uni 2

Germany

- Uni Ulm
- Helmholtz Zentrum Berlin
- TU Berlin Free University
- Forschungszentrum Juelich

Ireland

- Queens Uni
- DCU

Italy

- Niguarda Ca' Granda Hospital

Japan

- Shinshu
- AIST
- Hokkaido Uni
- Kanazawa Uni
- Tokyo Uni
- Kyoto Uni
- Gifu Uni

Korea

- Hanyang Uni
- Dongguk Uni
- Jeju Uni
- Seoul National Uni
- KIMM
- ETRI

Netherlands

- Twente
- Utrecht

New Zealand

- Otago Uni
- Uni Auckland

Poland

- Silesian Uni
- Adam Mickiewicz Uni

Serbia

- Uni Belgrade

Singapore

- National Uni of Singapore

Slovenia

- Uni Medical Centre Ljubljana

Sweden

- Linköpings Universitet

Spain

- CIC energigune
- Polymat
- Uni of Cantabria
- Tecnalia
- Universidad de Zaragoza

Switzerland

- Uni Zurich
- Uni Geneva

Turkey

- Karadeniz Technical Uni

United Kingdom

- Uni Cambridge
- Uni Birmingham
- Oxford Uni
- UK Stem cell bank
- Open Uni, Milton Keys

USA

- Uni of Massachusetts
- UCLA
- Rutgers Uni
- Uni Texas
- Furman Uni
- Uni Nth Carolina
- Uni Alabama
- Uni Colorado
- Virginia Tech
- Los Alamos
- Michigan Tech Uni
- Tufts Uni
- MIT
- WiCell Research Institute
- Brigham Young Uni
- Michigan State Uni

Table 4: ACES publication data as per scival, based on Scopus data 25 January 2016. Scopus uses Scimago Journal Ranking (SJR) as the basis for the top % of journals.

Number of publications	Number of citations	Outputs in top 10% most cited	Outputs in top 1% most cited	Field Weighted Citation Impact	Pubs in top 10% Journals	Pubs in top 1% Journals	International collaboration
2014-2015							
328	1,341	140 (42.7%)	17 (5.2%)	1.81	164 (52.4%)	17 (5.4%)	170 (51.8%)
2014-2015 Materials Science publication & citation impact of ACES							
165	635	71 (43.0%)	9 (5.5%)	1.99	95 (60.9%)	6 (3.8%)	86 (52.1%)
2013-2015 Engineering publication & citation impact of ACES							
75	178	27 (36.0%)	2 (2.7%)	2.04	21 (31.3%)	3 (4.5%)	36 (48.0%)

The key international partners based on the ACES publications 2014-2015 showing international co-authorship are listed in Table 5.

Table 5: Key international institutions as co-authors on ACES-affiliated publications 2014-2015 (Source: SciVal, based on Scopus data from 25 January 2016)

International institution	Number of publications with ACES	Pubs with ACES in top 25% most cited	Pubs with ACES in top 10% most cited	Pubs with ACES in top 25% Journals	Pubs with ACES in top 10% Journals
University of Texas at Dallas	13	12	6	12	11
Hanyang University	8	8	5	7	7
Helmholtz Zentrum Berlin for Materials and Energy	8	8	4	8	7
Dongguk University	7	7	4	6	-
Nanyang Technological University	7	7	3	5	-
Dublin City University	6	5	5	6	2
Freie Universitat Berlin	5	5	3	5	5
National Institute for Materials Science Tsukuba	5	5	4	5	4
University of Otago	5	5	3	5	5



Photo courtesy of Austrade Seoul

Europe

Strong ties built over more than 25 years between ACES researchers and European collaborators have led to significant achievements in biomedical engineering and electromaterials science.

The launch of a global Master of Philosophy in BioFabrication course is an example of how ACES is exploring new partnerships with European institutions, in this case Utrecht University in the Netherlands, and University of Wurzburg in Germany.

The ACES European network is extensive, and the team remains committed to seeking further alliances in Europe. The widely circulated ACES 'European Dimension' booklet welcomed the opportunity to

discuss collaborative research programs and exchange of researchers.

Korea

Mr Whie Jin Lee Consul-General, Consulate-General of the Republic of Korea and 20 Korean guests, gathered in Wollongong on 10 February, to celebrate 20 years of collaboration between IPRI/ACES and Korea. ACES Director Prof Gordon Wallace views Korea as a key strategic link and has built strong collaborations with institutions renowned for biomedical engineering. ACES welcomed long-term collaborator Hanyang University on board as an official partner.

The '**Australian Innovation Showcase 2015 – Medical Technologies**', held

in Korea on 30 June 2015 by Austrade, showcased Australia's advanced medical technology achievements and to foster new business opportunities between Korea and Australia.

The showcase was an opportunity to introduce Korea to Australia's advanced medical technology capability and to open the door to future collaborative efforts. Prof Gordon Wallace presented on, 'The commercialisation of Australia's medical research' and 'The effect of 3D bioprinting on medical science'. He explained that "medical devices such as glaucoma implants, cartilage restoration scaffolds, and customised drug delivery have been realised through 3D bioprinting" and that "the 3D printer has made basic stem cell research possible, while artificial tissue produced by 3D

printing could eventually replace animal testing. 3D printing challenges how we think about fabrication and enables us to more closely integrate fundamental and applied bio sciences."

The event was attended by the Australian Ambassador to South Korea, His Excellency Mr Bill Paterson PSM plus 70-80 guests.

7th Framework Programme - Marie Curie Action International Research Exchange Scheme

IRSES-AMBIPOD project (2014-2017): Dr Pawel Wagner (ACES SRF) hosted five students in 2015 at ACES/UOW as part of the "Multicoloured Ambipolar Conducting Polymers for Single Polymer Optoelectronic Devices" (AMBIPOD) project, which is funded under 7th Framework Programme -Marie Curie Actions. The project aims at conscious development of novel conjugated polymers featuring multielectrochromic properties that can find application in polymer electrochromic or electroluminescent devices. The aim is to obtain new π – conjugated polymers, containing both electron-donor and electron-accepting units by first selecting their monomeric precursors using quantum chemistry tools.

ACES UOW hosted Katrina Scanlan, a first year PhD student, from the University of Strathclyde, for 2 months and Przemyslaw Ledwon, Katarzyna Piwowar, Aleksandra Kurowska and Andrzej Milewski from the Silesian University of Technology, Poland, each for 3 months.

Putting ACES on the Global Stage

In the quest to consolidate existing collaborations and to initiate new ventures in research, ACES members were actively out and about speaking of

ACES New Dimensions to existing and potential collaborators as demonstrated by the information in the following tables.

Plenary/Keynote Addresses

20 Plenary or Keynote addresses were given by ACES members in 2015-details are in Appendix 2.

Invited Talks at International Conferences

57 invited talks were given by ACES members at International Conferences in 2015- details are in Appendix 3.

Invited Seminars / presentations/visits related to ACES work

A. Distinguished Visitor Lectures

17 invited 'distinguished visitor' lectures were given by ACES members in 2015- see Appendix 4.

ACES Synthetic Energy System theme leader and ARC Laureate Prof Douglas MacFarlane gave seven lectures as part of his Royal Society of Chemistry (RSC) Australasian Lectureship Tour that covered four Australian universities and three New Zealand universities.

B. Invited Seminars /Collaboration Visits

79 invited seminars and collaborative visits were given by ACES members in 2015- see Appendix 5.

Included are visits organised as part of the Distinguished Visiting Professor and Visiting Associate Professor positions offered by Shinshu University to ACES members Prof Gordon Wallace, A/Prof Attila Mozer and Dr Pawel Wagner which were extended from 2014 into 2015. The purpose of the

positions are to strengthen research collaborations in existing areas and to expand into new areas of carbon fibres, carbon dioxide reduction and water splitting, with a particular focus on developing advanced characterisation tools for 3D manufacturing. To date researchers have trialed the measurements of extruded coaxial conductive fibres by terahertz spectroscopy. The measurements showed that terahertz spectroscopy is sensitive to the highly conductive email wires in the fibres, but the spacial resolution was not enough for detailed studies.

Conference Presentations by ACES members

47 Conference presentations given by ACES members in 2015-for complete list see Appendix 6. Please note that presentations given by ACES members at ACES events are not included in any of these lists.

Encouraging Research Collaboration

Workshops

The advancement of the scientific knowledge that ACES generates is an important component of Centre activities. ACES runs at least two or more international conferences or workshops each year. ACES students and ECRs are given the opportunity to communicate their research in ACES showcase sessions and poster sessions at ACES events. Networking by ECRs and students with international guests is encouraged. Over the years, ACES has developed a reputation for not only excellence in the educational quality of its conferences, but also the collegial atmosphere.

Table 6 – ACES External Symposia & Workshops	
ACES sponsored session at the 7th Biennial Australian Colloid & Interface Symposium	Hobart, 1-5 February 2015
ACES- Hanyang University joint workshop	Wollongong 9-10 February 2015
ACES: The Korean Dimension	Novotel Wollongong, 10 February 2015
10th Annual International Electromaterials Science Symposium	Innovation campus, University of Wollongong 11 –13 February 2015
Electrofluidic Devices for Chemical and Biochemical Applications Mini-symposium	University of Tasmania 15 May 2015
ACES: The European Dimension workshop	Dublin City University, Ireland 21 May 2015
Australian Innovation Showcase event- Austrade Korea	Seoul, South Korea 30 June 2015
ACES - Shinshu University Workshop	Innovation Campus, Wollongong 7 September 2015
3D Printing in Oz- Informal Round Table Discussion A national collaboration: Brought together many of those involved in 3D printing to discuss facilities available and opportunities for collaboration.	St Vincent's Hospital, Fitzroy 7 October 2015
ACES Breakfast - Implantable Additive Biofabrication Technologies for Structural and Functional Tissue Applications	Melbourne Convention and Exhibition Centre 19 November 2015
Nanobionics: An ACES and Collaborators Showcase Event	St Vincent's Hospital, Melbourne 20 November 2015

**10th Annual International Electromaterials Science Symposium
Innovation campus, University of Wollongong
11 –13 February 2015**

This was a special symposium as we launched into a new era that we call, ACES: The New Dimensions. What a week! 170 delegates, 60 poster presenters, 11 countries represented plus one friendly visiting koala.

We informed our audience of the innovative programs in research training, commercialisation and

community engagement. These activities compliment a bold and ambitious research program aimed at realising both unprecedented fundamental advances in electromaterials, and the ability to use that knowledge to create useful devices for diagnostics, energy, medical and soft robotics.

The program was based on the premise that ACES will continue to build both national and international alliances that will bring new skills and ideas to our ACES research.

Our annual symposium each year is a celebration of these alliances! Attendance is by invitation and is an opportunity to bring together individuals who are already part of the ACES family, as well as to facilitate burgeoning relationships.

**ACES - Shinshu University Workshop
Innovation Campus, Wollongong
7 September 2015**

The ACES - Shinshu University Workshop was conceived to forge further research collaborations and student/staff exchanges. The workshop showcased research



activity occurring at ACES and Shinshu University which ranged from synthetic chemistry and renewable biomass resources, through to materials for resource recovery and environmental purification, energy and energy storage and then onto smart textiles.

3D Printing in Oz- Informal Round Table Discussion

St Vincent's Hospital Melbourne 7 October 2015

This national collaboration brought together many of those involved in 3D printing to discuss facilities available and opportunities for collaboration. Attendees were from University of Wollongong, University of Tasmania, University of Melbourne, CSIRO Manufacturing, Monash University, Macquarie University, RMIT, Deakin

University, University of Adelaide, Queensland University of Technology and Swinburne University of Technology.

ACES Breakfast - Implantable Additive Biofabrication Technologies for Structural and Functional Tissue Applications

Melbourne Convention and Exhibition Centre

19 November 2015

As part of the 2015 Joint Congress of the IPITA-IXA-CTS, this invitation-only event showcased ACES capabilities aimed at the development of cell/materials hybrid implants.

Speakers included:

- ACES Director Prof Gordon Wallace-Biofabrication for emerging technologies

- Orthopaedic surgeon Dr Claudia DiBella-Orthopaedic: Soft/tough gel printing for cartilage
- Dr Andrew Batty-Anatomics

Nanobionics: An ACES and Collaborators Showcase Event St Vincent's Hospital, Melbourne 20 November 2015

The program highlighted advances in the medical bionics field from ACES and Prof Wallace's ARC Laureate programs, including projects with current and potential partners. The 60 strong audience, including personnel from CSIRO, CRCs, Bionic Vision Institute and clinicians, heard from 20 speakers. In addition 11 posters from ACES and ALF projects were on display.



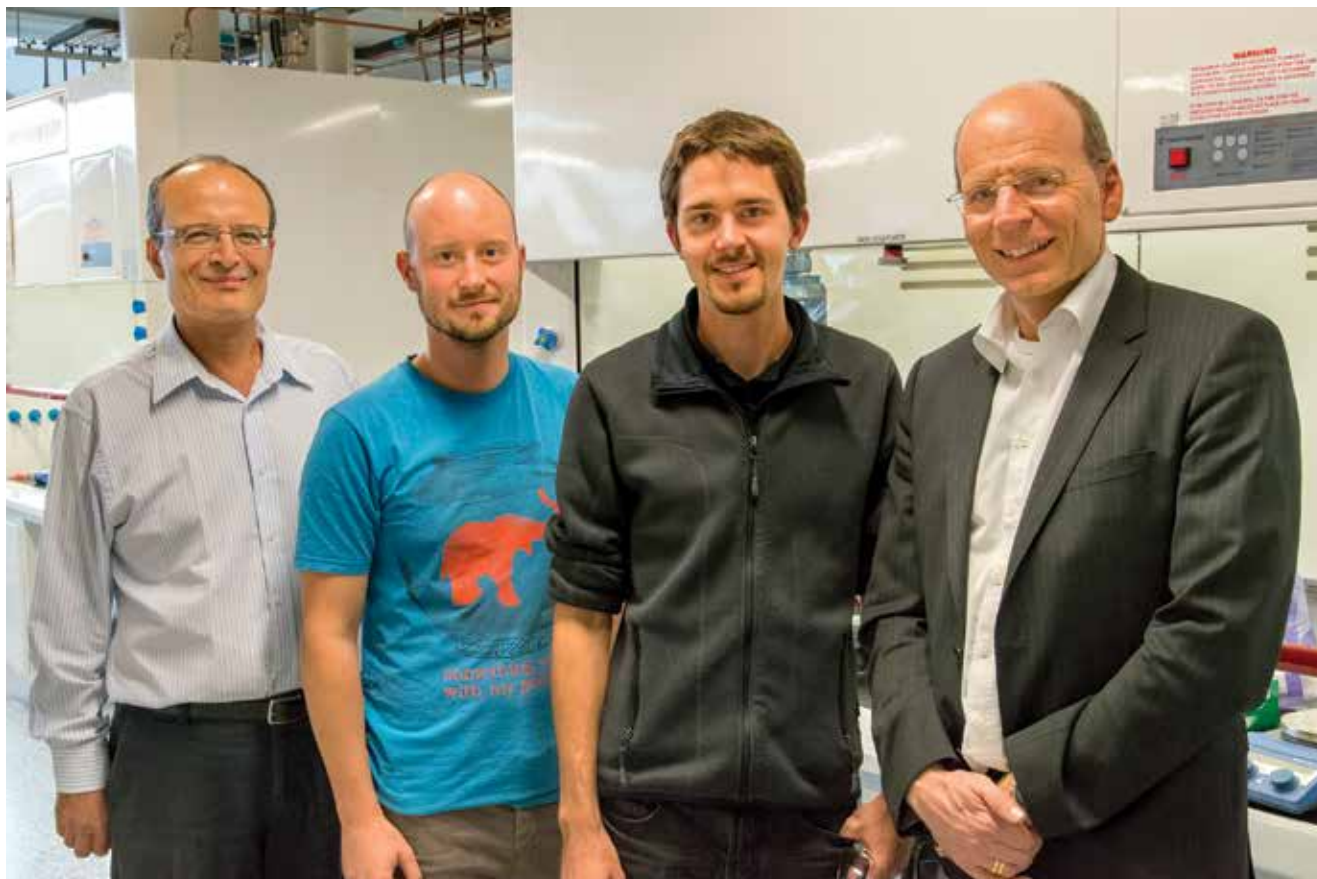
Visitors to ACES nodes

Visitors are welcomed to the ACES nodes to see our research and to discuss possible collaborations to enable us to develop together new sources of innovation and growth across the global network. Building collaborations puts ACES in the best position to benefit from the intellectual and financial leverage that comes with international partnerships. It also allows ACES to keep our national science relevant and of high quality. With the knowledge plus with communication channels in place this allows for better dissemination of the research, hence more impact.

38 visiting international academics, interns, undergraduate students or post graduate students were welcomed by ACES in 2015 to **work alongside ACES members** to further collaborative research or as part of ongoing collaborations. These included:

1. Raimund Koerver, Ruhr-University Bochum, Germany to Monash University to Monash University for 6 months 1 December 2014 to 11 May 2015.
2. Mohammad Ali Mahmoudzadeh Ahmadi Nejad, University of British Columbia to UOW 1 February to 15 March.
3. Thomas Glennon, DCU Ireland, to UOW 9 February to 8 May.
4. Conor O'Quigley, DCU Ireland, to UOW 21 February to 20 May.
5. PI Dirk Guldi, FAU, Germany, to UOW 2 weeks February.
6. PI Dermot Diamond, DCU, Ireland to UOW 10 days February.
7. PI Pat Unwin, University of Warwick, UK to UOW then Monash University for 2 weeks February
8. Marianna Diaz Vejo, University of Cantabria, Spain, to Deakin University, February to May.
9. Aneta Kondratowicz, Warsaw University of Technology, Poland, to Deakin University, February to May.
10. Vincent Gabaudan and Gael Talbi, University of Montpellier2, to Deakin University, February to June.
11. Kyle Debelak from USA, to Deakin University, February to July.
12. Simon Carroll, Trinity College Ireland, to UOW 1-22 March.
13. Dr Irene Ling, University of Malaya, Malaysia to Monash University 2 March to 29 May.
14. Erin Bullions, Warwick University UK to Monash University for 14 weeks 30 March to 3 July.
15. Prof Dong Young Kim, Korea Institute of Science and Technology (KIST) Korea, to UOW 15 April to 14 October.
16. Adel Hama, Ecole Nationale Supérieure des Mines de Saint Etienne France, to UOW 4 May to 8 June.
17. Katrina Scanlan, University of Strathclyde UK, to UOW 4 May to 28 June.
18. Casper Wright an Endeavour Fellow, University of Washington Bothell, to UOW 5 May to 10 September.
19. Brandon diTullio, Furman University, to UOW 15 May to 22 July.
20. Marco Marzocchi, University of Bologna, Italy to UOW 15 May to 15 August.
21. Dr Mathias Wiechen and Dr Steffen Meyer, two Feodor Lynen fellowship holders funded by the Humboldt Foundation in Germany spent 3 months at Monash University to August.
22. Prof Klaus Lips, Energy Materials In Situ Laboratory (EMIL), Institute for Nanospectroscopy, Helmholtz-Zentrum Berlin für Materialien und Energie to Monash University in August.
23. Dr Tiago Mendes, Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) through Science Without Borders, to Monash University for 12 months from 1 July 15.
24. Sonja Plaetzer, University of Vienna, Austria to Monash University for 3 months as a part of her Masters of Science degree, 12 July to 30 September.
25. Prof Bob Slade, University of Surrey to UOW, 14-26 July.
26. Aleksandra Kurowska, Silesian University of Technology, Poland, to UOW 1 August to 30 October.
27. Przemyslaw Ledwon, Silesian University of Technology, Poland, to UOW 1 August to 30 October.
28. Andrzej Milewski, Silesian University of Technology, Poland, to UOW 1 August to 30 October.
29. Katarzyna Pinowar, Silesian University of Technology, Poland, to UOW 1 August to 30 October.
30. Dermot Brabzon, DCU, Ireland to University of Tasmania, 26 August.
31. Prof David Mecerreyes, Polymat-University of the Basque Country, Spain at Deakin University from August to November.
32. Annakattrin Lennert, FAU Erlangen to UOW 31 August to 16 December.
33. Shogo Mori, Shinshu University, Japan to UOW 7 September to 2 October.
34. Conal McIntyre, Trinity College Dublin, Ireland to UOW 7 September to 4 December.
35. Prof Masahiro and Yoshizawa Fujita, Sophia University Japan to Deakin University 1-22 October.
36. A/Prof. Matthew Panzer, University of Tufts, USA to Monash University 5 October to 13 November.
37. John Landers, Rutgers University, USA to UOW 15 November to 15 December.
38. PhD Student from Quaid-i-Azam University Pakistan to Monash University for 6 months.

A further **20 international and 39 national academic guests** visited ACES nodes for the opportunity to present a research seminar to ACES members and



(L to R): ACES CI Prof Leone Spiccia with two Feodor Lynen fellowship holders Dr Mathias Wiechen and Dr Steffen Meyer and Prof Klaus Lips in Prof Spicica's New Horizons Renewable Energy Laboratories at Monash University.

view ACES facilities as a first step towards engagement. These lists do not include visitors who visited the ACES facilities as part of International conferences. For example, over 200 international academics visited the Deakin ACES laboratories in IFM on 3 November 2015 as a part of the 13th ATC conference chaired by ACES CI Prof Xungai Wang.

International visitors to ACES 2015

1. Dr Stefanie Doht, University Clinics of Wuerzburg to UOW, 29 January.
2. Prof Yoshihiro Iro, Riken, Japan to UOW 11 February.
3. Prof Ralph Cooney, University of Auckland to UOW 16 February.
4. Robert Luxenhofer, University of Wurzburg to UOW 11 March.
5. Prof Brian Meenan, University of Ulster to UOW 13 April.
6. Stefan Willfor, Chairman of Johan Gadolin Process Chemistry Centre, Abo Akademi University to UOW 12 May.
7. Arshad Munir, Experimental Physics Dept, Quaid-e-Azam University to UOW 18 June.
8. Magnus Nyden and Mikael Larsson, University College London, Australia to UOW 4 August.
9. Mr Johan Linden, Ms Simarpreet Kaur, University of South Australia to UOW 4 August.
10. Prof Louis Lemieux, University College London to UOW 7 August.
11. Prof. Mohamed Salem, University of Wollongong in Dubai to University of Wollongong, 26 August.
12. A/Prof Masahiro Yoshizawa-Fujita, Sofia University to Monash University, 20 October.
13. Takayuki Kawai, Integrated Biodevice Unit, Quantitative Biology Centre, RIKEN, Japan to University of Tasmania, 20 October.
14. Prof Toshihiro Hirai, Shinshu University to UOW 30 October.
15. Dr Norhayani Binti Othman, Nur Farizah Bte Ayub, Nurul Hzlina Binti Naemuddin, Siti Aishah Binti Ramli, Nur Amanina Binti Abdul Khlid, Sharina Binti Zakariya, Siti Khairunisah Binti Ghazali, Siti Aishah Binti Muhmed, University Teknolghi Malaysia postgraduate students to UOW 12 November.
16. Prof Qingsong Wang, University of Science & Technology of China to Monash University, 16 November.

17. Dr. Ramanan Nagasundara, Monash University Sunway Campus, Malaysia to Monash University Melbourne, 27 November.
18. Dr Rongxin Su, Prof Wei Qi, Dr Renliang Huang and Dr Mengfan Wang, Tianjin University China to Deakin University.
19. Dr Tadaharu Ueda, Kochi University, Japan to Monash University.
20. Prof Philippe Hapiot, Université de Rennes 1, France to Monash University.
13. Girish Lakhwani, University of Sydney to UOW 30 April.
14. Prof Ben Eggleton, Director, CUDOS ARC Centre of Excellence in Photonics to UOW 4 May.
15. Calum Drendel-Fulton, student Deakin University not currently involved in ACES to UOW 11 May for 3 days.
16. Vitor Sencadas, UOW School of Mechanical, Materials & Mechatronics Engineering to ACES UOW, 15 May.
17. Dr Thomas Birtchnell and 8 undergraduate students, Engineering at University of Wollongong to ACES UOW, 29 May.
27. Dr Steven Harvey & nine undergraduate students from School of Mechanical, Mechatronic & Materials Engineering at ACES UOW to view 3D Printing Facilities, 31 August.
28. Dr Gianni Renda and Bridgett Engeler, Swinburne University of Technology at UOW 4 September.
29. Bruce Ashford to UOW 8 September.
30. A/Prof Kurt Seemann, Dr Carolyn Barnes, Dr Nicole Aimers, Dr Lucy Parrington, Ms Lisa Giusti, Gesri Velocity from Swinburne University to UOW 10-11 September.

National Visitors to ACES 2015

1. Blair Kuys, Kate Bissett-Johnson & Nathan Loutit, Swinburne University of Technology to UOW 29 January.
2. Simon Cooper, Raj Evasahayam, Prof Gerard Sutton, Lions NSW Eye Bank to UOW, 29 January.
3. Kirsten Day, Swinburne University of Technology to UOW, 6 February.
4. Shayan Ziabari Seyedin & Joselito Razal, Deakin University to UOW 9 February.
5. Richard Wetherbee, University of Melbourne to UOW 9 February.
6. Nathan Creber, Melbourne University and Royal Victoria Eye & Ear Hospital to UOW 18 February.
7. David Patrech, UOW Engineering student to ACES UOW 25 February.
8. Drew Evans, Mawson Institute at University of South Australia to UOW 10 March.
9. Tillman Boehme and Sydney Business School undergraduates at University of Wollongong to ACES UOW 24 March.
10. Prof Alan Pettigrew, IHMRI UOW to ACES UOW 31 March.
11. Prof Dietmar Hutmacher, QUT to UOW 13 April.
12. Dr Gerard Sutton, Vision Eye Institute to UOW 21 April.
18. Lin Li, student UNSW to ACES UOW 18 June.
19. John Ramshaw, CSIRO to UOW 22 June.
20. Carrie Newbold, Adrienne Paterson, Paul Carter and Freddy Dueck, HEARing CRC, Cochlear Ltd to UOW 24 June.
21. Oscar Gregory, Cathy Foley, Leanne Grogan, Peter Key, Peter Chesworth, Peter Hodgson, Dale Clark, David Nolan, Julie Matarczyk, Adam Plunkett, Scott Burton from the ARC Steel Research Hub Advisory Panel to ACES UOW, 24 July.
22. Prof Sean Smith, Centre Director, School of Chemical Engineering UNSW to UOW 31 July.
23. Dayong Jin & Yong Liu, Macquarie University to UOW 7 August.
24. Dr Vitor Sencadas and 10 undergraduate Engineering Students University of Wollongong to ACES UOW 18 August.
25. Laurence Meagher, Monash University to UOW 25 August.
26. A/Prof Stuart MacKay (ENT Surgeon) & SueEllen Holmes (Research Scientist) from Illawarra ENT Head and Neck Clinic Wollongong to UOW 28 August.
31. David Nisbet and Antonio Tricoli, the Australian National University to UOW 11 September.
32. Prof Peter Choong, St Vincent's Hospital Melbourne to UOW 15 September.
33. Prof Don Iverson, Swinburne University to UOW 15 September.
34. Jo Williams, future student to UOW
35. Dr Basit Zeb, Prof. Ladislau Matekovits, Roy B.V.B. Simorangkir & Mr Rajas Khokle from Macquarie University to UOW 25 September.
36. Sean Elphick, Duane Robinson, Gerrard Drury, Sustainable Building Research Centre at University of Wollongong to view facilities at ACES UOW 25 September.
37. Trevor Lewis, University of Tasmania to UOW 9 October.
38. Dr Wayne Neil and Dr Grant McAdam, Department of Defence, Defence Science and Technology Organisation (DSTO) to Deakin University.
39. Mark Hodge, Defence Materials Technology Centre (DMTC) to Deakin University.



Book Chapters

6 book chapters were published in 2015.



Chinese set to read about ACES innovator Prof Gordon Wallace

The Chinese will be captivated reading ACES Director Professor Gordon Wallace's rumination on innovation following the imminent translation of the book *Innovation: How Innovators Think, Act and Change Our World*. Prof Wallace was one of more than 100 international "thought leaders" to contribute to the book by Kim Chandler McDonald, who set about to reveal the creativity, motivations and expertise of innovation leaders in a multitude of fields.

An innovator in electromaterials, Prof Wallace shares his thoughts on building an integrated team over 30 years at the University of Wollongong and touches on his many research endeavours including nerve/muscle regeneration, implantable bionics, biofabrication and sports bras.

Noble BB, Coote ML. (2015) Mechanistic Perspectives on Stereocontrol in Lewis Acid-Mediated Radical Polymerization: Lessons from Small-Molecule Synthesis in *Advances in Physical Organic Chemistry*. Vol 49: Academic Press Inc.; 189-258.

Pozo-Gonzalo C. (2015) Oxygen reduction reaction in ionic liquids: An overview in *Electrochemistry in Ionic Liquids: Volume 2: Applications*: Springer International Publishing; 507-529.

Molino PJ, Zhang B, Higgins MJ. (2015) Electroactive Anti-Microbial Surfaces in Antibacterial Surfaces, Editors: Elena Ivanova, Russell Crawford, ISBN: 978-3-319-18593-4 (Print) 978-3-319-18594-1 (Online); 41-60.

Higgins MJ, Wallace GG, Molino PJ, Gelmi A, Zhang H (2015) Conducting Polymers: Their Route to Nanobionics Applications via Atomic Force Microscopy in *Innovations in Nanomaterials*, Editors: Al-Nakib Chowdhury, Joe Shapter, Abu Bin Imran, Nova Science Publishers, Chapter 3; 41 – 76.

Gilbert F., Dodds S. (Accepted Manuscript 2015) Predictive Brain Devices and Automated Therapeutic Activation: Ethical Problems Ahead Chapter in "Neuro-Interventions and The Law: Regulating Human Mental Capacity" edited by N Vincent.

Journal Articles

190 Journal articles were published in 2015 with ARC Centre of Excellence for Electromaterials Science in the address line.

Of those journal articles **138 (73%)** had **impact factors > 2.95** and **62 (33%)** with **impact factors > 5.00**.

63.4% of the journal publications are

apportioned across at least two ERA ARC journal FOR codes at the 2 digit level, showing the multidisciplinary nature of the research.

ACES Journal Article List

1. Abdullah N, Noor NLM, Nordin AR, Halcrow MA, MacFarlane DR, Lazar MA, Pringle JM, Bruce DW, Donnio B, Heinrich B. Spin-crossover, mesomorphic and thermoelectrical properties of cobalt(II) complexes with alkylated N-3-Schiff bases. *Journal of Materials Chemistry C*. 2015;3(11):2491-2499. IF= 4.696.
2. Abeyasinghe HCS, Bokhari L, Quigley A, Choolani M, Chan J, Dusting GJ, Crook JM, Kobayashi NR, Roulston CL. Pre-differentiation of human neural stem cells into GABAergic neurons prior to transplant results in greater repopulation of the damaged brain and accelerates functional recovery after transient ischemic stroke. *Stem Cell Research & Therapy*. Sep 2015;6:19. IF= 6.233.
3. Ahmed R, Zhao L, Mozer AJ, Will G, Bell J, Wang HX. Enhanced Electron Lifetime of CdSe/CdS Quantum Dot (QD) Sensitized Solar Cells Using ZnSe Core-Shell Structure with Efficient Regeneration of Quantum Dots. *Journal of Physical Chemistry C*. Feb 2015;119(5):2297-2307. IF= 4.385.
4. Alsmadi NZ, Patil LS, Hor EM, Lofti P, Razal JM, Chuong CJ, Wallace GG, Romero-Ortega MI. Coiled polymeric growth factor gradients for multi-luminal neural chemotaxis. *Brain Research*. Sep 2015;1619:72-83. IF= 3.028.

5. Andrews PW, Baker D, Benvenisty N, Miranda B, Bruce K, Brustle O, Choi M, Choi YM, Crook JM, de Sousa PA, Dvorak P, Freund C, Firpo M, Furue MK, Gokhale P, Ha HY, Han E, Haupt S, Healy L, Hei DJ, Hovatta O, Hunt C, Hwang SM, Inamdar MS, Isasi RM, Jaconi M, Jekerle V, Kamthorn P, Kibbey MC, Knezevic I, Knowles BB, Koo SK, Laabi Y, Leopoldo L, Liu P, Lomax GP, Loring JF, Ludwig TE, Montgomery K, Mummery C, Nagy A, Nakamura Y, Nakatsuji N, Oh S, Oh SK, Otonkoski T, Pera M, Peschanski M, Pranke P, Rajala KM, Rao M, Ruttachuk R, Reubinoff B, Ricco L, Rooke H, Sipp D, Stacey GN, Suemori H, Takahashi TA, Takada K, Talib S, Tannenbaum S, Yuan BZ, Zeng F, Zhou Q. Points to consider in the development of seed stocks of pluripotent stem cells for clinical applications: International Stem Cell Banking Initiative (ISCBI). *Regenerative Medicine*. 2015;10(2):1-44. IF= 3.5.
6. Apollo NV, Maturana MI, Tong W, Nayagam DAX, Shivdasani MN, Foroughi J, Wallace GG, Praver S, Ibbotson MR, Garrett DJ. Soft, Flexible Freestanding Neural Stimulation and Recording Electrodes Fabricated from Reduced Graphene Oxide. *Advanced Functional Materials*. Jun 2015;25(23):3551-3559. IF= 11.805.
7. Arena F, Gumina B, Cannilla C, Spadaro L, Patti A, Spiccia L. Nanostructured MnO_x catalysts in the liquid phase selective oxidation of benzyl alcohol with oxygen Part II. Reaction mechanism, kinetics and deactivation pattern. *Applied Catalysis B-Environmental*. Jul 2015;170:233-240. IF= 6.007.
8. Arena F, Gumina B, Lombardo AF, Espro C, Patti A, Spadaro L, Spiccia L. Nanostructured MnO_x catalysts in the liquid phase selective oxidation of benzyl alcohol, with oxygen: Part I. Effects of Ce and Fe addition on structure and reactivity. *Applied Catalysis B-Environmental*. Jan 2015;162:260-267. IF= 6.007.
9. Arulmozhiraja S, Coote ML, Hasegawa JY. Electronic spectra of azaindole and its excited state mixing: A symmetry-adapted cluster configuration interaction study. *Journal of Chemical Physics*. Nov 2015;143(20):8. IF= 2.95.
10. Aziz S, Naficy S, Foroughi J, Brown HR, Spinks GM. Characterisation of torsional actuation in highly twisted yarns and fibres. *Polymer Testing*. Sep 2015;46:88-97. IF= 2.24.
11. Bakarich SE, Gorkin R, Panhuis MIH, Spinks GM. 4D Printing with Mechanically Robust, Thermally Actuating Hydrogels. *Macromolecular Rapid Communications*. Jun 2015;36(12):1211-1217. IF= 4.608.
12. Bano K, Bond AM, Zhang J. Determination of Fast Electrode Kinetics Facilitated by Use of an Internal Reference. *Analytical Chemistry*. 2015;87(16):8387-8393. IF= 5.636.
13. Bano K, Zhang J, Bond AM, Unwin PR, Macpherson JV. Diminished Electron Transfer Kinetics for [Ru(NH₃)₆]^{3+/2+}, [α-SiW₁₂O₄₀]^{4-/5-}, and [α-SiW₁₂O₄₀]^{5-/6-} Processes at Boron-Doped Diamond Electrodes. *Journal of Physical Chemistry C*. 2015;119(22):12464-12472. IF= 4.385.
14. Bentley CL, Bond AM, Hollenkamp AF, Mahon PJ, Zhang J. Electrochemical Proton Reduction and Equilibrium Acidity (pK(a)) in Aprotic Ionic Liquids: Protonated Amines and Sulfonamide Acids. *Journal of Physical Chemistry C*. Sep 2015;119(38):21828-21839. IF= 4.385.
15. Bentley CL, Bond AM, Hollenkamp AF, Mahon PJ, Zhang J. Electrochemical Proton Reduction and Equilibrium Acidity (pK(a)) in Aprotic Ionic Liquids: Phenols, Carboxylic Acids, and Sulfonic Acids. *Journal of Physical Chemistry C*. Sep 2015;119(38):21840-21851. IF= 4.385.
16. Bentley CL, Bond AM, Hollenkamp AF, Mahon PJ, Zhang J. Voltammetric Determination of the Iodide/Iodine Formal Potential and Triiodide Stability Constant in Conventional and Ionic Liquid Media. *Journal of Physical Chemistry C*. Oct 2015;119(39):22392-22403. IF= 4.385.
17. Beznosov SN, Veluri PS, Pyatibratov MG, Chatterjee A, MacFarlane DR, Fedorov OV, Mitra S. Flagellar filament bio-templated inorganic oxide materials - towards an efficient lithium battery anode. *Scientific Reports*. Jan 2015;5:7. IF= 5.578.
18. Bonke SA, Wiechen M, Hocking RK, Fang XY, Lupton DW, MacFarlane DR, Spiccia L. Electrosynthesis of Highly Transparent Cobalt Oxide Water Oxidation Catalyst Films from Cobalt Aminopolycarboxylate Complexes. *ChemSusChem*. Apr 2015;8(8):1394-1403. IF= 7.657.
19. Bonke SA, Wiechen M, MacFarlane DR, Spiccia L. Renewable fuels from concentrated solar power: towards practical artificial photosynthesis. *Energy & Environmental Science*. 2015;8(9):2791-2796. IF= 11.65.
20. Borgwardt M, Wilke M, Kampen T, Mahl S, Xiang WC, Spiccia L, Lange KM, Kiyan IY, Aziz EF. Injection Kinetics and Electronic Structure at the N719/TiO₂ Interface Studied by Means of Ultrafast XUV Photoemission Spectroscopy. *Journal of Physical Chemistry C*. Apr 2015;119(17):9099-9107. IF= 4.385.
21. Burger R, Kurzbuch D, Gorkin R, Kijanka G, Glynn M, McDonagh C, Duccée J. An integrated centrifugo-opto-microfluidic platform for arraying, analysis, identification and manipulation of individual cells. *Lab on a Chip - Miniaturisation for Chemistry and Biology*. 2015;15(2):378-381. IF= 6.115.

22. Cabral D, Howlett PC, Pringle JM, Zhang XY, MacFarlane D. Electrochemistry of tris(2,2'-bipyridyl) cobalt(II) in ionic liquids and aprotic molecular solvents on glassy carbon and platinum electrodes. *Electrochimica Acta*. Oct 2015;180:419-426. IF= 4.504.
23. Chen J, Huang ZG, Wang CY, Porter S, Wang BF, Lie W, Liu HK. Sodium-difluoro(oxalato)borate (NaDFOB): a new electrolyte salt for Na-ion batteries. *Chemical Communications*. 2015;51(48):9809-9812. IF= 6.834.
24. Chen Y, Yue ZL, Moulton SE, Hayes P, Cook MJ, Wallace GG. A simple and versatile method for microencapsulation of anti-epileptic drugs for focal therapy of epilepsy. *Journal of Materials Chemistry B*. 2015;3(36):7255-7261. IF= 4.726.
25. Cheng YY, Nattestad A, Schulze TF, Macqueen RW, Fückel B, Lips K, Wallace GG, Khoury T, Crossley MJ, Schmidt TW. Increased upconversion performance for thin film solar cells: A trimolecular composition. *Chemical Science*. 2015;7(1):559-568. IF= 9.211.
26. Cho I, Choi J, Kim K, Ryou MH, Lee YM. A comparative investigation of carbon black (Super-P) and vapor-grown carbon fibers (VGCFs) as conductive additives for lithium-ion battery cathodes. *Rsc Advances*. 2015;5(115):95073-95078. IF= 3.84.
27. Choi C, Kim SH, Sim HJ, Lee JA, Choi AY, Kim YT, Lepro X, Spinks GM, Baughman RH, Kim SJ. Stretchable, Weavable Coiled Carbon Nanotube/ MnO_2 /Polymer Fiber Solid-State Supercapacitors. *Scientific Reports*. Mar 2015;5:6. IF= 5.578.
28. Choi J, Kim K, Jeong J, Cho KY, Ryou MH, Lee YM. Highly Adhesive and Soluble Copolyimide Binder: Improving the Long-Term Cycle Life of Silicon Anodes in Lithium-Ion Batteries. *Acs Applied Materials & Interfaces*. Jul 2015;7(27):14851-14858. IF= 6.723.
29. Chung JHY, Naficy S, Wallace GG, Naficy S, O'Leary S. Inkjet-Printed Alginate Microspheres as Additional Drug Carriers for Injectable Hydrogels. *Advances in Polymer Technology*. 2015. IF= 1.045
30. Ciampi S, Choudhury MH, Ahmad S, Darwish N, Le Brun A, Gooding JJ. The impact of surface coverage on the kinetics of electron transfer through redox monolayers on a silicon electrode surface. *Electrochimica Acta*. Dec 2015;186:216-222. IF= 4.504.
31. Ciampi S, Eggers PK, Haworth NL, Darwish N, Wagner P, Coote ML, Wallace GG, Raston CL. Decoloration rates of a photomerocyanine dye as a visual probe into hydrogen bonding interactions. *Chemical Communications*. 2015;51(23):4815-4818. IF= 6.834.
32. Clarke TM, Lungenschmied C, Peet J, Drolet N, Mozer AJ. A Comparison of Five Experimental Techniques to Measure Charge Carrier Lifetime in Polymer/Fullerene Solar Cells. *Advanced Energy Materials*. Feb 2015;5(4):11. IF= 16.146.
33. Clarke TM, Lungenschmied C, Peet J, Drolet N, Mozer AJ. Tuning Non-Langevin Recombination in an Organic Photovoltaic Blend Using a Processing Additive. *Journal of Physical Chemistry C*. Apr 2015;119(13):7016-7021. IF= 4.385.
34. Crook JM, Wallace G, Tomaskovic-Crook E. The potential of induced pluripotent stem cells in models of neurological disorders: implications on future therapy. *Expert Review of Neurotherapeutics*. Mar 2015;15(3):295-304. IF= 2.783.
35. Currivan S, Connolly D, Paull B. Stepped gradients on polymeric monolithic columns by photoinitiated grafting. *Journal of Separation Science*. Nov 2015;38(21):3795-3802. IF= 2.737.
36. De Silva DA, Martens PJ, Gilmore KJ, Panhuis MIH. Degradation Behavior of Ionic-Covalent Entanglement Hydrogels. *Journal of Applied Polymer Science*. Jan 2015;132(1):10. IF= 1.768.
37. Deacon GB, Junk PC, Lee WW, Forsyth M, Wang J. Rare earth 3-(4'-hydroxyphenyl)propionate complexes. *New Journal of Chemistry*. 2015;39(10):7688-7695. IF= 3.086.
38. Ding J, Peng GR, Shu KW, Wang CY, Tian TF, Yang WR, Zhang YC, Wallace GG, Li WH. Novel reversible and switchable electrolytes based on magnetorheology. *Scientific Reports*. Oct 2015;5:11. IF= 5.578.
39. Duffy E, He X, Nesterenko EP, Brabazon D, Dey A, Krishnamurthy S, Nesterenko PN, Paull B. Thermally controlled growth of carbon anions within porous graphitic carbon-detonation nanodiamond monolithic composites. *Rsc Advances*. 2015;5(29):22906-22915. IF= 3.84.
40. Duffy E, He XY, Nesterenko PN, Paull B. Hierarchical porous graphitic carbon monoliths with detonation nanodiamonds: synthesis, characterisation and adsorptive properties. *Journal of Materials Science*. Oct 2015;50(19):6245-6259. IF= 2.37.
41. Duffy E, Mitev DP, Thickett SC, Townsend AT, Paull B, Nesterenko PN. Assessing the extent, stability, purity and properties of silanised detonation nanodiamond. *Applied Surface Science*. Dec 2015;357:397-406. IF= 2.711.
42. Dyer T, Thamwattana N, Jalili R. Modelling the interaction of graphene oxide using an atomistic-continuum model. *Rsc Advances*. 2015;5(94):77062-77070. IF= 3.84.
43. Ferris CJ, Stevens LR, Gilmore KJ, Mume E, Greguric I, Kirchmajer DM, Wallace GG, Panhuis MIH. Peptide modification of purified gellan gum. *Journal of Materials Chemistry B*. 2015;3(6):1106-1115. IF= 4.726.

44. Forsyth M, Chen F, O'Dell LA, Romanenko K. New insights into ordering and dynamics in organic ionic plastic crystal electrolytes. *Solid State Ionics*. 2015. IF= 2.561.
45. Forsyth M, MacFarlane D, Pringle J. Foreword. *Electrochimica Acta*. Sep 2015;175:1-4. IF= 4.504.
46. Fujioka T, Oshima N, Suzuki R, Higgins M, Price WE, Henderson RK, Nghiem LD. Effect of heat treatment on fouling resistance and the rejection of small and neutral solutes by reverse osmosis membranes. *Water Science and Technology-Water Supply*. 2015;15(3):510-516. IF= 0.39.
47. Gambhir S, Jalili R, Officer DL, Wallace GG. Chemically converted graphene: scalable chemistries to enable processing and fabrication. *Npg Asia Materials*. Jun 2015;7:15. IF= 10.118.
48. Gately RD, Panhuis MIH. Filling of carbon nanotubes and nanofibres. *Beilstein Journal of Nanotechnology*. Feb 2015;6:508-516. IF= 2.670.
49. Gately RD, Warren H, Scardamaglia M, Romeo T, Bittencourt C, Panhuis MIH. Sonication-induced effects on carbon nanofibres in composite materials. *Rsc Advances*. 2015;5(25):19587-19595. IF= 3.84.
50. Ge Y, Wang CY, Shu KW, Zhao C, Jia XT, Gambhir S, Wallace GG. A facile approach for fabrication of mechanically strong graphene/polypyrrole films with large areal capacitance for supercapacitor applications. *Rsc Advances*. 2015;5(124):102643-102651. IF= 3.84.
51. Ghayesh MH, Farokhi H, Alici G. Size-dependent electro-elasto-mechanics of MEMS with initially curved deformable electrodes. *International Journal of Mechanical Sciences*. Nov 2015;103:247-264. IF= 2.034.
52. Gilbert F. State of the Concussion Debate: From Sceptical to Alarmist Claims. *Neuroethics*. Apr 2015;8(1):47-53. IF= 1.311.
53. Gilbert F. Self-Estrangement & Deep Brain Stimulation: Ethical Issues Related to Forced Explantation. *Neuroethics*. Aug 2015;8(2):107-114. IF= 1.311.
54. Gilbert F, Focquaert F. Rethinking responsibility in offenders with acquired paedophilia: Punishment or treatment? *International Journal of Law and Psychiatry*. Jan-Feb 2015;38:51-60. IF= 0.934.
55. Gilbert F, Vranic A. Paedophilia, Invasive Brain Surgery, and Punishment. *Journal of Bioethical Inquiry*. Sep 2015;12(3):521-526. IF= 0.747.
56. Goujon N, Byrne N, Walsh TR, Forsyth M. The Influence of Water and Metal Salt on the Transport and Structural Properties of 1-Octyl-3-methylimidazolium Chloride. *Australian Journal of Chemistry*. 2015;68(3):420-425. IF= 1.558.
57. Goujon N, Forsyth M, Dumeé LF, Bryant G, Byrne N. Characterization of the phase behaviour of a novel polymerizable lyotropic ionic liquid crystal. *Physical Chemistry Chemical Physics*. 2015;17(35):23059-23068. IF= 4.493.
58. Greene GW, Ponzio F, Iranipour N, Zhu H, Seeber A, Forsyth M, Howlett PC. Enhanced ionic mobility in Organic Ionic Plastic Crystal - Dendrimer solid electrolytes. *Electrochimica Acta*. Sep 2015;175:214-223. IF= 4.504.
59. Gryn'ova G, Coote ML, Corminboeuf C. Theory and practice of uncommon molecular electronic configurations. *Wiley Interdisciplinary Reviews: Computational Molecular Science*. 2015;5(6):440-459. IF= 11.885.
60. Gu Q, Hao J, Lu YJ, Wang L, Wallace GG, Zhou Q. Three-dimensional bio-printing. *Science China-Life Sciences*. May 2015;58(5):411-419. IF= 1.688.
61. Gujral SS, Simonov AN, Higashi M, Abe R, Spiccia L. Optimization of Titania Post-Necking Treatment of TaON Photoanodes to Enhance Water-Oxidation Activity under Visible-Light Irradiation. *Chemelectrochem*. Sep 2015;2(9):1270-1278. IF= 7.657.
62. Hackett AJ, Malmstroem J, Molino PJ, Gautrot JE, Zhang HR, Higgins MJ, Wallace GG, Williams DE, Travas-Sejdic J. Conductive surfaces with dynamic switching in response to temperature and salt. *Journal of Materials Chemistry B*. 2015;3(48):9285-9294. IF= 4.726.
63. Han JP, Xu GY, Dou H, MacFarlane DR. Porous Nitrogen-Doped Carbon Microspheres Derived from Microporous Polymeric Organic Frameworks for High Performance Electric Double-Layer Capacitors. *Chemistry-a European Journal*. Feb 2015;21(6):2310-2314. IF= 5.731.
64. Han Y, Meyer S, Dkhissi Y, Weber K, Pringle JM, Bach U, Spiccia L, Cheng YB. Degradation observations of encapsulated planar CH₃NH₃PbI₃ perovskite solar cells at high temperatures and humidity. *Journal of Materials Chemistry A*. 2015;3(15):8139-8147. IF= 7.443.
65. Han Y, Pringle JM, Cheng YB. Improved Efficiency and Stability of Flexible Dye Sensitized Solar Cells on ITO/PEN Substrates Using an Ionic Liquid Electrolyte. *Photochemistry and Photobiology*. Mar-Apr 2015;91(2):315-322. IF= 2.266.
66. Hancock AN, Lobachevsky S, Haworth NL, Coote ML, Schiesser CH. The effect of leaving radical on the formation of tetrahydroselenophene by S(H) ring closure: an experimental and computational study. *Organic & Biomolecular Chemistry*. 2015;13(8):2310-2316. IF= 3.562.
67. Harman DG, Gorkin R, Stevens L, Thompson B, Wagner K, Weng B, Chung JHY, Panhuis MIH, Wallace GG. Poly(3,4-ethylenedioxythiophene):dextran sulfate (PEDOT:DS) - A highly processable conductive organic biopolymer. *Acta Biomaterialia*. Mar 2015;14:33-42. IF= 6.025.

68. Hocking RK, King HJ, Hesson A, Bonke SA, Johannessen B, Fekete M, Spiccia L, Chang SLY. Engineering Disorder at a Nanoscale: A Combined TEM and XAS Investigation of Amorphous versus Nanocrystalline Sodium Birnessite. *Australian Journal of Chemistry*. 2015;68(11):1715-1722. IF= 1.558.
69. Ihsan M, Meng Q, Li L, Li D, Wang HQ, Seng KH, Chen ZX, Kennedy SJ, Guo ZP, Liu HK. V₂O₅/Mesoporous Carbon Composite as a Cathode Material for Lithium-ion Batteries. *Electrochimica Acta*. Aug 2015;173:172-177. IF= 4.504.
70. Iranipour N, Gunzelmann DJ, Seeber A, Vongsivut J, Doherty C, Ponzio F, O'Dell LA, Hollenkamp AF, Forsyth M, Howlett PC. Ionic transport through a composite structure of N-ethyl-N-methylpyrrolidinium tetrafluoroborate organic ionic plastic crystals reinforced with polymer nanofibres. *Journal of Materials Chemistry A*. 2015;3(11):6038-6052. IF= 7.443.
71. Jamali SS, Moulton SE, Tallman DE, Forsyth M, Weber J, Mirabedini A, Wallace GG. Corrosion protection afforded by praseodymium conversion film on Mg alloy AZNd in simulated biological fluid studied by scanning electrochemical microscopy. *Journal of Electroanalytical Chemistry*. Feb 2015;739:211-217. IF= 2.729.
72. Jamali SS, Moulton SE, Tallman DE, Forsyth M, Weber J, Wallace GG. Evaluating the corrosion behaviour of Magnesium alloy in simulated biological fluid by using SECM to detect hydrogen evolution. *Electrochimica Acta*. Jan 2015;152:294-301. IF= 4.504.
73. Jeong HT, Kim BC, Higgins MJ, Wallace GG. Highly stretchable reduced graphene oxide (rGO)/single-walled carbon nanotubes (SWNTs) electrodes for energy storage devices. *Electrochimica Acta*. May 2015;163:149-160. IF= 4.504.
74. Jiang FZ, Wang XZ, He CC, Saricilar S, Wang HL. Mechanical properties of tough hydrogels synthesized with a facile simultaneous radiation polymerization and cross-linking method. *Radiation Physics and Chemistry*. Jan 2015;106:7-15. IF= 1.380.
75. Jiang JL, Yue Z, Bauquier SH, Lai A, Chen Y, McLean KJ, Halliday AJ, Sui Y, Moulton S, Wallace GG, Cook MJ. Injectable phenytoin loaded polymeric microspheres for the control of temporal lobe epilepsy in rats. *Restorative Neurology and Neuroscience*. 2015;33(6):823-834. IF= 2.49.
76. Johnson LSM, Partridge B, Gilbert F. Framing the Debate: Concussion and Mild Traumatic Brain Injury. *Neuroethics*. Apr 2015;8(1):1-4. IF= 1.311.
77. Jourdin L, Grieger T, Monetti J, Flexer V, Freguia S, Lu Y, Chen J, Romano M, Wallace GG, Keller J. High Acetic Acid Production Rate Obtained by Microbial Electrosynthesis from Carbon Dioxide. *Environmental Science & Technology*. Nov 2015;49(22):13566-13574. IF= 5.330.
78. Justin Raj C, Kim BC, Cho WJ, Park S, Jeong HT, Yoo K, Yu KH. Rapid hydrothermal synthesis of cobalt oxyhydroxide nanorods for supercapacitor applications. *Journal of Electroanalytical Chemistry*. 2015;747:130-135. IF= 2.729.
79. Kapsa RMI. Autologous Cell Replacement for Hereditary Muscle Disease. *Journal of Gene Medicine*. Aug-Sep 2015;17(8-9):192-193. IF= 2.472.
80. Khaldi A, Maziz A, Alici G, Spinks GM, Jager EWH. Soft, flexible micromanipulators comprising polypyrrole trilayer microactuators. *Electroactive Polymer Actuators and Devices (Eapad)* 2015. 2015;9430:7. IF= 1.94.
81. Khan M, Xiao J, Zhou FL, Yablonskikh M, MacFarlane DR, Spiccia L, Aziz EF. On the Origin of the Improvement of Electrodeposited MnOx Films in Water Oxidation Catalysis Induced by Heat Treatment. *Chemsuschem*. Jun 2015;8(11):1980-1985. IF= 7.657.
82. Kianzad S, Pandit M, Bahi A, Ravandi AR, Ko F, Spinks GM, Madden JDW. Nylon coil actuator operating temperature range and stiffness. *Electroactive Polymer Actuators and Devices (Eapad)* 2015. 2015;9430:6. IF= 1.94.
83. Kim BC, Hong JY, Wallace GG, Park HS. Recent Progress in Flexible Electrochemical Capacitors: Electrode Materials, Device Configuration, and Functions. *Advanced Energy Materials*. Nov 2015;5(22):33. IF= 16.146.
84. Kim BC, Jeong HT, Higgins MJ, Yu KH, Wallace GG. Dynamic Electrochemical Properties of Extremely Stretchable Electrochemical Capacitor Using Reduced Graphene Oxide/Single-Wall Carbon Nanotubes Composite. *Journal of the Electrochemical Society*. 2015;162(12):A2351-A2355. IF= 3.266.
85. Kim SH, Lima MD, Kozlov ME, Haines CS, Spinks GM, Aziz S, Choi C, Sim HJ, Wang XM, Lu HB, Qian D, Madden JDW, Baughman RH, Kim SJ. Harvesting temperature fluctuations as electrical energy using torsional and tensile polymer muscles. *Energy & Environmental Science*. 2015;8(11):3336-3344. IF= 11.65.
86. Kirchmayer DM, Gorkin R, Panhuis MIH. An overview of the suitability of hydrogel-forming polymers for extrusion-based 3D-printing. *Journal of Materials Chemistry B*. 2015;3(20):4105-4117. IF= 4.726.
87. Klein A, Whitten PG, Resch K, Pinter G. Nanocomposite hydrogels: Fracture toughness and energy dissipation mechanisms. *Journal of Polymer Science Part B-Polymer Physics*. Dec 2015;53(24):1763-1773. IF= 3.830.

88. Klinska M, Smith LM, Gryn'ova G, Banwell MG, Coote ML. Experimental demonstration of pH-dependent electrostatic catalysis of radical reactions. *Chemical Science*. 2015;6(10):5623-5627. IF= 9.211.
89. Koerver R, MacFarlane DR, Pringle JM. Evaluation of Electrochemical Methods for Determination of the Seebeck Coefficient of Redox Electrolytes. *Electrochimica Acta*. Dec 2015;184:186-192. IF= 4.504.
90. Kwon CH, Lee JA, Choi YB, Kim HH, Spinks GM, Lima MD, Baughman RH, Kim SJ. Stability of carbon nanotube yarn biofuel cell in human body fluid. *Journal of Power Sources*. Jul 2015;286:103-108. IF= 6.217.
91. Lederhose P, Haworth NL, Thomas K, Bottle SE, Coote ML, Barner-Kowollik C, Blinco JP. Design of Redox/Radical Sensing Molecules via Nitrile Imine-Mediated Tetrazole-ene Cycloaddition (NITEC). *Journal of Organic Chemistry*. Aug 2015;80(16):8009-8017. IF= 4.721.
92. Li CP, Zhu HJ, Hou TT, Vongsivut J, Dai JX, She FH, Kong LX. Simultaneous polymerization and crosslinking for the synthesis of molecular-level graphene oxide-polyacryl amide-CeOx composites. *Chemical Engineering Journal*. Mar 2015;263:27-37. IF= 4.321.
93. Li HT, Sun CH, Ali MT, Zhou FL, Zhang XY, MacFarlane DR. Sulfated Carbon Quantum Dots as Efficient Visible-Light Switchable Acid Catalysts for Room-Temperature Ring-Opening Reactions. *Angewandte Chemie-International Edition*. Jul 2015;54(29):8420-8424. IF= 11.261.
94. Li HT, Zhang XY, MacFarlane DR. Carbon Quantum Dots/Cu2O Heterostructures for Solar-Light-Driven Conversion of CO2 to Methanol. *Advanced Energy Materials*. Mar 2015;5(5):6. IF= 16.146.
95. Li JY, Zhu HJ, Wang XE, Armand M, MacFarlane DR, Forsyth M. Synthesis of Sodium Poly 4 styrenesulfonyl -(trifluoromethylsulfonyl) imide-co-ethylacrylate Solid Polymer Electrolytes. *Electrochimica Acta*. Sep 2015;175:232-239. IF= 4.504.
96. Li J, Zhu H, Wang X, MacFarlane DR, Armand M, Forsyth M. Increased ion conduction in dual cation [sodium] [tetraalkylammonium] poly[4-styrenesulfonyl(trifluoromethylsulfonyl) imide-co-ethylacrylate] ionomers. *Journal of Materials Chemistry A*. 2015;3(39):19989-19995. IF= 7.443.
97. Lima MD, Hussain MW, Spinks GM, Naficy S, Hagenasr D, Bykova JS, Tolly D, Baughman RH. Efficient, Absorption-Powered Artificial Muscles Based on Carbon Nanotube Hybrid Yarns. *Small*. 2015;11(26):3113-3118. IF= 8.368.
98. Lin JJ, Heo YU, Nattestad A, Shahabuddin M, Yamauchi Y, Kim JH. N719-and D149-sensitized 3D hierarchical rutile TiO₂ solar cells-a comparative study. *Physical Chemistry Chemical Physics*. 2015;17(11):7208-7213. IF= 4.493.
99. Lin JJ, Heo YU, Nattestad A, Yamauchi Y, Dou SX, Kim JH. Mesoporous Hierarchical Anatase for Dye-sensitized Solar Cells Achieving Over 10% Conversion Efficiency. *Electrochimica Acta*. Jan 2015;153:393-398. IF= 4.504.
100. Lin JJ, Peng Y, Pascoe AR, Huang FZ, Cheng YB, Heo YU, Nattestad A, Seung W, Kim SK, Yoon HJ, Kim SW, Yamauchi Y, Dou SX, Kim JH. A Bi-layer TiO₂ photoanode for highly durable, flexible dye-sensitized solar cells. *Journal of Materials Chemistry A*. 2015;3(8):4679-4686. IF= 7.443.
101. Lin JJ, Zhao L, Heo YU, Wang LZ, Bijarbooneh FH, Mozer AJ, Nattestad A, Yamauchi Y, Dou SX, Kim JH. Mesoporous anatase single crystals for efficient Co(2+/3+)-based dye-sensitized solar cells. *Nano Energy*. Jan 2015;11:557-567. IF= 10.325.
102. Linnemann J, Giorgio J, Wagner K, Mathieson G, Wallace GG, Officer DL. A simple one step process for enhancement of titanium foil dye sensitised solar cell anodes. *Journal of Materials Chemistry A*. 2015;3(7):3266-3270. IF= 7.443.
103. Liu FL, Alici G, Zhang BB, Beirne S, Li WH. Fabrication and characterization of a magnetic micro-actuator based on deformable Fe-doped PDMS artificial cilium using 3D printing (vol 24, 035015, 2015). *Smart Materials and Structures*. Jun 2015;24(6):1. IF= 2.449.
104. Liu FL, Alici G, Zhang BB, Beirne S, Li WH. Fabrication and characterization of a magnetic micro-actuator based on deformable Fe-doped PDMS artificial cilium using 3D printing. *Smart Materials and Structures*. Mar 2015;24(3):9. IF= 2.449.
105. Liu G, Hall J, Nasiri N, Gengenbach T, Spiccia L, Cheah MH, Tricoli A. Scalable Synthesis of Efficient Water Oxidation Catalysts: Insights into the Activity of Flame-Made Manganese Oxide Nanocrystals. *ChemSusChem*. 2015;8(24):4162-4171. IF= 7.657.
106. Liu YP, Guo SX, Ding L, Ohlin CA, Bond AM, Zhang J. Lindqvist Polyoxoniobate Ion-Assisted Electrodeposition of Cobalt and Nickel Water Oxidation Catalysts. *Acs Applied Materials & Interfaces*. Aug 2015;7(30):16632-16644. IF= 6.723.
107. Liu YQ, Weng B, Razal JM, Xu Q, Zhao C, Hou YY, Seyedin S, Jalili R, Wallace GG, Chen J. High-Performance Flexible All-Solid-State Supercapacitor from Large Free-Standing Graphene-PEDOT/PSS Films. *Scientific Reports*. Nov 2015;5:11. IF= 5.578.
108. Lozano R, Stevens L, Thompson BC, Gilmore KJ, Gorkin R, Stewart EM, Panhuis MIH, Romero-Ortega M, Wallace GG. 3D Printing of layered brain-like structures. *Journal of Neurochemistry*. Aug 2015;134:87-88. IF= 4.281.

109. Lozano R, Stevens L, Thompson BC, Gilmore KJ, Gorkin R, Stewart EM, Panhuis MIH, Romero-Ortega M, Wallace GG. 3D printing of layered brain-like structures using peptide modified gellan gum substrates. *Biomaterials*. Oct 2015;67:264-273. IF= 8.557.
110. Mac Kenna N, Calvert P, Morrin A, Wallacec GG, Moulton SE. Electro-stimulated release from a reduced graphene oxide composite hydrogel. *Journal of Materials Chemistry B*. 2015;3(12):2530-2537. IF= 4.726.
111. MacFarlane DR, Tachikawa N, Forsyth M, Pringle JM, Howlett PC, Elliott GD, Davis JH, Watanabe M, Simon P, Angell CA. Energy applications of ionic liquids. *Energy & Environmental Science*. 2014;7(1):232-250. IF= 11.65.
112. Malgras V, Nattestad A, Yamauchi Y, Dou SX, Kim JH. The effect of surface passivation on the structure of sulphur-rich PbS colloidal quantum dots for photovoltaic application. *Nanoscale*. 2015;7(13):5706-5711. IF= 7.394.
113. Malgras V, Zhang GR, Nattestad A, Clarke TM, Mozer AJ, Yamauchi Y, Kim JH. Trap-Assisted Transport and Non-Uniform Charge Distribution in Sulfur-Rich PbS Colloidal Quantum Dot-based Solar Cells with Selective Contacts. *Acs Applied Materials & Interfaces*. Dec 2015;7(48):26455-26460. IF= 6.723.
114. Malmstrom J, Wason A, Roache F, Yewdall NA, Radjainia M, Wei SH, Higgins MJ, Williams DE, Gerrard JA, Travas-Sejdic J. Protein nanorings organized by poly(styrene-block-ethylene oxide) self-assembled thin films. *Nanoscale*. 2015;7(47):19940-19948. IF= 7.394.
115. Mirabedini A, Foroughi J, Romeo T, Wallace GG. Development and Characterization of Novel Hybrid Hydrogel Fibers. *Macromolecular Materials and Engineering*. Dec 2015;300(12):1217-1225. IF= 2.661.
116. Mirabedini A, Foroughi J, Thompson B, Wallace GG. Fabrication of Coaxial Wet-Spun Graphene-Chitosan Biofibers. *Advanced Engineering Materials*. 2015. IF= 1.75.
117. Molino PJ, Innis PC, Higgins MJ, Kapsa RMI, Wallace GG. Influence of biopolymer loading on the physiochemical and electrochemical properties of inherently conducting polymer biomaterials. *Synthetic Metals*. Feb 2015;200:40-47. IF= 2.252.
118. Molino PJ, Wallace GG. Next generation bioelectronics: Advances in fabrication coupled with clever chemistries enable the effective integration of biomaterials and organic conductors. *APL Materials*. Jan 2015;3(1):12. IF= No impact factor available.
119. Mumford KA, Pas SJ, Linseisen T, Statham TM, Nicholas NJ, Lee A, Kezia K, Vijayraghavan R, MacFarlane DR, Stevens GW. Evaluation of the protic ionic liquid, N,N-dimethyl-aminoethylammonium formate for CO₂ capture. *International Journal of Greenhouse Gas Control*. Jan 2015;32:129-134. IF= 3.946.
120. Murakami T, Schmidt B, Brown HR, Hawker CJ. One-Pot "Click" Fabrication of Slide-Ring Gels. *Macromolecules*. Nov 2015;48(21):7774-7781. IF= 5.800.
121. Murray E, Sayyar S, Thompson BC, Gorkin R, Officer DL, Wallace GG. A bio-friendly, green route to processable, biocompatible graphene/polymer composites. *Rsc Advances*. 2015;5(56):45284-45290. IF= 3.84.
122. Murray E, Thompson BC, Sayyar S, Wallace GG. Enzymatic degradation of graphene/polycaprolactone materials for tissue engineering. *Polymer Degradation and Stability*. Jan 2015;111:71-77. IF= 3.163.
123. Naficy S, Spinks GM. Effect of Tensile Load on the Actuation Performance of pH-Sensitive Hydrogels. *Journal of Polymer Science Part B-Polymer Physics*. Feb 2015;53(3):218-225. IF= 3.830.
124. Najafpour MM, Fekete M, Sedigh DJ, Aro EM, Carpentier R, Eaton-Rye JJ, Nishihara H, Shen JR, Allakhverdiev SI, Spiccia L. Damage Management in Water-Oxidizing Catalysts: From Photosystem II to Nanosized Metal Oxides. *Acs Catalysis*. Mar 2015;5(3):1499-1512. IF= 9.312.
125. Noor SAM, Yoon H, Forsyth M, MacFarlane DR. Gelled ionic liquid sodium ion conductors for sodium batteries. *Electrochimica Acta*. Jul 2015;169:376-381. IF= 4.504.
126. O'Connell CD, Higgins MJ, Moulton SE, Wallace GG. Nano-bioelectronics via dip-pen nanolithography. *Journal of Materials Chemistry C*. 2015;3(25):6431-6444. IF= 4.696.
127. Oza YV, MacFarlane DR, Forsyth M, O'Dell LA. Characterisation of ion transport in sulfonate based ionomer systems containing lithium and quaternary ammonium cations. *Electrochimica Acta*. Sep 2015;175:80-86. IF= 4.504.
128. Pahnke K, Brandt J, Gryn'ova G, Lindner P, Schweins R, Schmidt FG, Lederer A, Coote ML, Barner-Kowollik C. Entropy driven chain effects on ligation chemistry. *Chemical Science*. 2015;6(2):1061-1074. IF= 9.211.
129. Pope CR, Romanenko K, MacFarlane DR, Forsyth M, O'Dell LA. Sodium ion dynamics in a sulfonate based ionomer system studied by Na-23 solid-state nuclear magnetic resonance and impedance spectroscopy. *Electrochimica Acta*. Sep 2015;175:62-67. IF= 4.504.
130. Raj CJ, Kim BC, Cho WJ, Park S, Jeong HT, Yoo K, Yu KH. Rapid hydrothermal synthesis of cobalt oxyhydroxide nanorods for supercapacitor applications. *Journal of Electroanalytical Chemistry*. Jun 2015;747:130-135. IF= 2.729.

131. Romanenko K, Pringle JM, O'Dell LA, Forsyth M. New insights into the thermal behaviour of organic ionic plastic crystals: magnetic resonance imaging of polycrystalline morphology alterations induced by solid-solid phase transitions. *Physical Chemistry Chemical Physics*. 2015;17(29):18991-19000. IF= 4.493.
132. Romano MS, Razal JM, Antiohos D, Wallace G, Chen J. Nano-Carbon Electrodes for Thermal Energy Harvesting. *Journal of Nanoscience and Nanotechnology*. Jan 2015;15(1):1-14. IF= 1.556.
133. Ross C, Pandav SS, Li YQ, Nguyen DQ, Beirne S, Wallace GG, Shaarawy T, Crowston JG, Coote M. Determination of Bleb Capsule Porosity With an Experimental Glaucoma Drainage Device and Measurement System. *Jama Ophthalmology*. May 2015;133(5):549-554. IF= 3.318.
134. Salari M, Aboutalebi SH, Aghassi A, Wagner P, Mozer AJ, Wallace GG. Disorder engineering of undoped TiO₂ nanotube arrays for highly efficient solar-driven oxygen evolution. *Physical Chemistry Chemical Physics*. 2015;17(8):5642-5649. IF= 4.493.
135. Sangian D, Naficy S, Spinks GM, Tondur B. The effect of geometry and material properties on the performance of a small hydraulic McKibben muscle system. *Sensors and Actuators a-Physical*. Oct 2015;234:150-157. IF= 1.903.
136. Sarwar MSU, Dobashi Y, Glitz EFS, Farajollahi M, Mirabbasi S, Naficy S, Spinks GM, Madden JDW. Transparent and Conformal 'Piezonic' Touch Sensor. *Electroactive Polymer Actuators and Devices (Eapad)* 2015. 2015;9430:9. IF= 1.94.
137. Sayyar S, Murray E, Gambhir S, Spinks G, Wallace GG, Officer DL. Synthesis and Characterization of Covalently Linked Graphene/Chitosan Composites. *JOM*. 2015. IF= 1.757.
138. Sayyar S, Murray E, Thompson BC, Chung J, Officer DL, Gambhir S, Spinks GM, Wallace GG. Processable conducting graphene/chitosan hydrogels for tissue engineering. *Journal of Materials Chemistry B*. 2015;3(3):481-490. IF= 4.726.
139. Scales N, Chen J, Hanley TL, Riley DP, Lumpkin GR, Luca V. Hierarchically porous carbon-zirconium carbide spheres as potentially reusable transmutation targets. *Microporous and Mesoporous Materials*. Aug 2015;212:100-109. IF= 3.453.
140. Schirmer KSU, Esrafilzadeh D, Thompson BC, Quigley AF, Kapsa RMI, Wallace GG. From nanoparticles to fibres: effect of dispersion composition on fibre properties. *Journal of Nanoparticle Research*. Jun 2015;17(6):11. IF= 2.184.
141. Seyedin MZ, Razal JM, Innis PC, Jalili R, Wallace GG. Achieving Outstanding Mechanical Performance in Reinforced Elastomeric Composite Fibers Using Large Sheets of Graphene Oxide. *Advanced Functional Materials*. Jan 2015;25(1):94-104. IF= 11.805.
142. Seyedin S, Razal JM, Innis PC, Jeiranikhameneh A, Beirne S, Wallace GG. Knitted Strain Sensor Textiles of Highly Conductive All-Polymeric Fibers. *ACS Applied Materials & Interfaces*. Sep 2015;7(38):21150-21158. IF= 6.723.
143. She XD, Chen LJ, Velleman L, Li CP, Zhu HJ, He CZ, Wang T, Shigdar S, Duan W, Kong LX. Fabrication of high specificity hollow mesoporous silica nanoparticles assisted by Eudragit for targeted drug delivery. *Journal of Colloid and Interface Science*. May 2015;445:151-160. IF= 3.368.
144. Shu KW, Wang CY, Li S, Zhao C, Yang Y, Liu HK, Wallace G. Flexible free-standing graphene paper with interconnected porous structure for energy storage. *Journal of Materials Chemistry A*. 2015;3(8):4428-4434. IF= 7.443.
145. Sim HJ, Choi C, Lee CJ, Kim YT, Spinks GM, Lima MD, Baughman RH, Kim SJ. Flexible, Stretchable and Weavable Piezoelectric Fiber. *Advanced Engineering Materials*. Sep 2015;17(9):1270-1275. IF= 1.75.
146. Simons TJ, Salsamendi M, Howlett PC, Forsyth M, Macfarlane DR, Pozo-Gonzalo C. Rechargeable Zn/PEDOT Battery with an Imidazolium-Based Ionic Liquid as the Electrolyte. *ChemElectroChem*. 2015. IF= 7.657.
147. Simpson C, Clarke TM, MacQueen RW, Cheng YY, Trevitt AJ, Mozer AJ, Wagner P, Schmidt TW, Nattestad A. An intermediate band dye-sensitised solar cell using triplet-triplet annihilation. *Physical Chemistry Chemical Physics*. 2015;17(38):24826-24830. IF= 4.493.
148. Singh A, Fekete M, Gengenbach T, Simonov AN, Hocking RK, Chang SLY, Rothmann M, Powar S, Fu D, Hu Z, Wu Q, Cheng YB, Bach U, Spiccia L. Catalytic Activity and Impedance Behavior of Screen-Printed Nickel Oxide as Efficient Water Oxidation Catalysts. *ChemSusChem*. 2015. IF= 7.657.
149. Sparrow R. Enhancement and Obsolescence: Avoiding an "Enhanced Rat Race". *Kennedy Institute of Ethics Journal*. Sep 2015;25(3):231-260. IF= 1.21.
150. Sparrow R. Robots in aged care: a dystopian future? *AI and Society*. 2015. IF= Not available.
151. Stewart E, Kobayashi NR, Higgins MJ, Quigley AF, Jamali S, Moulton SE, Kapsa RM, Wallace GG, Crook JM. Electrical Stimulation Using Conductive Polymer Polypyrrole Promotes Differentiation of Human Neural Stem Cells: A Biocompatible Platform for Translational Neural Tissue Engineering. *Tissue Engineering Part C-Methods*. Apr 2015;21(4):385-393. IF= 4.448.

152. Suematsu M, Yoshizawa-Fujita M, Zhu HJ, Forsyth M, Takeoka Y, Rikukawa M. Effect of zwitterions on electrochemical properties of oligoether-based electrolytes. *Electrochimica Acta*. Sep 2015;175:209-213. IF= 4.504.
153. Sui ZY, Wang CY, Shu KW, Yang QS, Ge Y, Wallace GG, Han BH. Manganese dioxide-anchored three-dimensional nitrogen-doped graphene hybrid aerogels as excellent anode materials for lithium ion batteries. *Journal of Materials Chemistry A*. 2015;3(19):10403-10412. IF= 7.443.
154. Sui ZY, Wang CY, Yang QS, Shu KW, Liu YW, Han BH, Wallace GG. A highly nitrogen-doped porous graphene - an anode material for lithium ion batteries. *Journal of Materials Chemistry A*. 2015;3(35):18229-18237. IF= 7.443.
155. Theivaprakasam S, MacFarlane DR, Mitra S. Electrochemical studies of N-Methyl N-Propyl Pyrrolidinium bis(trifluoromethanesulfonyl) imide ionic liquid mixtures with conventional electrolytes in LiFePO₄/Li cells. *Electrochimica Acta*. Oct 2015;180:737-745. IF= 4.504.
156. Tsekouras G, Boudoire F, Pal B, Vondracek M, Prince KC, Sarma DD, Braun A. Electronic structure origin of conductivity and oxygen reduction activity changes in low-level Cr-substituted (La, Sr)MnO₃. *Journal of Chemical Physics*. Sep 2015;143(11):7. IF= 2.95.
157. Usov PM, McDonnell-Worth C, Zhou FL, MacFarlane DR, D'Alessandro DM. The Electrochemical Transformation of the Zeolitic Imidazolate Framework ZIF-67 in Aqueous Electrolytes. *Electrochimica Acta*. Jan 2015;153:433-438. IF= 4.504.
158. Vallotton P, Kapsa RMI. "To measure is to know": how advances in image analysis are supporting neural repair strategies. *Neural Regeneration Research*. Jul 2015;10(7):1040-1042. IF= 0.220.
159. van der Salm H, Lind SJ, Griffith MJ, Wagner P, Wallace GG, Officer DL, Gordon KC. Probing Donor-Acceptor Interactions in meso-Substituted Zn(II) Porphyrins Using Resonance Raman Spectroscopy and Computational Chemistry. *Journal of Physical Chemistry C*. Oct 2015;119(39):22379-22391. IF= 4.385.
160. Wallace G. 3D scaffolds containing living cells. *Xenotransplantation*. Nov 2015;22:S55-S55. IF= 2.84.
161. Wang CY, Wallace GG. Flexible Electrodes and Electrolytes for Energy Storage. *Electrochimica Acta*. Sep 2015;175:87-95. IF= 4.504.
162. Wang J, Zhu H, Hurren C, Zhao J, Pakdel E, Li Z, Wang X. Degradation of organic dyes by P25-reduced graphene oxide: Influence of inorganic salts and surfactants. *Journal of Environmental Chemical Engineering*. 2015;3(3):1437-1443. IF= not available.
163. Wang M, Wang JZ, Hou YY, Shi DQ, Wexler D, Poynton SD, Slade RCT, Zhang WM, Liu HK, Chen J. N-Doped Crumpled Graphene Derived from Vapor Phase Deposition of PPy on Graphene Aerogel as an Efficient Oxygen Reduction Reaction Electrocatalyst. *Acs Applied Materials & Interfaces*. Apr 2015;7(13):7066-7072. IF= 6.723.
164. Warren H, Panhuis MIH. Highly conducting composite hydrogels from gellan gum, PEDOT:PSS and carbon nanofibres. *Synthetic Metals*. Aug 2015;206:61-65. IF= 2.252.
165. Weng B, Diao JL, Xu Q, Liu YQ, Li CM, Ding AL, Chen J. Bio-Interface of Conducting Polymer-Based Materials for Neuroregeneration. *Advanced Materials Interfaces*. May 2015;2(8):23. IF= impact factor not available.
166. Whitten PG, Nealon D, Saricilar SZ, Wallace GG. Ionic Liquid Solvated Polymer Networks for Stretchable Electronics. *Polymer-Plastics Technology and Engineering*. 2015;54(3):310-314. IF= 1.481.
167. Wright BF, Sunahara K, Furube A, Nattestad A, Clarke TM, Bazan GC, Azoulay JD, Mozer AJ. Driving Force Dependence of Electron Transfer Kinetics and Yield in Low-Band-Gap Polymer Donor-Acceptor Organic Photovoltaic Blends. *Journal of Physical Chemistry C*. Jun 2015;119(23):12829-12837. IF= 4.385.
168. Xiao F, Naficy S, Casillas G, Khan MH, Katkus T, Jiang L, Liu H, Li H, Huang Z. Edge-Hydroxylated Boron Nitride Nanosheets as an Effective Additive to Improve the Thermal Response of Hydrogels. *Advanced Materials*. 2015;27(44):7196-7203. IF= 17.49.
169. Xiao J, Khan M, Singh A, Suljoti E, Spiccia L, Aziz EF. Enhancing Catalytic Activity by Narrowing Local Energy Gaps-X-Ray Studies of a Manganese Water Oxidation Catalyst. *Chemsuschem*. Mar 2015;8(5):872-877. IF= 7.657.
170. Xin H, Brown HR, Naficy S, Spinks GM. Time-dependent mechanical properties of tough ionic-covalent hybrid hydrogels. *Polymer*. May 2015;65:253-261. IF= 3.562.
171. Yamaguchi S, Yoshizawa-Fujita M, Zhu HJ, Forsyth M, Takeoka Y, Rikukawa M. Improvement of charge/discharge properties of oligoether electrolytes by zwitterions with an attached cyano group for use in lithium-ion secondary batteries. *Electrochimica Acta*. Dec 2015;186:471-477. IF= 4.504.
172. Yamamoto S, Mori S, Wagner P, Mozer AJ, Kimura M. A Novel Covalently Linked Zn Phthalocyanine-Zn Porphyrin Dyad for Dye-sensitized Solar Cells. *Israel Journal of Chemistry*. 2015. IF= 2.221.
173. Yan S, Zhang J, Pan C, Yuan D, Alici G, Du HP, Zhu YG, Li WH. An integrated dielectrophoresis-active hydrophoretic microchip for continuous particle filtration and separation. *Journal of Micromechanics and Microengineering*. Aug 2015;25(8):9. IF= 1.731.

174. Yang M, Liang Y, Gui Q, Chen J, Liu Y. Electroactive biocompatible materials for nerve cell stimulation. *Materials Research Express*. 2015;2(4). IF= not available
175. Yildirim T, Ghayesh MH, Li W, Alici G. An experimental investigation into nonlinear dynamics of a magneto-rheological elastomer sandwich beam. *Smart Materials and Structures*. 2015;25(1). IF= 2.449.
176. Yoon H, Best AS, Forsyth M, MacFarlane DR, Howlett PC. Physical properties of high Li-ion content N-propyl-N-methylpyrrolidinium bis(fluorosulfonyl) imide based ionic liquid electrolytes. *Physical Chemistry Chemical Physics*. 2015;17(6):4656-4663. IF= 4.493.
177. Yuan T, Zhang WM, Li WT, Song CT, He YS, Razal JM, Ma ZF, Chen J. N-doped pierced graphene microparticles as a highly active electrocatalyst for Li-air batteries. *2d Materials*. Jun 2015;2(2):7. IF= No impact factor available.
178. Yune JH, Karatchevtseva I, Evans PJ, Wagner K, Griffith MJ, Officer D, Triani G. A versatile binder-free TiO₂ paste for dye-sensitized solar cells. *Rsc Advances*. 2015;5(37):29513-29523. IF= 3.84.
179. Zhang BB, Nagle AR, Wallace GG, Hanks TW, Molino PJ. Functionalised inherently conducting polymers as low biofouling materials. *Biofouling*. 2015;31(6):493-502. IF= 3.415.
180. Zhang BG, Quigley AF, Bourke JL, Nowell CJ, Myers DE, Choong PFM, Kapsa RM. Combination of agrin and laminin increase acetylcholine receptor clustering and enhance functional neuromuscular junction formation In vitro. *Developmental Neurobiology*. 2015. IF= 3.37.
181. Zhang HR, Molino PJ, Wallace GG, Higgins MJ. Quantifying Molecular-Level Cell Adhesion on Electroactive Conducting Polymers using Electrochemical-Single Cell Force Spectroscopy. *Scientific Reports*. Sep 2015;5:13. IF= 5.578.
182. Zhang LJ, Xia GL, Ge Y, Wang CY, Guo ZP, Li XG, Yu XB. Ammonia borane confined by nitrogen-containing carbon nanotubes: enhanced dehydrogenation properties originating from synergetic catalysis and nanoconfinement. *Journal of Materials Chemistry A*. 2015;3(41):20494-20499. IF= 7.443.
183. Zhao C, Shu KW, Wang CY, Gambhir S, Wallace GG. Reduced graphene oxide and polypyrrole/reduced graphene oxide composite coated stretchable fabric electrodes for supercapacitor application. *Electrochimica Acta*. Aug 2015;172:12-19. IF= 4.504.
184. Zhao L, Wagner P, van der Salm H, Clarke TM, Gordon KC, Mori S, Mozer AJ. Dichromophoric Zinc Porphyrins: Filling the Absorption Gap between the Soret and Q Bands. *Journal of Physical Chemistry C*. Mar 2015;119(10):5350-5363. IF= 4.385.
185. Zhao L, Wagner P, van der Salm H, Gordon KC, Mori S, Mozer AJ. Enhanced Electron Lifetimes in Dye-Sensitized Solar Cells Using a Dichromophoric Porphyrin: The Utility of Intermolecular Forces. *Acs Applied Materials & Interfaces*. Oct 2015;7(39):22078-22083. IF= 6.723.
186. Zhao MD, Björninen M, Cao L, Wang HR, Pelto J, Li XQ, Hyttinen J, Jiang YQ, Kellomäki M, Miettinen S, Sándor GK, Seppänen R, Haimi S, Dong J. Polypyrrole coating on poly-(lactide/glycolide)- β -tricalcium phosphate screws enhances new bone formation in rabbits. *Biomedical Materials (Bristol)*. 2015;10(6). IF= 3.697.
187. Zhao SF, Horne M, Bond AM, Zhang J. Electrochemical reduction of aromatic ketones in 1-butyl-3-methylimidazolium-based ionic liquids in the presence of carbon dioxide: the influence of the ketone substituent and the ionic liquid anion on bulk electrolysis product distribution. *Physical Chemistry Chemical Physics*. 2015;17(29):19247-19254. IF= 4.493.
188. Zhao Y, Meng YN, Wu HP, Wang Y, Wei ZX, Li XJ, Jiang P. In situ anchoring uniform MnO₂ nanosheets on three-dimensional macroporous graphene thin-films for supercapacitor electrodes. *RSC Advances*. 2015;5(110):90307-90312. IF= 3.84.
189. Zhou FL, McDonnell-Worth C, Li HT, Li JY, Spiccia L, Macfarlane DR. Enhanced photo-electrochemical water oxidation on MnO_x in buffered organic/inorganic electrolytes. *Journal of Materials Chemistry A*. 2015;3(32):16642-16652. IF= 7.443.
190. Zhu B, Lee R, Li J, Ye X, Hong SN, Qiu S, Coote ML, Jiang Z. Chemoselective Switch in the Asymmetric Organocatalysis of 5H-Oxazol-4-ones and N-Itaconimides: Addition-Protonation or [4+2] Cycloaddition. *Angewandte Chemie - International Edition*. 2015. IF= 11.261

AWARDS

Maria Forsyth recognised with Australian Academy of Science Fellowship

Prof Forsyth, ACES Associate Director was elected to the Australian Academy of Science in 2015. About 450 Australian scientists have received this lifetime honour since the Academy was established in 1954 by Australian Fellows of the Royal Society of London.

ACES Executive Research Director Prof Gordon Wallace said Prof Forsyth was well regarded around the world.

"This award is recognition of Maria's standing on the global stage," he said. "We are privileged to have the opportunity to work alongside such an exceptional scientist."

With seemingly limitless energy, Prof Forsyth is bearing the torch for science education and working to help the world achieve clean energy and infrastructure sustainability.



Michelle Coote Pople Medal Winner

ACES CI Prof Michelle Coote was awarded the 2015 Pople medal of the Australasian Association of Theoretical and Computational Chemistry for her pioneering work on the development and application of accurate computational chemistry procedures for modelling radical polymerisation processes.

Building on the ACES reputation as a leader in medical device research and development

Following on from 2014 – a year where ACES research at UOW was listed on the Timeline of key Australian medical

technology inventions for both 2013 and 2014 (*Medical Technology Australia: Key Facts and Figures 2014, Occasional Paper Series: Sydney. Medical technology Association of Australia Limited (2014)*) - ACES continues to develop new technologies and be recognised for their achievements, especially in the key area of health.

Winner of Epilepsy Foundation 2015 Shark Tank Competition

Winner of Epilepsy Foundation 2015 Shark Tank Competition for innovative

ideas in epilepsy and seizure treatment and care was Mark Cook, MD, Professor, St. Vincent's Hospital Melbourne, The University of Melbourne, Department of Neurosciences and chief investigator ARC Centre of Excellence for Electromaterials Science for Sub-scalp Seizure Monitor for Epilepsy Management. Mark won \$125,000, \$50,000 from a Judges Award and \$75,000 from a People's Choice Award. The winners use their award money to accelerate their ideas toward development and commercialisation to bring their projects to help people living with epilepsy.

1999	Long-wearing night and day contact lenses that transmit an increased volume of oxygen and can remain in place for 30 days are developed by the Cooperative Research Centre for Eye Research and Technology NSW.
2005	Dr Fiona Wood is named Australian of the Year for her work in burns treatment, including the development of spray-on skin for burns victims .
2010	An Australian hospital performs the Southern Hemisphere's first total artificial heart implant. The artificial mechanical device mimics the function of both heart ventricles, which are responsible for pumping blood.
2011	Melbourne-based company Phosphagenics aims to offer patients with diabetes the world's first transdermally delivered insulin .
2013	A partnership between scientists at the University of Wollongong and St Vincent's Hospital in Melbourne leads to a breakthrough in tissue engineering, with researchers growing cartilage from stem cells in 3D printed scaffolds to treat cancers, osteoarthritis and traumatic injury.
2014	A handheld bio-pen is developed by the University of Wollongong, which allows surgeons to design customised implants on-site and at the time of surgery. The BioPen prototype was designed and built using 3D printing equipment and will be suitable for repairing damaged bone and cartilage.

ACES through work done at UOW and St Vincent's Hospital Melbourne was recognised in 2013 for their research on growing cartilage from stem cells in 3D printed scaffolds and in 2014 the work on the hand held biopen (Medical Technology in Australia: Key Facts and Figures 2014, Occasional Paper Series: Sydney. Medical Technology Association of Australia Limited (2014) page 30).

Winner of international engagement scholarship from the NSW Government's Medical Devices Fund

A UOW-led project has won a major award following completion of the NSW Medical Device Commercialisation Training Program (MDCTP) 2015. Dr Robert Gorkin was part of the 12-week intensive course commissioned by NSW Health to help their research become commercialised and reach the public domain, to the benefit of Australia's economy and overall health.

The research supported by the Bill & Melinda Gates Foundation and backed by experts at UOW and Swinburne University, Dr Gorkin is leading the development of a next-generation condom made of new tough hydrogel materials, originally developed within ACES, in order to improve feeling and increase regular use.

Winners of Thinkable Inspire Australia Research Competition

Teams led by Cathal O'Connell (IPRI ECR) and Robert Gorkin (IPRI research fellow) showcasing some of the research being undertaken using ACES materials came first and second respectively in the Thinkable Inspire Australia Research Competition! This is a crowd funding - Inspire Australia Research Competition with a prize pool on this occasion >\$14,000 AUD (3D BioPrinting <https://thinkable.org/submission/3100> & Geldom <https://thinkable.org/submission/3095>).

The Thinkable organisation is 'Connecting the world with the latest scientific research via video so anyone can learn, support and engage with the frontiers of science'. The competition is run on social media with public voting via Facebook. The public votes are combined with the judges votes to announce the overall winners.

Awards to Communicate and Advance ACES research

Prof Gursel Alici ACES CI and Soft Robotics theme leader from UOW was awarded a fellowship as Chinese Academy of Sciences Visiting Professor for International academics. Gursel took up the position for 5 months in 2015 to collaborate in smart actuators for robotics and mechatronics applications, and robotic drug delivery systems.

ACES CI Prof Leone Spiccia from Monash University received a Helmholtz International Research Award in 2014. Visits were made to Helmholtz Zentrum Berlin in June-July and Helmholtz Zentrum Dresden-Rossendorf in August 2015 as part of this award.

ACES mid career researcher Dr Caiyun Wang received a travel award to present her work on "Three Dimensional



The Hon Jillian Skinner, NSW Minister for Health, presented Dr Gorkin an international engagement scholarship worth \$10,000 to aid exploration of foreign markets.

Organic Conductors with Tunable Properties for Energy Storage" at the Theo Murphy Australian Frontiers of Science Symposium held in Melbourne from the 9-11 December. The Academy of Science has hosted the Theo Murphy Australian Frontiers of Science symposium since 2003, bringing together the very best young Australian scientists to discuss emerging technologies, new opportunities and exciting cutting-edge advances in their fields. This year, 70 outstanding early- and mid-career researchers (EMCRs) identified ways to bring the ever-expanding 'tool-kit' of materials science to bear on the important materials-based problems of the 21st century.

Ethics, Policy and Public Engagement theme member Frederic Gilbert has been awarded approximately \$10,000 from the Brocher Foundation to host an international symposium on ethical issues related to 3D printing in 2016.

Dr Justin Bourke (ECR UOM) received \$3000 for the St Vincents Hospital ECR Bionics Prize for Excellence in Neurophysiology Research 2014-2015.

Dr Erlendur Jonsson (ECR Deakin) in 2015 received a prize of 10 000 SEK (=1600 AUD) for the best PhD thesis defended during the 2013-2014 academic year from the Department of Applied Physics from Chalmers University of Technology, Gothenburg Sweden.

Awards for Research or Research Training

Prof Maria Forsyth received the Deakin University's Vice-Chancellor Award for Excellence in Research Supervision in November 2015.

A/Prof Jennifer Pringle received the Deakin University's Vice-Chancellors Award for Excellence in Research Advancement in November 2015.





Key Performance Indicator (KPI)	Target 2015	Actual 2015
Research Findings		
Number of research outputs- Journal publications	105	190
Number of research outputs- Book chapters	0	6
Number of research outputs- Conference publications	20	9 refereed papers 124 unpublished abstracts*
Number of research outputs- Patents (filed)	0	2 PCT/AU2015/901513: Functionalised Photo-Electrocatalyst and Method for Chemical Conversion PCT/AU2015/000248: Thermo-Electrochemical Cell and Method of Use
Quality of research outputs - At least 50% of journal articles in journals with impact factor >2.95	>53 (50%)	138 (73%)
Quality of research outputs - H index (ISI) Centre Researchers	5 > 50 4 > 30 6 > 25 6 > 20 3 > 15	5 > 50 7 > 30 9 equal to or > 25 5 equal to or > 20 3 > 15
Quality of research outputs - Overall publication and citation activity of ACES publications since 2014 (SciVal Scopus). World average field weighted citation impact is 1.00.	Field weighted citation impact : • Overall • Materials Science • Engineering Outputs in : • top 10% most cited • top 10% journals	Field weighted citation impact for ACES 2014-15 (SciVal ,Scopus data 25.1.16) • Overall 1.81 (328 pubs) • Materials Science 1.99 (165 pubs) • Engineering 2.04 (75 pubs) Outputs in : • top 1% most cited: 17 (5.2%) • top 10% most cited: 140 (42.7%) • top 10% journals: 164 (52%)
Number of invited talks/papers/keynote lectures given at major international meetings.	30	94 20 Plenary/Keynote 57 invited 17 'distinguished visitor' lectures

Key Performance Indicator (KPI)	Target 2015	Actual 2015
Number and nature of commentaries about the Centre's achievements	100 web 20 print 10 radio 5 TV	209 web 40 print 18 radio 12 TV
Citation data for publications	1.5 average (Av) cumulative citations per published journal article	2014-2015 (SCOPUS) 354 articles 1258 citations 3.6 Av cumulative citation per published article (SCOPUS)
Research training and professional education		
Number of professional training courses for staff and postgraduate students attended	6	16
Number of Centre attendees at all professional training/development courses offered by the Centre	40	360
Number of new postgraduate students working on core Centre research and supervised by Centre staff	24	27
Number of new postdoctoral researchers recruited to the Centre working on core Centre research	16.4 FTE	24 FTE
Number of new Honours students working on core Centre research and supervised by Centre staff	0	1
Number of postgraduate completions and completion times, by students working on core Centre research and supervised by Centre staff	0	0
Number of Early Career Researchers (within five years of completing PhD) working on core Centre research	8	15.5 FTE
Number of students mentored	33	265 see Appendix 1
Number of mentoring programs offered by the Centre	2	21 events see Appendix 1
Establish international masters course	1 within first 2 years of operation	1
International, national and regional links and networks		
Number of international visitors and visiting fellows	30	57
Number of national and international workshops held/organised by the Centre	2	7
Number of visits to overseas laboratories and facilities	20	66
Examples of relevant interdisciplinary research supported by the Centre	30% of journal publications each year will be apportioned across at least 2 FOR codes at the 2 digit level	64% <i>ERA ARC journal FOR codes were used.</i>

Key Performance Indicator (KPI)	Target 2015	Actual 2015
End-user links		
Number of government, industry and business community briefings	15	48
Number and nature of public awareness/ outreach programs	5 3 public lectures 1 Open day 1 school visit	24 13 Public lectures 2 Open days 9 school visits
Currency of information on the Centre's website	One new content item uploaded onto the website each week	Average 6 new blogs per month
		Jan-7
		Feb-9
		Mar-8
		Apr-5
		May-6
		Jun-5
Number of website hits	Average 1300 sessions/month	Jul-7
		Aug-6
		Sept-5
		Oct-3
		Nov-7
		Dec-4
		Average 3230 sessions/month
		Dec-2,516
		Nov-3,161
		Oct-2,921
		Sep-3,459
		Aug-4,010
		July-3,860
		June-3,317
Number of talks given by Centre staff open to the public	3	12
Establish Fabrication Fellow program	1 within first 2 years of operation	0
Organisational support		
Number of new organisations collaborating with, or involved in, the Centre	1	0
Annual cash contributions from Administering and Collaborating Organisations	UOW: \$982,473 Deakin: \$330,000 Monash: \$255,354 UTas: \$145,445 UOM: \$50,000 ANU: \$50,718	UOW: \$867,440 Deakin: \$300,000 Monash: \$310,215 UTas: \$98,945 UOM: \$100,000 ANU: \$38,039 Contribution as per financial statement submitted to administrating organisation.
Annual in kind contributions from Administering and Collaborating Organisations	UOW: \$488,051 Deakin: \$386,549 Monash: \$170,206 UTas: \$125,695 UOM: \$368,486 ANU: \$160,492	UOW: \$468,016 Deakin: \$247,457 Monash: \$175,641 UTas: \$163,150 UOM: \$315,581 ANU: \$170,197
Annual in kind contributions from Partner Organisations	DCU: \$63,300 Warwick: \$41,000 Friedrich Alexander: \$40,000 Hanyang: \$31,000 Yokohama: \$30,500	DCU: \$85,746 Warwick: \$41,000 Friedrich Alexander: \$29,800 Hanyang: \$29,500 Yokohama: \$25,500

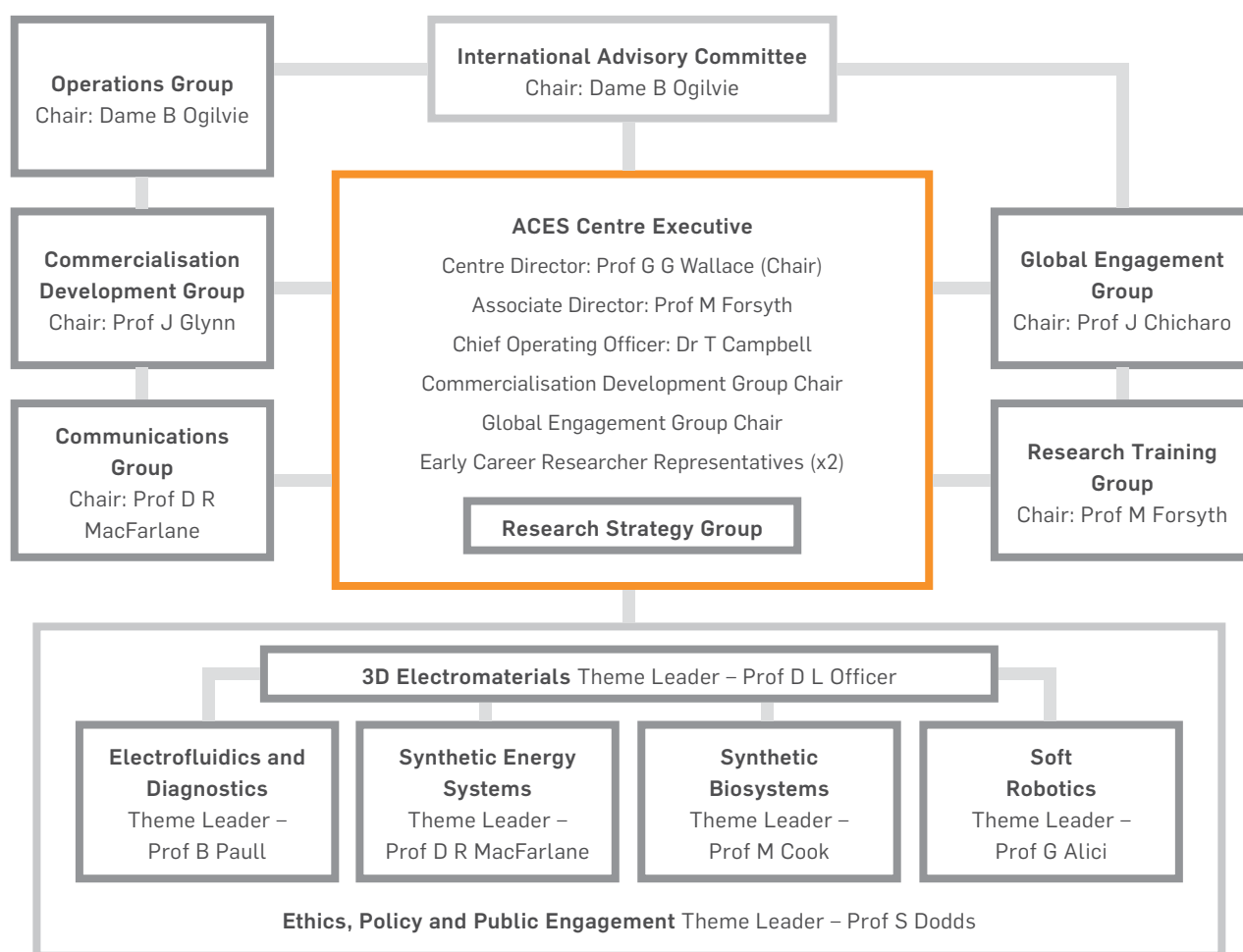
Key Performance Indicator (KPI)	Target 2015	Actual 2015
Other research income secured by Centre staff	\$1 million • 70% ARC grants • 20% other Australian competitive grants • 10% Industry or CRC	2015 income: \$10,511,333 • 51% ARC grants • 19% Other Australian Competitive grants • 6% Public Sector grants • 19% industry (12%)/ CRC (7%) • 5% Other income
Level and quality of infrastructure provided to the Centre	On an annual basis in the ARC report ACES will report on additional 1. laboratory space available at the various nodes 2. comment on additional successful funding for new equipment or facilities	Deakin University have new characterisation tools available: 1. a Netzsch DSC 214 Polyma used to study thermal phase change behaviour in samples 2. a JEOL JSM-IT300LV a low vacuum scanning electron microscope with a sample transfer chamber for air-sensitive samples 3. a differential scanning calorimeter for use in measuring a number of characteristic properties of a material 4. UV-VIS spectrophotometer and electrochemistry flow cell Melbourne University (St Vincents Hospital) have for characterisation a FACS analyser for rapid through-put characterisation of stem cells and cells differentiated from them plus the effects of materials and fabrication on cell phenotype ARC LIEF16 (LE160100063) grant awarded to purchase an advanced focused ion beam microscope with secondary ion mass spectrometer for trace element analysis and nanomachining of soft and hard matter to be located at UOW. ARC LIEF16 (LE160100120) grant awarded to purchase a dynamic nuclear polarisation system for molecular structure determination to be located at Deakin University.
Governance		
Breadth, balance and experience of the members of the Advisory Committee (IAC)	The IAC will be made up of 12 people: 7 with R&D backgrounds and 5 with business/ enduser connections	10 R&D background 4 enduser connections
Frequency, attendance and value added by Advisory Committee meetings	2 per year	Feb & Oct 2015
Vision and usefulness of the Centre strategic plan	By end of 2015 have a draft ACES strategic plan developed in consultation with the IAC	ACES Strategic Plan approved by IAC in Oct 2015 and submitted to ARC in Nov 2015

Key Performance Indicator (KPI)	Target 2015	Actual 2015
The adequacy of the Centre's performance measure targets	KPIs reviewed annually at the February IAC meeting; with any changes requested through the ARC	Adequate reviewed by IAC 11 Feb 2016
Effectiveness of the Centre in bringing researchers together to form an interactive and effective research team	40% of researchers to have cross-nodal supervision	63%
Effectiveness of the Centre in bringing researchers together to form an interactive and effective research team	35% of ACES publications co-authored with international collaborators	79%
Effectiveness of the Centre in bringing researchers together to form an interactive and effective research team	15% of ACES publications co-authored with national collaborators	33%
An annual survey of Centre members re interaction effectiveness		An 'open to the floor' session, entitled ' <i>What is ACES? How can we make it better?</i> ' was run at the ACES Full Centre meeting 12 August 2015
National Benefit		
Contribution to the National Research Priority-Frontier Technologies for Building & Transforming Australian Industries in the goal areas of Advanced Materials, Frontier Technologies, Breakthrough Sciences.	20% of ACES publications	50% of ACES publications were coded with FOR codes of: '03' -Chemical Sciences '09'-Engineering '10'-Technology MD-multidisciplinary
Contribution to the National Research Priority-Frontier Technologies for Building & Transforming Australian Industries in the goal areas of Advanced Materials, Frontier Technologies, Breakthrough Sciences.	10% of public conferences, government and industry briefings, and communiques	49% Of ACES organised public conferences, government and industry breakfasts/ symposia

Legend:

* Number of unpublished abstracts reported do not include abstracts for ACES organised events.

GOVERNANCE



ACES Governance Structure

The Centre's governance structure aims to ensure the efficient operation of the Centre across multiple locations and is focused on achievement of Centre objectives through specialist committees and advisory groups informing the Centre Executive. The Governance arrangements provide the appropriate mix of strategic planning and day to day management and ensure proper engagement with key stakeholders and end-users. The

diagram below illustrates the structure and relationships in place during 2014 and 2015.

The University of Wollongong is the administering organisation with the Centre Director, Prof Gordon Wallace providing the leadership necessary to make ACES a pre-eminent global centre for electromaterials research and reporting to Deputy Vice-Chancellors of the participating Australian universities through the operations group. Prof

Maria Forsyth, the Associate Director, works closely with the Centre Director to oversee the ACES research program. Dr Toni Campbell, the Chief Operations Officer manages the Centre's day-to-day operations in consultation with the Centre Director.

External Advisors are of invaluable assistance to ACES and is provided by a number of eminent advisors drawn from the scientific, business, academic and government communities. The specific

Table 7: Members of the IAC for 2015

Dame Bridget Ogilvie Chair ACES IAC AC, DBE, FAA, FRS, FMedSci	Prof Ric Kaner UCLA, USA
Prof Ray Baughman Director of the MacDiarmid Centre for Nanotechnology, USA	Prof Yoshihito Osada Former Deputy Director of the RIKEN Advanced Science Institute, Japan
Dr Ian Dagley CEO CRC for Polymers, Australia	Prof Lee Won-Mook President of Hanbat University, Korea
Prof Hans-Joachim Freund Director Fritz-Haber-Institut der Max-Planck-Gesellschaft, Germany	Dr Jan Weber Boston Scientific, Netherlands
Dr Anita Hill Division Chief CSIRO Process Science and Engineering, Australia	Prof Chung-Yu (Peter) Wu Chair Professor at National Chiao Tung University; Director Nanotechnology Program, Taiwan
Dr Russell Jones Bio-MPD Leader, Cell and Gene Therapy Platform, Biopharm R&D, GlaxoSmithKline, UK	Prof Daoben Zhu Former Director Institute of Chemistry, Chinese Academy of Science, China

contributions are detailed below and include Dame Bridget Ogilvie (FRS and former Director, UK Wellcome Trust), Chair of ACES International Advisory Committee; Prof John Glynn (Executive Dean, Faculty of Business, UOW), Chair of ACES Commercialisation Development Group; and Prof Joe Chicharo (DVC-Global Strategy, UOW), Chair of the ACES Global Engagement Group.

Centre Executive Committee

The Centre Executive Committee oversees the Centre's operations and reviews performance against defined indicators and is responsible for reporting outcomes to the ARC and other stakeholders and for setting strategic directions and broad budget allocations. The committee is advised by the International Advisory Committee. The executive committee met four times in 2015. The committee reviewed and endorsed the activities of its sub-committees (Research Strategy Group, Commercialisation Development Group, Global Engagement Group, Research Training Group and Communications Group).

International Advisory Committee

The role of the International Advisory Committee (IAC) provides high-level strategic advice to the Centre Director into the positioning of the Centre's activities to secure and retain a position of global leadership in electromaterials science as well as ongoing input into the Centre's research programs. The IAC has met twice in 2015 (February and October) and the IAC members are listed in Table 7.

Operations Group

The operations group comprises of the DVC (Research) from each of the collaborating organisations or an agreed representative. The meetings are chaired by Dame Bridget Ogilvie (IAC chair) and address cross-institutional matters. The Operations Group met on 18 February 2015 and 24 February 2016.

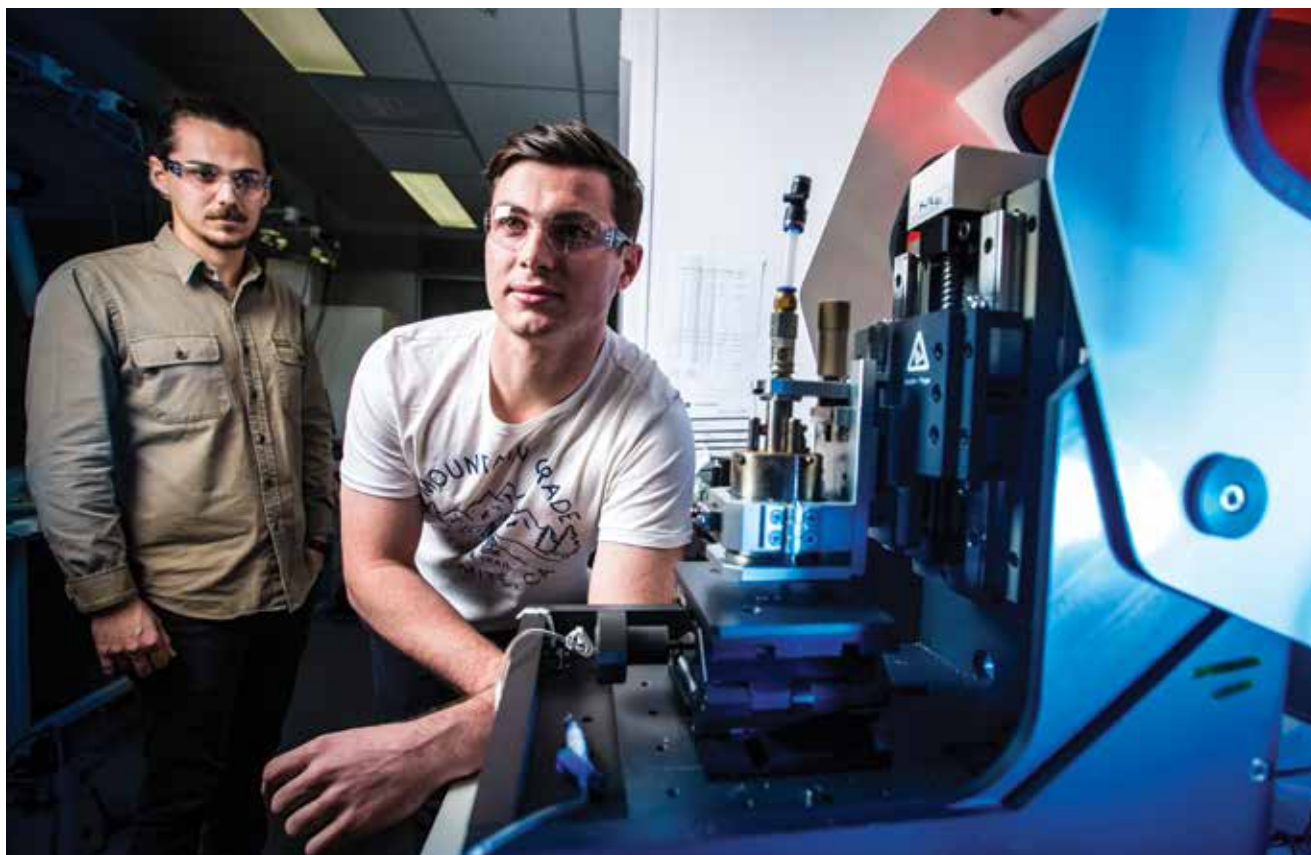
Research Strategy Group

The key goal of the Research Strategy Group (RSG) was to generate the most

cohesive and constructive collaborative effort within the ACES research teams in 2015. The group drives ACES interconnecting theme projects, as well as coordinates the theme activities to maximise the synergies that arise from the diverse skill-sets of the researchers. Chaired by the Centre Director Prof Gordon Wallace, the RSG met 3 times in 2015.

Research Training Group

The Research Training Group (RTG) met 4 times in 2015. Chaired and led by A/Prof Jennifer Pringle, with the assistance of Associate Director Prof Maria Forsyth in 2015, this group was responsible for designing, establishing and implementing the research training and career development program. Outside the research it was agreed that the most important contribution ACES could make is in delivering advanced teaching and learning practices; especially in post graduate training. The delivery of the two Masters courses: Biofabrication and Electromaterials will highlight these practices.



Communications Group

The communications group met 4 times in 2015. Thanks to a proactive approach to pitching to media, plus further developing relationships with journalists and collaborative work with partner University media teams, ACES is enjoying significant media coverage this year across a number of research topics. Facebook, YouTube, Twitter and LinkedIn platforms all have an increased ACES presence.

The communications group is also responsible for designing, establishing and implementing research training and a career development program in communications; so liaises closely with the RTG group.

Commercialisation Development Group

The Commercialisation Development Group (CDG) was chaired by Prof John Glynn (MA, MPhil, PhD, FCPA, FCCA,

MIACD), Executive Dean (Faculty of Business), University of Wollongong. Prof Glynn is responsible for the strategic direction of the Faculty of Business, including the Sydney Business School at the University of Wollongong.

The CDG group met twice in 2015. In its role to assist the Centre to identify, review and advise on commercial opportunities, the group supported the ACES decision to undertake an audit of the ACES research and associated technologies/ capabilities and how those match the needs of the market. That CTechBA report has now been delivered.

Prof Glynn and the Sydney Business School partnered ACES in running the Graduate Certificate in Entrepreneurship and Innovation in 2015 which graduated 7 students and in 2016 the Sydney business school will offer a 1 year non-academic award program of a Certificate in Entrepreneurship and Innovation to ACES members.

Global Engagement Group

The Global Engagement Group (GEG), chaired by Prof Joe Chicharo, Deputy Vice-Chancellor (Global Strategy), University of Wollongong met once in February then convened a workshop with all the participating universities in November; from which the ACES organisations agreed to draw up a high level set of guiding principles for engagement with possible strategic partners.

To date the GEG has (i) mapped current ACES international partnerships; (ii) captured achievements/goals in the ACES strategic plan and (iii) looked at what the impact of the international partnerships via journal publications and citations has been.

The ACES strategy into 2016 will be to invest in relationships to deliver for ACES on a Centre to Centre basis or as a member of a network of Research Centres.

FINANCES

Financial Statement

Statement of Operating Income and Expenditure for year ended 31 December 2015.

Income	2015 \$
ARC Centre Grant	3,745,256
Institutions cash Support	1,714,639
NSW State Government Dept I&I-RAPP Grant interest	14,728
Total income	5,474,623

Expenditure-ARC and Institutional cash	2015 \$
Personnel (salaries & stipends)	3,737,270
Equipment	159,702
Travel	287,220
Research maintenance & consumables	353,915
Other (3rd party expert services, administration, dissemination, outreach)	99,745
Total Expenditure	4,637,852
Surplus	836,771

Other Research Developments

ACES members are involved in other research initiatives. In some cases the ACES entity (facilities, personnel and market presence) has enabled the development of these research initiatives that could not be funded by the Centre of Excellence core funding. A list of some of the other research initiatives is shown in Table 8.

The split of other research income secured by Centre staff is shown in the chart.

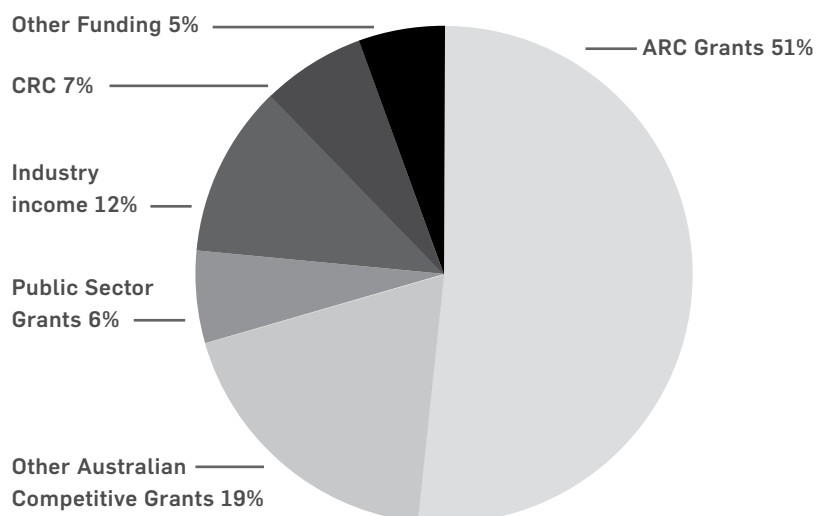


Table 8: Examples of other research initiatives where ACES members are involved.			
ACES Research Area	Project	Researcher	Funding Body
Materials/ Energy	2016-2019: Towards high stability, high energy density Na batteries for widespread energy storage	Prof Maria Forsyth (ACES) A/Prof Patrick Howlett (ACES) Dr Alexey Glushenkov Prof Michel Armand	ARC Discovery grant DP160101178
Materials/ Modelling	2015-2017: Controlling polymer microstructure with structured Lewis acids	Coote, Prof Michelle L (ACES)	ARC Discovery grant DP150104454
Materials/ Characterisation	2015-2017: Electrochemical Resonance Energy Transfer	C Hogan L Spiccia (ACES) P Barnard J Jasieniak	ARC Discovery grant DP150102741
Materials/ Fabrication	2015-2017: This project will explore the potential and limits of chemopropulsion and its use as a driving mechanism for cargo-carrying vehicles in fluids. The resulting fluidic transport systems could be used to transport medicine in the human body, act as chemical messengers for signal transduction in sensing or other systems or move cargo around microfluidic devices.	Officer, Prof David (ACES) Wagner, Dr Pawel (ACES) Wagner, Dr Klaudia Diamond, Prof Dermot Gordon, Prof Keith Florea, Dr Larisa	ARC Discovery Grant DP150104532
Materials	2014-2019: ARC Research Hub for a World-class Future Fibre Industry. This research hub aims to transform the Australian fibre industry into a dynamic sector focused on high-performance and high-value fibres and fibre-based products. These materials are expected to help to reduce energy costs, minimise the environmental footprint of manufacturing processes and improve public health and safety. The hub will also train the next generation of industry-savvy fibre research leaders.	Prof Xungai Wang (ACES) et al	IH140100018
Materials/ Fluidics	2014: ARC Training Centre for Portable Analytical Separation Technologies. The aim is to discover and create new technologies to enable more portable separation science applications.	Prof EF Hilder A/Prof RA Shellie Prof PR Haddad Prof MC Breadmore Prof B Paull (ACES) Prof PN Nesterenko Dr RM Guijt	IC140100022
Medical Bionics	2014-2017: For the application of intelligent conducting polymers for treating schizophrenia and allied disorders focusing on neuronal outgrowth, myelination and synaptogenesis.	Prof Xu-Feng Huang A/Prof Jeremy Crook (ACES) A/Prof Robert Kapsa (ACES) Prof Gordon Wallace (ACES)	NHMRC grant 1065463
Medical Bionics	2014-2017: Biopolymer Conduit for Peripheral Nerve Repair	A/Prof Robert Kapsa (ACES) Prof Gordon Wallace (ACES) A/Prof Michael Murphy Prof Geoff Spinks (ACES)	NHMRC grant 1062569

Table 8: Examples of other research initiatives where ACES members are involved.			
ACES Research Area	Project	Researcher	Funding Body
Materials Engineering	2014-2017: This project aims to understand the behaviour of haematopoietic stem cells (HSC) in novel 3D scaffolds based on short silk nanofibres.	Wang, Prof Xungai (ACES) Sutti, Dr Alessandra Rajkhowa, Dr Rangam Wong, Dr Cynthia Kirkland, A/Prof Mark A	ARC Linkage Grant LP140100287 with partner Cytomatrix Pty Ltd
Materials Engineering	2014-2016: This project will design and characterise novel solid state electrolyte membranes composed of plastic crystals and polymer nanofibres.	Howlett, Dr Patrick (ACES) Pringle, Dr Jennifer (ACES) Armand, Prof Michel Greene, Dr George W	ARC Discovery Grant DP140101535
Materials	2013-2015: Characterising and exploiting hydrogen tunnelling in environmentally and medically important enzymes	Coote, Prof Michelle L (ACES) Jackson, Dr Colin J	ARC Discovery grant DP13010244
Materials	2013-2015: Understanding the interaction between wool fibre surface and ionic liquids	Wang, Prof Xungai (ACES) Byrne, Dr Nolene	ARC Discovery grant DP130101263
Materials	2013-2016: Phosphonium Ionic Liquids for Advanced Lithium Energy Storage Systems	MacFarlane (ACES) Forsyth (ACES) Izgorodina Howlett (ACES) Robertson	ARC Linkage grant LP120200181
Materials	2013-2015: Highly-efficient, reversible fuel cell	G. F. Swiegers G. G. Wallace (ACES) P. Barrett	ARC Linkage grant LP13010113 with partner Aquahydrex
Policy	2013-2016: Corporate political activity of tobacco, alcohol and gambling companies in Australia	Miller, A/Prof Peter Hancock, Prof Linda (ACES) Wakefield, Prof Melanie Kypri, A/Prof Kypros Livingstone, Dr Charles Daube, Prof Michael Giorgi, Ms Caterina Adams, A/Prof Peter McCambridge, Dr Jim	ARC Linkage grant LP130100046 with partner Cancer Council of Victoria, Foundation for Alcohol Research and Education, The University of Auckland
Materials	2013-2016: Functionalized nanomaterials for application as multimodal cancer imaging agents	Spiccia, Prof Leone (ACES)	ARC Discovery Grant and Discovery Outstanding Researcher Award DP130100816
Materials	2012–2016: Protonic materials for green chemical futures By emulating the structures that nature has evolved this project will create novel materials that will be used to develop new sustainable chemical technologies. Working with local and international collaborators, outcomes will include new approaches to the conversion of carbon dioxide into valuable chemicals and for renewable energy generation and storage.	Prof DR MacFarlane (ACES)	ARC Laureate FL120100019

Table 8: Examples of other research initiatives where ACES members are involved.			
ACES Research Area	Project	Researcher	Funding Body
Materials/ Energy	2011-2016: New materials for a sustainable energy future This project will research and develop new selective transport materials to create new sustainable technologies for energy storage (e.g. batteries and capacitors) which will allow greater use of renewable energy sources, desalination and CO2 capture.	Prof Maria Forsyth (ACES)	ARC Laureate FL110100013
Bionics	2011-2016: New dimensions in organic bionics The advent of the next generation of medical bionic devices is critically dependent on advances in multifunctional organic materials that, like living systems, provide spatial and temporal control. These advances will provide a platform to revolutionise medical treatments such as nerve and muscle regeneration, with impact on neural prosthetics.	Prof Gordon Wallace (ACES)	ARC Laureate FL110100196
Materials/ Energy	2012-2015: Phosphonium ionic liquids for advanced lithium energy storage systems. Project summary: This project will develop, along with a leading manufacturer in the world, high performance electrolytes for lithium batteries. The technologies and expertise generated will be of importance to many niche industries in Australia in their shift towards lower carbon operations.	Prof DR MacFarlane (ACES) Prof Maria Forsyth (ACES) Dr Ekaterina Izgorodina Dr Patrick C Howlett (ACES) Mr Alan J Robertson	ARC Linkage Project LP120200181 with partner Cytec Industries Inc.
Manufacturing	2012-2015: Australian ultrafine wool dehairing and processing	Wang, Prof Xungai (ACES) Hurren, Dr Christopher J	ARC Linkage Project LP120200536 with partner Shangdong Ruyi Woolen Textile
Materials/ Bionics	2011-2015: Mechanical advantage: biomimetic artificial muscles for micro machines This project commenced in July 2011 with work to develop gel rods containing longitudinal channels. The gel materials were based on other tough gels developed within ACES. The artificial muscles developed in this project may also be used in other ACES activities.	Prof Geoffrey M Spinks (ACES) with collaborator A/Prof Seon Jeong Kim (Korea)	ARC Discovery (DP110101073) Prof Spinks was awarded an ARC Australian Professorial Fellowship (APF) on this project.
Bionics/ Characterisation	2011-2015: Synergistic nanostimulation of nerve cells using atomic force microscopy technology The project is for developing multifunctional nanoelectrodes for neural prosthetic devices; specifically developing single nanoelectrodes based on Atomic Force Microscope (AFM) tip integration of conducting polymers and carbon nanotubes functionalised with biomolecules specific for stem (neural) cell differentiation and survival.	Dr Michael J Higgins (ACES)	Australian Research Fellowships (ARF)



Table 8: Examples of other research initiatives where ACES members are involved.

ACES Research Area	Project	Researcher	Funding Body
Energy/ Characterisation	2011-2015: Next generation excitonic solar cells using advanced charge generation concepts: setting the new efficiency benchmark. Project summary: Next generation cheap organic solar cells will be developed, which will facilitate the large scale deployment of affordable solar cells, thus enabling Australia to reduce its carbon footprint. The proposed significant advances in solar cell design will place Australia at the forefront of this technology creating new industries.	Dr Attila J Mozer (ACES) Prof Dr Niyazi S Sariciftci Prof Keith C Gordon	ARC Discovery DP110101369 Dr Attila Mozer received an Australian Research Fellowship (ARF) for this ARC discovery project
Materials	2011-2015: Engineering a silk fibroin based ear drum with optimum acoustic properties	Prof Xungai Wang (ACES) Dr Rangam Rajkhowa Dr Robert J Marano Prof Marcus D Atlas	ARC Linkage: LP110200547



ACES members in 2015 included: 24 Chief Investigators, 5 Partner Investigators, 1 Chief Operations Officer, 9 Research Fellows, 2 Engineers, 15 Early Career Researchers, 27 PhD students all working on core funded projects. In addition the Centre employed casual research assistants and administration staff members. A list of those ACES members and their roles in the research program is shown below.

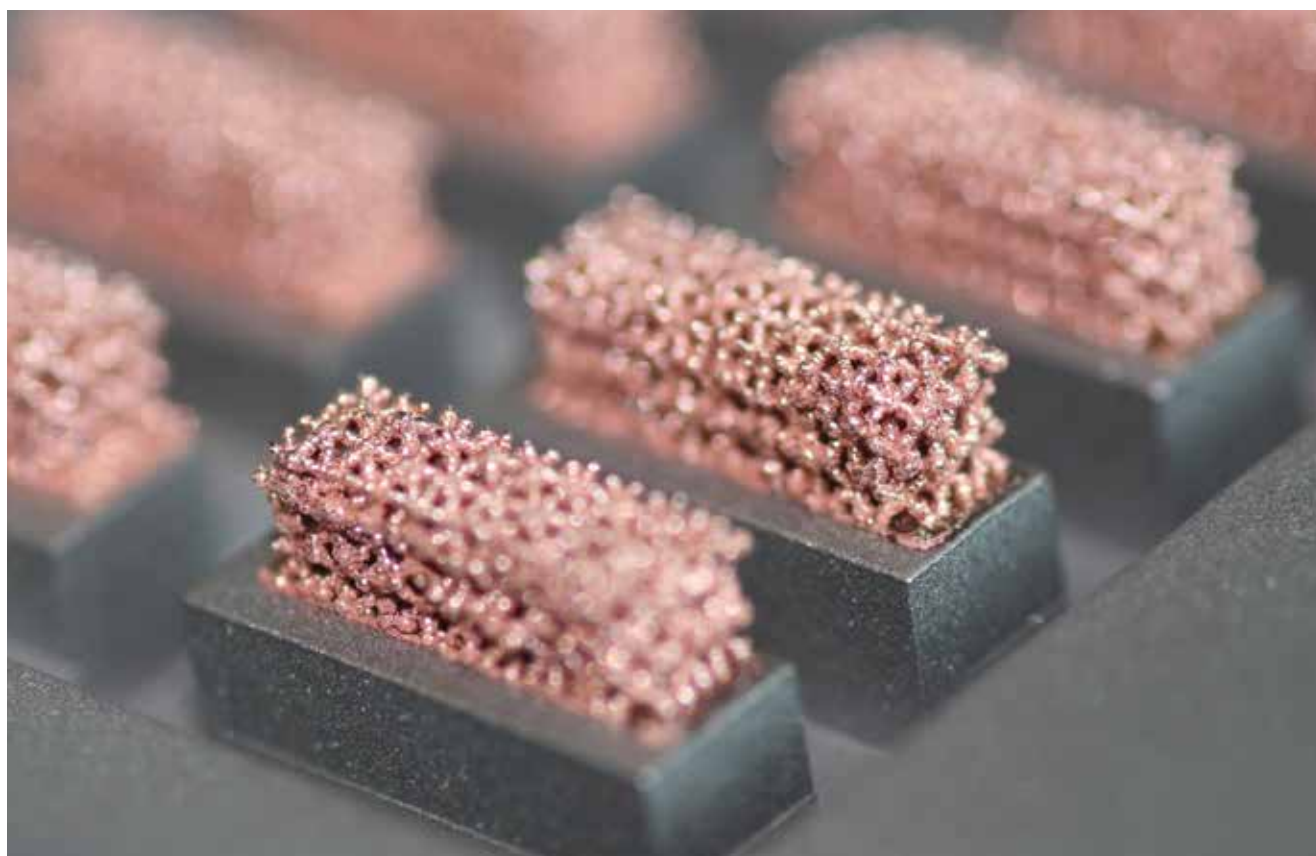
Name	Node	EM	SES	SBS	SR	E&D	EPPE
Chief investigators							
Wallace, Gordon	University of Wollongong	✓	✓	✓	✓	✓	
Officer, David	University of Wollongong	✓	✓				
Spinks, Geoffrey	University of Wollongong	✓	✓		✓		
Alici, Gursel	University of Wollongong	✓			✓		
Innis, Peter	University of Wollongong	✓				✓	
Higgins, Michael	University of Wollongong	✓		✓			
Mozer, Attila	University of Wollongong	✓	✓				
in het Panhuis, Marc	University of Wollongong	✓		✓	✓		
Kapsa, Robert	University of Wollongong	✓		✓			
Moulton, Simon	University of Wollongong	✓		✓		✓	
Crook, Jeremy	University of Wollongong	✓		✓			
MacFarlane, Douglas	Monash University	✓	✓				
Spiccia, Leone	Monash University	✓	✓				
Zhang, Jie	Monash University	✓	✓				
Sparrow, Robert	Monash University						✓
Forsyth, Maria	Deakin University	✓	✓	✓			
Howlett, Patrick	Deakin University	✓	✓		✓		
Pringle, Jennifer	Deakin University	✓	✓				
Wang, Xungai	Deakin University	✓					
Hancock, Linda	Deakin University						✓
Paull, Brett	University of Tasmania	✓				✓	
Dodds, Susan	University of Tasmania						✓
Cook, Mark	University of Melbourne	✓		✓			
Coote, Michelle	Australian National University	✓	✓	✓			

Name	Node	EM	SES	SBS	SR	E&D	EPPE
Partner Investigators							
Kim, Seon Jeong	Hanyang University, Korea	✓			✓		
Guldi, Dirk	Friedrich Alexander University, Germany	✓					
Watanabe, Masa	Yokohama University, Japan	✓	✓				
Diamond, Dermot	Dublin City University, Ireland	✓				✓	
Unwin, Patrick	Warwick University, UK	✓	✓				
Postdoctoral researchers recruited to the Centre working on core Centre research							
Research Fellows							
Kerry Gilmore	University of Wollongong	✓		✓			
Pawel Wagner (0.5 FTE)	University of Wollongong	✓					
Caiyun Wang	University of Wollongong	✓	✓				
Eva Tomaskovic-Crook	University of Wollongong	✓		✓			
Alexandr Simonov (Sasha) (0.5 FTE)	Monash University	✓	✓				
Si-Xuan Guo	Monash University	✓	✓				
Jian Fang	Deakin University	✓					
Cristina Pozo-Gonzalo	Deakin University	✓	✓				
Julie Freeman	Deakin University						✓
Naomi Haworth	Australian National University	✓					
Early Career Researchers							
Holly Warren	University of Wollongong	✓		✓	✓		
Ashley Walker	University of Wollongong	✓					
Rouhollah Jalili	University of Wollongong	✓	✓	✓			
Andres Ruland	University of Wollongong	✓					
Binbin Zhang	University of Wollongong	✓		✓			
Rahim Mutlu	University of Wollongong				✓		
Fengling Zhou	Monash University		✓				
Maxime Fournier (Max) (0.5FTE)	Monash University	✓	✓				
Katrina Hutchison	Monash University						✓
Liyu Jin (0.6FTE)	Deakin University	✓	✓				
Ruhamah Yunis (0.5 FTE)	Deakin University	✓	✓				
Erlendur Jonsson	Deakin University	✓	✓				
Yafei Zhang (0.4 FTE)	Deakin University	✓	✓				
Niall MacDonald	University of Tasmania	✓				✓	
Joan-Marc Cabot Canyelles	University of Tasmania	✓				✓	
Frederic Gilbert (0.8 FTE Jan-April15 then DECRA fellow)	University of Tasmania						✓

Name	Node	EM	SES	SBS	SR	E&D	EPPE
Eliza Goddard (0.8 FTE Sept-Dec15)	University of Tasmania						✓
Justin Bourke	University of Melbourne			✓			
Technicians /Engineers/ Research Assistants							
Fletcher Thompson	Fabrication Engineer University of Wollongong	✓	✓	✓	✓	✓	
Armstrong Xie	Engineer Deakin University	✓					
Jun (Rossie) Rao (3 months)	Research Assistant Deakin University						
Emer Duffy	Casual Research Assistant University of Tasmania					✓	
Umme Kalsoom	Casual Research Assistant University of Tasmania					✓	
A Ganesan (3 months)	Research Assistant Australian National University	✓					
Non-Academic Positions							
Toni Campbell	University of Wollongong	Chief Operations Officer					
Natalie Foxon-Phillips	University of Wollongong	Communications & Media Officer					
Karla House	University of Wollongong	Administration					
Sona Shekibi (0.4 FTE)	Deakin University	Administration					
Sacha Lauder	Deakin University	Administration					
Helena Alexellis (0.1 FTE)	Deakin University	Administration					
Gary Annat (0.4 FTE)	Monash University	Administration					
Mark Andrew Howard (casual)	Monash University	Administration					
Eliza Goddard (0.2 FTE)	University of Tasmania	Administration					

A list of ACES postgraduate students working on core Centre research and supervised by Centre staff in 2015 is shown below.

Name	Node	Country of Origin	Program Theme
Fahimeh Mehropouya	University of Wollongong	Iran	EM/SBS
Zhi Chen	University of Wollongong	China	EM/SBS
Syamak Farajikhah	University of Wollongong	Iran	EM/EFD
Christina Puckert	University of Wollongong	Germany	EM/SBS
Alex Nagle	University of Wollongong	Ireland	EM
Cody Wright	University of Wollongong	USA	EM
Jaecheol Choi	University of Wollongong	Korea	EM/SES
Tom Barsby	University of Wollongong/ St Vincent's Hospital Melbourne	UK	SBS
Jianfeng Li	University of Wollongong	China	SBS



Name	Node	Country of Origin	Program Theme
Charles Hamilton	University of Wollongong	USA	SR
Dijon Hoogeveen	Monash University	New Zealand	EM/SES
Fengwang Li	Monash University	China	SES
Changlong Xiao	Monash University	China	EM/SES
Nhien Le	Monash University	Vietnam	EM/SES
Manjunath Chatti	Monash University	India	EM/SES
Ying (Sherry) Zhang	Monash University	China	SES
Diogo Cabral	Monash University	Brazil	SES
Ken Chun	Monash University	China	SES
Abuzar Taheri	Deakin University	Iran	SES
Shannon Biddulph	Deakin University	Australia	EM/SES
Jun (Rossie) Rao	Deakin University	China	EM
Danah Al-Masri	Deakin University	Jordan	SES
Srdan Begic	Deakin University	Sweden	EM/SES
Sidra Waheed	University of Tasmania	Pakistan	EFD
Catherine Simpson	Australian National University	Australia	EM/SES
Richmond Lee	Australian National University	Singapore	EM
Benjamin Noble	Australian National University	Australia	EM



Goal 1: Research

END 2016

Produce and characterise electromaterials and develop methods for 3D assembly

END 2016 Research Milestones

Electromaterials

Milestone EM1: Supplied 1st Generation structural, reaction centre and electro-materials for the application themes projects.

Milestone EM2: Developed a fully integrated multi-axial material delivery system for fabrication of core-shell structures.

Milestone EM3: Developed the 1st example of a contactless characterisation probe.

Electrofluidics and Diagnostics

Milestone E&D1: Determined the effect of distributed composition and structure on fluid flow throughout 3D structures.

Synthetic Energy Systems

Milestone SES1: Determined the impact of 3D architecture on catalytic activity, ionic conductivity and charge storage.

Synthetic Biosystems

Milestone SB1: Elucidated the effect of the mechanical properties of structural components on the cell behaviour within a cytocompatible matrix

Milestone SB2: Determined the impact of electromaterial distribution on cell behaviour.

Soft Robotics for Prosthetic Devices

Milestone SR1: Determined the impact of composition and porosity distribution on mechanical properties.

Ethics, Policy and Public Engagement

Continue work towards milestone EPE1: Identified the potential ethical responsibilities of manufacturers to end users for prosthetic organs.

Goal 2: Research Training

END 2016

Implement a Masters training program in Electromaterials Science

END 2016

Refine and introduce the most appropriate training program for entrepreneurship

Goal 3: Translation Commercialisation

END 2016

Produce a development plan for new venture opportunities

Goal 4: Communications

End 2016

Implement communication strategies to maximise visibility and coherence of the ACES message to key target audiences

END 2016

Host annual community awareness outreach events

END 2016

Continue to develop coordinated projects with UOW Science Centre

Goal 5: Global Engagement

FROM 2016

Develop strategic partnerships with select research countries across the globe

FROM 2016

Develop International Training opportunities



Appendix 1: ACES Workshops & Symposia for Mentoring & Training

Workshop description	Where and When?	Mentoring / Training KPI list
Networking breakfast: Smart materials for next generation solutions	Geelong, Victoria 25 February	29 attendees 5 ACES CI, 3 ACES RF, 7 non-ACES academics, 1 affiliate ECR, 1 DVCR, 12 industry
Synthetic Biosystems (SBS) – face to face meeting orientated at the material needs for the proposed SBS 3D microtissue constructs for evaluation of neural function in normal and dysfunctional central nervous system settings.	St Vincents Hospital Melbourne 11 May	10 attendees 1 ACES PhD, 2 affiliate PhD students, 2 ACES ECRs, 1 ACES affiliate ECRs, 3 ACES CI, 1 Associate Investigator (AI)
Electrofluidics and Diagnostics Theme (EFD) Mini-Symposium on Applied 3D Fluidics - The event was split between a morning open mini-symposium, and an afternoon closed ACES workshop of project development within EFD.	University of Tasmania 15 May	30 attendees 3 ACES PhD, 4 ACES ECRs, 3 ACES AI, 5 ACES CI, 4 non-ACES academic, 8 non-ACES PhD students, 2 industry
3D Printing Process	University of Wollongong 20 July	35 attendees 4 BIOFAB masters, 1 non-ACES masters, 4 ACES PhD, 2 ACES CI, 6 ACES affiliate PhD, 6 ACES RF (3 ECR), 8 non-ACES PhD, 1 affiliate RF, 2 ANFF technicians, 1 visiting professor.
Materials for 3D Printing	University of Wollongong 22 July	40 attendees 4 BIOFAB masters, 1 non-ACES masters, 4 ACES PhD, 3 ACES CI, 8 ACES affiliate PhD, 5 ACES RF (3 ECR), 11 non-ACES PhD, 1 affiliate RF, 2 ANFF technicians, 1 visiting professor.
Material Characterisation & Surface Analysis	University of Wollongong 27 July	33 attendees 4 BIOFAB masters, 1 non-ACES masters, 4 ACES PhD, 2 ACES CI, 6 ACES affiliate PhD, 3 ACES RF (2 ECR), 10 non-ACES PhD, 1 affiliate RF, 2 ANFF technicians.
Microscopy (Electron Microscopy and Atomic Force Microscopy)	University of Wollongong 29 July	20 attendees 4 BIOFAB masters, 2 ACES PhD, 2 ACES CI, 6 ACES affiliate PhD, 5 non-ACES PhD, 1 affiliate RF.
Techniques in Cell Biology	University of Wollongong 31 July	26 attendees 4 BIOFAB masters, 1 non-ACES masters, 3 ACES PhD, 4 ACES CI, 4 ACES affiliate PhD, 2 ACES RF (1 ECR), 8 non-ACES PhD.

Workshop description	Where and When?	Mentoring / Training KPI list
Electromaterials (EM)- Face to face meeting on the modelling capabilities and current projects at the each of the ACES nodes, followed by a general discussion of ways in which collaboration within ACES could be fostered.	Deakin University, Melbourne 11 August	21 attendees 6 ACES CIs, 5 ACES PhD, 6 ACES ECR, 2 ACES AI, 2 non-ACES academic.
ACES Full Centre Meeting- a range of topics and panels including: - What is ACES? - How can we make it better? - How to grow as a researcher - Science Communication - Ethical Procurement in the lab - Intellectual Property/ Commercialisation - Molecular Modelling - What can it do for you? - Masters Degree in Electromaterials - ECR/PhD burster sessions - Posters/networking	Deakin University, Melbourne 12 August	90 attendees 22 ACES CI, 14 ACES RF, 10 ACES ECR, 17 ACES PhD, 11 Affiliate PhD, 7 ACES AI, 1 FAB tech, 4 BIOFAB masters students, 2 admin, 1 communications officer, 1 COO.
EM - Electrochemistry workshop. Given by AI Alan Bond this workshop explored a new electrochemistry research technique, and discussed how this technique may benefit individual research projects.	Monash University, Melbourne 13 August	18 attendees
Ethics, Public Policy and Engagement (EPPE) workshop: Genuine parts and authorised repair: ethical issues associated with maintaining synthetic organs.	Monash University, Melbourne 13 August	18 attendees 5 ACES PhD, 7 ACES ECRs, 5 ACES AI, 3 ACES CI, 1 non-ACES academic, 1 non-ACES undergraduate student
Synthetic Biosystems (SBS) – face to face coordination workshop to align ACES program activities as well as align parallel research activities within Prof Gordon Wallace's laureate program.	University of Wollongong 24 August	28 attendees 6 ACES PhD, 6 affiliate PhD students, 2 ACES ECRs, 3 ACES affiliate ECRs, 4 ACES AI, 3 ACES CI, 3 ACES RF, 1 ACES fab technician.
Synthetic Energy System (SES) - Carbon dioxide reduction workshop.	A virtual meeting 14 September	18 attendees 4 ACES PhD, 2 affiliate PhD students, 4 ACES ECRs, 3 ACES affiliate ECRs, 3 ACES AI, 2 ACES CI
3D BioPrinting: Ethical and Regulatory Matters	University of Wollongong 16 September	35 attendees 4 BIOFAB masters, 5 ACES PhD, 4 ACES CI, 6 ACES affiliate PhD, 3 ACES RF (2 ECR), 11 non-ACES PhD, 1 non-ACES RF, 1 ANFF technician.
Synthetic Energy System (SES) – Battery Workshop on metal air, zinc, redox flow batteries and organic conductor-based materials with the aim to increase nodal collaboration, sample exchange and use of computational tools.	A virtual meeting 22 September	21 attendees 5 ACES PhD, 3 affiliate PhD students, 5 ACES ECRs, 2 ACES RF, 3 ACES AI, 3 ACES CI
Graphene Synthesis Scale Up and Characterisation Workshop	University of Wollongong 24 September	25 attendees 4 BIOFAB masters, 1 non-ACES masters, 4 ACES PhD, 3 Affiliate PhD, 4 non-ACES PhD, 4 ACES RF (3 ECR), 4 ACES CI, 1 ANFF RF.
SES -Thermal Energy Harvesting Workshop. Investigation of new redox couples discussed, plans for material exchange (in particular carbon electrodes) and the transfer of new 3D printed cells arranged.	A virtual meeting 29 September	9 attendees 2 ACES PhD, 1 ACES ECRs, 2 ACES AI, 3 ACES CI

Workshop description	Where and When?	Mentoring / Training KPI list
The aim of this modelling workshop was to enable more collaboration on projects within ACES by combining experiments with theoretical work. The presentations were short, discussions extensive and a number of possible future projects outlined.	ANU, Canberra 19 October	17 attendees 3 ACES PhD, 1 non-ACES PhD, 2 ACES ECRs, 1 ACES affiliate ECR, 1 ACES RF, 5 ACES AI, 4 ACES CI
EFD - Fibre Fluidics Workshop	University of Tasmania 9 November	16 attendees 3 ACES PhD, 5 ACES ECR, 5 ACES AI, 3 non-ACES Academic, 3 ACES RF (2 ECR)
Smart Coatings Symposium ACES- Steel Hub event	Innovation Campus, Wollongong 10 November	27 attendees 2 ACES PhD, 2 non ACES PhD, 1 affiliate ACES PhD, 4 non-ACES academics, 1 international academic, 3 ACES CI, 2 CSIRO, 5 industry, 7 steel hub
Molecules from Seaweed to Fabricated Structures	Innovation Campus, Wollongong 12 November	35 attendees 3 affiliate PhD students, 1 ACES ECRs, 3 ACES RF (2 ECR), 1 ACES affiliate ECR, 1 ACES AI, 5 ACES CI, 6 non-ACES academics, 14 industry, 1 government
Nanobionics: An ACES and Collaborators Showcase Event	St Vincent's Private Hospital, Melbourne 20 November	63 attendees 4 Biofab master students, 2 ACES PhD, 5 ALF PhD, 12 non-ACES students, 2 ACES ECR, 1 ACES RF, 6 ACES CI, 7 ACES AI, 11 non-ACES academics, 3 clinicians, 1 CSIRO, 4 CRC, 4 industry.

Appendix 2: List of Plenary/Keynote Addresses given by ACES members

Plenary/Keynote Addresses given by ACES members	
1.	Wang, X. (2015) Carbon Fibre Microelectrodes for Neuroscience Applications at the Fiber Society Spring Conference in conjunction with 2015 International Conference on Advanced Fibers and Polymer Materials, Shanghai, China, 25 May.
2.	Wallace, G. (2015) Organic Bionics: The Need for 3D Printing at 4th International Conference "Strategies in Tissue Engineering", Wurzburg, Germany, 10-12 June.
3.	Breadmore M., Shallan A., Macdonald N., Kalsoom U., Petr Smjekal, Boyce M., Guijt R., Paull B. (2015) Electrophoretic systems and devices: fabrication, design and applications at the 7th International Symposium on Microchemistry and Microsystems (ISMM 2015), Kyoto, Japan, 8-10 June (Plenary).
4.	Wallace, G. (2015) 3D Bioprinting – New Dimensions for Bionics at 5th International Symposium on Organic and Inorganic Electronic Materials and Related Nanotechnologies (EM-NANO 2015), Niigata, Japan, 19 June (via Skype).
5.	Zhang, J. (2015) Determination of fast electrode kinetics using Fourier transformed large amplitude ac voltammetry, Midlands Electrochemistry Student Meeting at University of Warwick, UK, 22 June.
6.	Coote, M. (2015) Electrostatic Catalysis of Non-Redox Reactions at 9th International Conference on Chemical Kinetics, Ghent, Belgium, June 28 - July 2 (plenary).
7.	Wallace, G. (2015) 3D Bioprinting – New Dimensions for Bionics at 6th International Nanomedicine Conference, Sydney, 6-8 July.
8.	Spiccia L. (2015) Novel Redox Mediators for Dye-Sensitized Solar Cells. 3rd International Conference on Advanced Complex Inorganic Nanomaterials, held at the University of Namur (FUNDP), Namur, Belgium 13-17 July.
9.	Coote, M.L.; Gryn'ova, G.; Noble, B.B.; Smith, L.M. (2015) Electrostatic Catalysis of Radical Reactions at the 7th Pacific Symposium on Radical Chemistry, Singapore, 15-18 July (Keynote)
10.	MacFarlane, D. R. (2015) Energy Applications of Ionic Liquids at 12th International Conference on Materials Chemistry (MC12), University of York, UK, 20-23 July.

Plenary/Keynote Addresses given by ACES members	
11.	Coote, M.L. Haworth, N.L.; Bloomfield, N.J.; Gryn'ova, G.; Klinska, M.; Smith, L.M.; Banwell, M.G.; Ciampi, S.; Aragonès, A.C.; Darwish, N.; Diez-Perez, I.(2015) Manipulating Chemical Reactions with Electric Fields at the Golden Jubilee Chemistry Conference, 6-8 August (Golden Jubilee Lecture by M.L. Coote).
12.	MacFarlane, D. R. (2015) Ionic liquids for sustainable chemistry: applications in the chemical-, materials-, electro-, and bio-sciences, RSC Lectureship Tour, University of Newcastle, Australia, 28 August.
13.	Paull, B. (2015) Revealing the complexity of marine dissolved organic matter – lessons in analytical multidimensionality, Euroanalysis2015, Bordeaux, France, 6-10 September (Keynote).
14.	Paull, B. (2015) organised symposium on 3D printed/patterned platforms for biochemical analysis, at Euroanalysis2015, Bordeaux, France, 6-10 September.
15.	Wang, X. (2015) Natural Fibre Research – Impact Factor versus Factua Impact, Fiber Society Spring Conference, NCSU, Raleigh, 29 October.
16.	Kapsa, R (2015) Biofabricating Autologous Cell Therapy for Hereditary Muscle Disease, Cell Transplantation Society, International Joint Congress, Melbourne 19 November.
17.	Coote, M.L.; Noble, B.B.; Smith, L.M. (2015) Lewis acid-mediated radical polymerization: catalysis versus stereocontrol at the 2015 RACI Polymer Symposium, UNSW, Sydney 20 November (Keynote Lecture by M.L. Coote)
18.	in het Panhuis, M. (2015) lead organizer of 'Symposium C' on tough, smart and printable hydrogels at the MRS conference in Boston, 30 November 2015.
19.	Coote, M.L.; Noble, B.B.; Smith, L.M. (2015) Computer-Aided Design of Control Agents for Radical Polymerization at the 14th Pacific Polymer Conference, Hawaii USA, 9-13 December (Plenary Lecture by M.L. Coote)
20.	Spiccia L. (2015). Water oxidation catalysts derived from metal complexes Symposium #76 Molecular Catalysis of Water Splitting Reactions, Pacificchem 2015, Honolulu, 15-20 December.

Appendix 3: List of Invited Talks/Panels

Invited Talks/Panels given by ACES members	
1.	Forsyth, M. (2015) Ionic Liquid Electrolytes for Sodium Battery Applications, IBA 2015, Hawaii USA, 5-9 January.
2.	Howlett, P. (2015) Organic Ionic Plastic crystals and high lithium concentration ionic liquids – novel electrolytes for the lithium metal electrode, IBA2015 Hawaii, 8 January.
3.	Mozer A. J., L. Zhao, P. Wagner, A. B. S. Elliott, M. J. Griffith, T. M. Clarke, K. C. Gordon, S. Mori (2015) Charge generation, transport and recombination in di-chromophoric porphyrin-sensitised solar cells at 7th International Conference on Advanced Materials and Nanotechnology AMN-7, Nelson, New Zealand, 8-12 February.
4.	Paull, B. (2015) Nanostructured phases for separation science, Nanolytica, Melbourne, 9 February.
5.	Howlett, P. (2015) Characterisation of nanostructured electromaterials for energy storage, Nanolytica, Melbourne, 9 February.
6.	Wallace, G. (2015), Advances in Fabrication of Interest to Carbon Fibre Lovers at Carbon Fibre Future Directions Conference 2015, Geelong, 24-27 February.
7.	Breadmore M., Shallan A., Macdonald N., Smjekal P, Guijt R, Paull B (2015) 3D printed microfluidic devices using consumer-focused printers at Pittcon 2015, New Orleans, LA, USA 8-12 March.
8.	Kapsa R. (2015) Autologous Cell Therapy for Hereditary Muscle Disease, NSW Stem Cell Society Meeting, University of Sydney, 8 April.
9.	Cook, M. (2015) Invited Expert Panel Discussion: The experimental and clinical nature of status epilepticus at the 5th London-Innsbruck Colloquium on Status Epilepticus and Acute Seizures, London, United Kingdom, 9-11 April.
10.	Wang, X. (2015) The Majic of Wilk Silk Fibres and Structures, 2nd International Conference on Natural Fibres, Azores, Portugal, 27 April.
11.	Wallace, G. (2015), New Dimensions for 3D Printing at AusMedtech2015, Melbourne, 29-30 April.
12.	Wallace, G. (2015), Surfaces, Interfaces and Organic Bionics at EUPOC 2015 on Conducting Polymeric Materials, Gargnano-Lake Garda, Italy 24-28 May.
13.	Paull B., Gupta V., Sandron S., Talebi M., Nesterenko P.N., Collins D., Nesterenko E.P., Heery B., Beirne S., Thompson F., and Wallace G.G. (2015) Polymer Monoliths in Titanium 'Printed' Columns at the Virtual Symposium on Applied Separation Science, 25-29 May.

Invited Talks/Panels given by ACES members	
14.	Mozer, A, L. Zhao, P. Wagner, T. M. Clarke, K. C. Gordon, S. Mori (2015), Charge generation and recombination in di-chromophoric carbazole-thiophene-porphyrin-sensitised solar cells at ECS207 meeting, Chicago, USA, 24-28 May.
15.	Officer D. L., P. Wagner, K. Wagner, N. Roach, R. Mitchell, C. Hobbs, A. Elliot, H van der Salm, K. Gordon, G. Kodali, B. Discher, C. Moser, P. L. Dutton (2015) Creating Artificial Photosynthetic Reaction Centres: Amphiphilic Protein Maquette Complexes at the 227th Electrochemical Society Meeting, Chicago, USA, 24-28 May.
16.	Wang, X. (2015) Natural Fibres: facts and Myths, 13th International Wool Research Conference and AATCC Sustainability Symposium, Hangzhou, 11 June.
17.	Forsyth, M. (2015) Molecular Insights into Structure and Dynamics of Organic Ionic Plastic Crystal Electrolytes, 20th International Conference on Solid State Ionics (SSI 20), Keystone Colorado USA, 14-19 June.
18.	Zhang, J. (2015) Determination of the reversible potential of water oxidation catalysts under catalytic turnover conditions using Fourier transformed large amplitude ac voltammetry at the 11th ECHEMS, Germany, 15-18 June.
19.	MacFarlane, D. R. (2015) Sustainable Energy Applications of Ionic Liquids, 6th International Congress on Ionic Liquids (COIL-6), Jeju, South Korea, 18 June.
20.	Pringle, J., Al-Masri, D., Lazar, M., MacFarlane, D. (2015) Harvesting waste heat using ionic liquid-based thermocells at 6th International Congress on Ionic Liquid (COIL6), Korea, 16-20 June.
21.	Wallace, G. (2015) Graphene: Source to Structures, Deutsche Bank Conference (dbAccess Australia Future Metals Corporate Day), Deutsche Bank Place, Sydney, 17 June.
22.	Gilbert, F. (2015) Invitation to join panel discussion on "How Should We Address the Special Challenges of Using Neuroscience-based Therapies in the Developing Brains of Children and Adolescents?" Neuroethics network, Paris, 17-19 June.
23.	Higgins, M (2015) Probing the Electrode-Biological Interface at the 5th International Symposium on Organic and Inorganic Electronic Materials and Related Nanotechnologies (EM-NANO 2015), Niigata, Japan, 19 June.
24.	O'Connell, C. (2015) Gave an invited talk on the 'Biopen – connecting academia and end-users' at the workshop Future Generation Bionic Technologies hosted by Bionic Vision Australia, Melbourne, 25 June.
25.	Wallace, G. (2015) Medical Technology Innovation Showcase (Part 1) at Australia Innovation Showcase Medical Technologies 2015, Seoul, Korea, 29 June.
26.	Wallace, G. (2015) Medical Technology Innovation Showcase: 3D Bio Printing (Part 2) at Australia Innovation Showcase Medical Technologies 2015, Seoul, Korea, 29 June.
27.	Wallace, G. (2015) 3D Printing: Printing Parts for Bodies at the 2nd International Bionics Forum and Expo, COEX, Seoul, Korea, 1-3 July.
28.	Moulton SE (2015) Materials in Medicine, Polymer Vic RACI Victorian Polymer Group, Monash University, Parkville, Victoria, 2-3 July.
29.	Wang, X. (2015) Innovation with Polymer Fibre Materials, PolymerVIC 2015, Monash Institute of Pharmaceutical Science, Melbourne, 2 July.
30.	Gilbert F., (2015) Experimental use of Invasive Technologies in the Brain: The Case of Predictive and Advisory Brain Devices, International Bioethics Retreat, Paris, France, 1-3 July.
31.	in het Panhuis, M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels at 6th International Nanomedicine Conference, Sydney, 6-8 July.
32.	Higgins, M. (2015) "Molecular Electroceuticals": the emergence of targeted delivery of electrical signals for modulating biological function at 6th International Nanomedicine Conference, Sydney, 6-8 July.
33.	Coote, M. (2015) Electrostatic Catalysis of Radical Reactions at 7th Pacific Symposium on Radical Chemistry, Singapore, 15-18 July.
34.	Officer D.L., P. Wagner, K. Wagner, N. Roach, R. T. Mitchell, C. Hobbs, A. B. S. Elliott, H. van der Salm, K. C. Gordon, G. Kodali, B. Disher, C. Moser, P. L. Dutton (2015) Developing an artificial photosynthetic reaction centre based on porphyrin-maquette ensembles at the 12th International Conference on Material Chemistry, York, UK, 20-23 July.
35.	Pringle, J. (2015) The development of Organic Ionic Plastic Crystals as Solid State Electrolytes for Energy Storage at ECS Conference on Electrochemical Energy Conversion & Storage, Glasgow, Glasgow, 26-31 July.
36.	Simpson, C.D.; Haworth, N.L.; Ciampi, S.; Coote, M.L.(2015) External and Intramolecular Influences on Spiropyran – Merocyanine Interconversion, 2015 Virtual Conference on Computational Chemistry, 1-31 August (Invited Virtual presentation by M.L. Coote).
37.	Cook, M (2015) Brain Activity and Seizure Statistics in Epilepsy at the 7th International Workshop on Seizure Prediction, Melbourne, 3 August.
38.	Cook, M. (2015) Implantable devices at the Melbourne Epilepsy Meeting, Melbourne, 6 August.

Invited Talks/Panels given by ACES members	
39.	Coote, M.L.; Gryn'ova, G. (2015) The fascinating redox behavior of nitroxide radicals, Symposium on Calculating pKa and Redox Potentials at the 250th ACS National Meeting, Boston, 16-20 August (Invited Lecture by M.L. Coote)
40.	Spiccia L. (2015) Water Oxidation Catalysts: From Metal Complexes to Mineral Oxides. Soft X-ray in Energy and Time (SEXT) Symposium, Helmholtz Zentrum Berlin, 20-21 August.
41.	Paul B., Sandron S., Cardona A.R., Davies N.W., Wilson R., Horne J., Shellie R.A., Haddad P. and Nesterenko P.N. (2015) "Revealing the Complexity of Marine Dissolved Organic Matter – Lessons in Analytical Multidimensionality" at Euroanalysis, Bordeaux, 6-10 September.
42.	Cook, M. (2015) Progress of Therapeutic Device for Epilepsy at the Beijing Epilepsy and Neurophysiology Summit, Beijing, China, 12 September.
43.	Officer, D. L. (2015) Developing Porphyrin-based Electroactive Nanomaterials for Energy Applications at the XIV Brazilian MRS Meeting, Rio de Janeiro, Brazil, 27 September - 1 October.
44.	Forsyth, M. (2015) Ionic Liquid and Organic Ionic Plastic Crystal Electrolytes for Energy Storage Devices, ABAA8 conference, Bilbao Spain, 30 September-2 October.
45.	Zhang, J. (2015) Determination of fast electrode kinetics Facilitated by Use of an Internal Reference at the 66th Annual Meeting of the International Society of Electrochemistry, Taipei, Taiwan, 4-9 October.
46.	Moulton SE. (2015) Interactive Materials in Medical Research at the ASEAN Congress on Medical Biotechnology and Molecular Biosciences, Bangkok, Thailand, 8 October.
47.	Howlett, P. (2015) Mixed ionic liquid-NaFSI salts with high Na ⁺ transference number and improved electrochemical cycling, 2nd International Na Battery Conference, Arizona, 9 October.
48.	Officer, D. L., S. Gambhir, R. Jalili, S. Sayyar, D. Li, G. G. Wallace (2015) Scalable graphene chemistries for processing and fabrication at the 7th Annual Conference in Recent Progress in Graphene and Two-dimensional Materials Research, Mantra Resort, Lorne, Australia, 25 - 29 October.
49.	Cook, M. (2015) Epilepsy – The Future at the 4th Neuropsychiatry and Behaviour Conference, Melbourne, 6 November.
50.	Kapsa, R. (2015) Autologous Cell Replacement Therapies for Hereditary Muscle Disease, Australian Society for Stem Cell Research, Annual International Conference, Hunter Valley Australia, 8 November.
51.	Wallace, G. (2015) talk on "Printing Cells and Living Cells" was given by A/Prof Michael Higgins at the 2015 MRS Fall Meeting & Exhibit, Boston, Massachusetts, 30 November.
52.	Forsyth, M. (2015) Speciation and dynamics of alkali metal ions mixed salt/ ionic liquid electrolytes: towards improved Li and Na based energy storage, Pacifichem 15, Hawaii USA, 15-20 December.
53.	Coote, M.L.; Gryn'ova, G.(2015) pH-Switching of nitroxide radical stability and orbital conversion Nitroxide Radicals: Synthesis And Functional Bio-/Nanomaterials, The 2015 International Chemical Congress of Pacific Basin Societies (PACIFICHEM 2015), Honolulu 15-20 December (Invited Lecture by M.L. Coote)
54.	Noble, B.B.; Smith, L.M.; Coote, M.L. (2015) Computer-aided design of radical polymerization catalysts and stereocontrol agents Interplay between Theory and Experiment in Catalytic Research at the 2015 International Chemical Congress of Pacific Basin Societies (PACIFICHEM 2015) Honolulu 15-20 December (Invited Lecture by M.L. Coote).
55.	Pringle, J. (2015) Using ionic liquids to harvest waste heat at The International Chemical Congress of Pacific Basin Societies (Pacifichem), Honolulu, Hawaii, USA, 15-20 December.
56.	Pozo-Gonzalo, C. (2015) Phosphonium-based Ionic Liquids for Energy Storage Devices, Pacifichem, Honolulu, Hawaii, USA, 15-20 December.
57.	Higgins, M.J (2015) Nanobionics, Pacifichem, Honolulu, Hawaii, USA, 15-20 December.

Appendix 4: A List of Distinguished Visitor Lectures

Distinguished Visitor Lectures given by ACES members	
1.	MacFarlane, D. R. (2015) Ionic liquids for sustainable chemistry: applications in the chemical-, materials-, electro-, and bio-sciences, RSC Lectureship Tour, University of Auckland, New Zealand, 20 February.
2.	MacFarlane, D. R. (2015) Ionic liquids for sustainable chemistry: applications in the chemical-, materials-, electro-, and bio-sciences, RSC Lectureship Tour, University of Waikato, New Zealand, 26 February.

Distinguished Visitor Lectures given by ACES members	
3.	MacFarlane, D. R. (2015) Ionic liquids for sustainable chemistry: applications in the chemical-, materials-, electro-, and bio-sciences, RSC Lectureship Tour, University of Otago, New Zealand, 27 February.
4.	MacFarlane, D. R. (2015) Ionic liquids for sustainable chemistry: applications in the chemical-, materials-, electro-, and bio-sciences, RSC Lectureship Tour, University of Tasmania, Australia, 25 March.
5.	MacFarlane, D. R. (2015) Ionic liquids for sustainable chemistry: applications in the chemical-, materials-, electro-, and bio-sciences, RSC Lectureship Tour, University of Western Australia, Perth, 9 April.
6.	MacFarlane, D. R. (2015) Ionic liquids for sustainable chemistry: applications in the chemical-, materials-, electro-, and bio-sciences, RSC Lectureship Tour, Curtin University, Perth, 10 April.
7.	MacFarlane, D. R. (2015) Ionic liquids for sustainable chemistry: applications in the chemical-, materials-, electro-, and bio-sciences, RSC Lectureship Tour, Griffith University, Brisbane, 1 May.
8.	Unwin, P. (2015) gave a 'Distinguished Visitor Lecture on Nanoscale Electrochemical Imaging at Science and Engineering QUT, Brisbane, Australia, 9 February.
9.	Wallace, G. (2015) Collaborative Research Networks: Building Pyramids from the Top Down at Shinshu University (Nagano), Japan, 2 March.
10.	Wallace, G. (2015) ACES: The New Dimensions at Shinshu University (Matsumoto), Japan, 3 March.
11.	Wallace, G. (2015) Surfaces, Interfaces and Organic Bionics at University of Pisa, Italy, 29 May.
12.	Wang, X. (2015) Advanced Fibre Lecture Series, Kyoto Institute of Technology, Japan, May 2015.
13.	Wallace, G. (2015) Organic Bionics at Aula Magna, Istituto di Ricerca Codivilla-Putti, Bologna, Italy, 3 June.
14.	Wallace, G. (2015) 3D Bioprinting - Printing Parts for Bodies at Accademia delle Scienze, Bologna, Italy, 3 June.
15.	Wallace, G. (2015) 3D Electrodes Based on Graphene at Universitaet Erlangen-Nuernberg, Erlangen, Germany, 11-13 June.
16.	Cook, M (2015) Prediction, Stimulation and Devices for Epilepsy Distinguished Visiting Scholar at the Department of Neurology, Philadelphia, United States, 5-17 July.
17.	Officer, D. L. (2015) An Overview of Chemopropulsion Systems at Small Power: Chemopropulsion of Microdroplets using Chemical Gradients Symposium, Dublin City University, Dublin, 29 July.

Appendix 5: List of ACES work given via Invited Seminars / Collaborative visits

Invited Seminars / collaborative visits related to ACES work	
1.	Wallace G. (2015) 3D Bioprinting – New Dimensions for Bionics, for the Neuroscience Seminar at Queensland Brain Institute, The University of Queensland, Queensland, Australia, 4 February.
2.	Wallace G. (2015) 3D Bioprinting – New Dimensions for Bionics at Cook Medical, Brisbane Technology Park, Australia, 5 February.
3.	Unwin P. (2015) seminar at ARC Centre of Excellence for Convergent Bio-Nano Science, UNSW node, Sydney, Australia, 16 February.
4.	Wallace G. (2015) Helping to Build Frontier Industries at Australasian Industry Research Group (AIRG) 50th Anniversary Meeting, Melbourne, 24 February.
5.	Wallace G. (2015) Printing Parts for Bodies, at TEDx Event, Flinders University, Adelaide, Australia, 27 February.
6.	Unwin P. (2015) gave a lecture on Nanoscale Electrochemical Imaging at Chemistry, Monash University, Melbourne, Australia, 23 February.
7.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels at University of British Columbia, Canada in addition to visit Prof John Madden about hydrogel sensor research, February.
8.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels during a visit to A/Prof Ali Aldalbahi at King Saud University, Riyadh, Saudi Arabia, 3 March.
9.	Wagner P. (2015) Visiting associate professorship undertaken for 3 weeks with hosts Profs S Mori and M Kimura at Shinshu University, Ueda, Japan to establish new collaborations for the ACES core electromaterials program 16 March-1 April.
10.	Mozer A. (2015) Visiting associate professorship undertaken for 3 weeks with hosts Profs S Mori and M Kimura at Shinshu University, Japan to establish new collaborations for the ACES synthetic energy system core program 16 March-1 April.

Invited Seminars / collaborative visits related to ACES work	
11.	Howlett P. (2015) Ionic Liquid and Organic Ionic Plastic Crystal Electrolytes for Energy Storage Devices, UNSW, Sydney, 19 March.
12.	Howlett P. (2015) Ionic Liquid and Organic Ionic Plastic Crystal Electrolytes for Energy Storage Devices, University of Newcastle, Newcastle, 20 March.
13.	Moulton SE (2015) 5th International Symposium of Surface and Interface of Biomaterials and the 24th Annual Conference of the Australasian Society for Biomaterials, Sydney Australia, 7-10 April.
14.	Wallace G. (2015) New Dimensions for 3D Printing at AusMedtech2015, Australia's Medtech Conference, Melbourne, Australia, 29 April.
15.	Wallace G. (2015), Surfaces, Interfaces and Organic Bionics at Deakin University, Melbourne, Australia, 1 May.
16.	Moulton SE (2015) Gave lecture Electroactive Materials for Drug Delivery and Tissue Engineering and held meetings with various members of the Department of Chemistry, Science and Engineering Faculty and Research and International Office to discuss ways in which to develop collaborative research partnerships, including student exchange and joint PhD possibilities, University of Campinas Brazil, 5-6 May.
17.	Moulton SE (2015) Gave lecture Electroactive Materials for Drug Delivery and Tissue Engineering and held meetings with various members of the Department of Chemistry, Science and Engineering Faculty and Research and International Office to discuss ways in which to develop collaborative research partnerships, including student exchange and joint PhD possibilities, Federal University of Minas Gerais Brazil – Department of Chemistry, 7-8 May.
18.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels at University of Colorado, Boulder, USA, 7 May.
19.	Wallace G. (2015) ACES: Electromaterials - The New Dimensions at ACES: The European Dimension Workshop, National Centre for Sensor Research, Dublin City University, Ireland 21 May.
20.	Wallace G. (2015) ACES - The New Dimensions at Australian-European connections in emerging 3D printed bio-compatible technologies, Australian Embassy, Dublin, Ireland 21 May.
21.	Officer D. (2015) invited lecture at Electrochemical Society, Chicago, USA, 24-28 May.
22.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels in addition to visiting A/Prof Shane Ellis, A/Prof Hans Savelberg and Prof Ron Heeren within the 4MI Institute at University of Maastricht, Netherlands, 29 May.
23.	Forsyth M. (2015) Visited, gave a lecture on Ionic Liquid And Organic Ionic Plastic Crystal Electrolytes For Energy Storage Devices and discussed collaborative research opportunities with Dr Charl Faul in the department of Chemistry, Bristol University, UK, May.
24.	Forsyth M. (2015) Visited Dr Melanie Britton at Birmingham University, UK to discuss ongoing collaborations in in-situ NMR measurements of electrochemical processes, 29 May.
25.	Forsyth M. (2015) Visited Prof Ken Sudden at QUILL, UK to discuss research in the ionic liquids area being undertaken within ACES, 30 May.
26.	Forsyth M. (2015) Visited Oxford university and met with PI Pat Unwin at Warwick University to discuss potential ACES projects and student/staff exchange, May.
27.	Forsyth M. (2015) gave a lecture on Ionic Liquid and Organic Ionic Plastic Crystal Electrolytes for Energy Storage Devices and discussed potential collaborations in energy storage research with Prof Dominique Guyomard and Prof Jean le Bideau from Nante University and CNRS, in Nante, June 2015.
28.	Forsyth M. (2015) Visited Prof David Mecerreyes and Dr Gabriela Chotro, University of the Basque Country to discuss cotutelle arrangements and research exchange opportunities, 8-10 June.
29.	Forsyth M. (2015) Visited Dr Michael Deschamps and Dr Yann Vailis at CEMHTI lab in Orleans, to discuss research collaborations and cotutelle agreements 11-12 June.
30.	Gilbert F (2015) Collaborative visit and discussion, University of Geneva, 14 June.
31.	Spiccia L. (2015) Collaborative research visit to Helmholtz Zentrum Berlin to visit Prof Emad Aziz, Prof Klaus Lips and Dr Alexander Schnegg, June-July.
32.	Spiccia L. (2015) visited, gave a lecture Water Oxidation Catalysis: From Molecules to Minerals and reviewed facilities of Christian Limberg at Humboldt University Berlin, Germany, June.
33.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels at University British Columbia, Vancouver, Canada, 1 June.
34.	Gilbert F (2015) Collaborative visit and discussion, Institut du Cerveau et de la Moelle Epiniere (ICM), France, 19 June.
35.	Zhang J. (2015) Collaborative research visit Warwick University, UK, 19-23 June.

Invited Seminars / collaborative visits related to ACES work	
36.	O'Connell C. (2015) The Handheld Biopen story given at the workshop Future Generation Bionic Technologies organised by Bionic Vision Australia in Melbourne on 25 June.
37.	Higgins, M. (2015) invited seminar "Getting a Grip" on Cell-Material Adhesion using Bio-AFM at UTS Sydney, 12 June.
38.	Spiccia L. (2015) visited, gave a lecture From Metal Complexes to Minerals Catalysing Water Oxidation and reviewed facilities of (i) Professor Hans-Joachim Freund and Robert Schoegl, Fritz Haber Institute, Germany and (ii) Prof Matthias Driess at Technical University Berlin, in July.
39.	Alici G. (2015) Spent 3 weeks at the University of Science and Technology of China (USTC) as part of the fellowship 'Chinese Academy of Sciences (CAS) visiting professorship for senior international scientists' in the robotics research laboratory and visited also the biomedical research centre and innovation centre of USTC, July.
40.	Alici G. (2015) gave an invited seminar 'From Soft Actuators to Soft Robotics: where are we now?' at Shenyang Ligong University, China, July.
41.	Gilbert F (2015) visited Brain & Spine Institute (ICM), Hopital Pitie Salpetriere, Paris, France 5-6 July.
42.	Wagner P. (2015) gave an invited seminar during his collaborative visit to ACES partner node FAU at Erlangen, 7-8 July.
43.	Wagner P. (2015) gave an invited seminar during his collaborative visit as part of the IRSES-AMBIPOD project at Silesian University of Technology, Gliwice, Poland, 9-19 July.
44.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels in addition to visiting Prof Ric Kaner at UCLA, Vancouver, Los Angeles, USA, 13 July 2015.
45.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels in addition to visiting Prof Brian Meenan at University of Ulster, Jordanstown, Northern Ireland, 20 July.
46.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels during a visit to A/Prof Andreas Heise at Dublin City University, Ireland, 22 July.
47.	Pringle J., Al-Masri D., MacFarlane D. (2015) Poster Harvesting waste heat using ionic liquid-based thermoelectrochemical cells at the 12th International Conference on Materials Chemistry (MC12), University of York, UK, 20-23 July 2015.
48.	Alici G. (2015) From Soft Actuators to Soft Robotics: where are we now?, Shenyang Ligong University, Liaoning Province, Shenyang, China, 21 July.
49.	in het Panhuis M. (2015) 3D and 4D Bioprinting of tough and conducting hydrogels at University of Cambridge, Cambridge, UK, 24 July.
50.	Gilbert F. (2015) Predictive Brain Implants: Could Have I Done Otherwise?' Philosophy and Gender Studies Seminar, UTAS, Hobart, Australia, 31 July.
51.	Coote M.L.(2015) Electrostatic Catalysis of Non-Redox Reactions invited lecture at the Institute of High-Performance Computing at AStar Singapore, 3 August.
52.	Officer D. L. (2015) Porphyrins for Artificial Photosynthesis: Solar Cells and Solar Fuels at École Polytechnique Fédérale de Lausanne (EPFL)-Valais, Sion, Switzerland, 7 August. This was the first invited lecture given at the new EPFL-Valais facilities.
53.	Spiccia L. (2015) visited, gave a lecture Minerals Derived from Metal Complexes as Water Oxidation Catalysts and reviewed facilities of Prof Michael Mehring, Technical University Chemnitz, August.
54.	Higgins M.J. (2015) presented ACES research and visited facilities at the Microstructural Analysis Unit, UTS on 9 August.
55.	Spiccia L. (2015) Collaborative research visit to Karlsruhe Institute of Technology to visit Prof Annie Powell and Dr Sharali Malik, August-September.
56.	Gilbert F. (2015) Invasive Brain Technologies for treatment of Psychiatric Conditions. Seminar Series, Institute for the Study of Social Science, UTAS, Hobart, Australia, 16 August.
57.	Ciampi S. (2015) Shear in thin films, any measurable effect on entropy? at Flinders University, Adelaide, Australia, 27 August.
58.	Officer D. L. (2015) Nanostructured Electromaterials for Energy Applications at Nanotechnology and Integrated Bioengineering Centre (NIBEC), Ulster University, Belfast, Ireland, 11 September.
59.	Thompson F. (2015) visits and collaborating with surgeons C DiBella and Prof Peter Choong at St Vincent's hospital Melbourne, 15 & 30 September.
60.	Gilbert F. (2015) enjoyed a collaborative visit at the Université de Montréal–McGill University 18 September–1 October.
61.	Hancock L. (2015) India-Australia energy policy meeting with Dr Amit Kumar; Dr B Prasad, Dr Vidya S Batra and Atul Kumar at TERI University, Delhi, India, September.

Invited Seminars / collaborative visits related to ACES work	
62.	Howlett P. (2015) Collaborative research visit to Warwick Manufacturing Group (WMG) Battery Prototyping facility, UK, 25 September.
63.	Forsyth M. (2015) Visited University of the Basque Country to officially sign off on the cotutelle arrangements and research exchange opportunities, 27 September.
64.	Forsyth M. (2015) Visited Tecnalia, Spain to discuss ongoing collaborations in energy storage, ionic liquids and corrosion, 27 September.
65.	Forsyth M. (2015) visited Prof Teofilo Rojo, Dr Aitor Villaverde, Dry Room Manager, Dr Damien Saurel and Prof Michel Armand at CIC Energigune, Spain to discuss ongoing collaborations in Na battery devices and to investigate how their prototyping facilities operate, 28-29 September.
66.	Hutchison K. (2015) 'Device industry employees as carers and educators: ethical issues' given at the Centre for Applied Philosophy and Public Ethics (CAPPE) in Canberra 30 September.
67.	Gilbert F., Cook M (2015) Are Predictive and Advisory Brain Implants an Indispensable Feature of Autonomy, Montreal Neuroethics Network Speaker Series plus visit for a fortnight at the Institut de Recherches Cliniques de Montreal (IRCM), Canada, 1-13 October.
68.	Moulton SE (2015) Lecture on Electroactive Materials for Biomedical Research and collaborative talks, Mahidol University, Bangkok, Thailand, 5-6 October.
69.	Howlett P. (2015) Ionic Liquid and Organic Ionic Plastic Crystal Electrolytes for Energy Storage, CIC Energigune, Spain, 6 October.
70.	Gilbert F., Cook M, O'Brien T, (2015) Poster: The Incursion of Predictive and Advisory Brain Devices: New Ethical Issues Ahead? At the International Neuroethics Society Annual Meeting, Chicago, US, 15-16 October.
71.	Hutchison K. (2015) seminar 'Device industry employees in the clinic: ethical issues' to the Monash University Philosophy department, 16 October.
72.	Hutchison K., Sparrow R. (2015) Visit and discussion with Health Purchasing Victoria, October.
73.	Wang C.(2015) Talk 'Three Dimensional Organic Conductors with Tunable Properties for Energy Storage' and visited Profs Guoxiong Wang and Xinhe Bao at Dalian Institute of Chemical Physics (DICP), Chinese Academy of Sciences (CAS), 26 October.
74.	Pozo-Gonzalo C. (2015) visited Prof Peter Bruce at Oxford University to perform characterisation studies using surface enhancement raman spectroscopy (SERS), 19-23 October.
75.	Wang, X. (2015), Fibre Materials Research, KU Leuven, Belgium, 19 November.
76.	Zhang J. (2015) Collaborative research visit to (i) Fujian Institute of Research on the Structure of Matter, CAS, China and (ii) East China Science and Technology University, China in December.
77.	in het Panhuis M., Warren H., Spinks G. (2015) visited Profs Zhigang Suo and Joost Vlassak at Harvard University, School of Engineering and Applied Sciences to discuss hydrogel printing research for neural interfaces, 4 December.
78.	Wang X. (2015) Wuhan Textile University, China to perform collaborative research.
79.	Wang X. (2015) (i) University of Zagreb, Croatia; (ii) North Carolina State University, USA and (iii) Donghua University, China to review facilities.

Appendix 6: Conference Presentations

List of ACES Conference presentations not listed in previous tables. Note that the lists included in this report do not contain presentations by ACES members at ACES run events.

ACES Conference Presentations	
1.	Higgins M. (2015) "Watching" Single Proteins in Action on Material Surfaces using High-Speed Atomic Force Microscopy at Australian Colloid and Interface Conference, Hobart 1-5 February.
2.	Paull, B., Kazarian, T., Deverell, J. (2015) Nano-structured functionalized porous layers in open tubular 'parallel hole' capillary formats for bioaffinity applications at 7th Biennial Australian Colloid and Interface Symposium, Hobart, Australia, 1-5 February.
3.	Unwin, P (2015) at AMN-7, Nelson New Zealand, 8-12 February.

ACES Conference Presentations	
4.	Wagner P., Wagner K., Bijarbooneh F. H., Officer D. L. (2015) Developing New Low Cost Pigments for Dye Sensitised Solar Cells, 7th International Conference on Advanced Materials and Nanotechnology AMN-7, Nelson, New Zealand, 8-12 February.
5.	Wagner P., Wagner K., Bijarbooneh F. H., Officer D. L. (2015) Developing New Low Cost Pigments for Dye Sensitised Solar Cells, 7th International Conference on Advanced Materials and Nanotechnology AMN-7, Nelson, New Zealand, 8-12 February.
6.	Higgins, M (2015) "Watching" Single Proteins in Action on Material Surfaces using High-Speed Atomic Force Microscopy at 7th International Conference on Advanced Materials and Nanotechnology AMN-7, Nelson, New Zealand, 8-11 February.
7.	Breadmore M., Shallan A., Macdonald N., Smjekal P., Guijt R., Paull B. (2015) 3D printed microfluidic devices using consumer-focused printers at Pittcon 2015, New Orleans, 8-12 March.
8.	In het Panhuis, M (2015) Printed organic bioelectronics devices from ion-conducting tough hydrogels at MRS San Francisco, USA, 7 April.
9.	Higgins M., Moulton S., Zhang H., Stewart E., Yue Z., Schirmer K., Bjorninen M., Zhang H., all gave talks or posters at 5th International Symposium of Surface and Interface of Biomaterials and the 24th Annual Conference of the Australasian Society for Biomaterials, Sydney, 7-10 April.
10.	Officer, D (2015) Lecture at ARENA workshop, UNSW, 1 May.
11.	Mozer, A. (2015), A Comparison of Experimental Techniques to Measure Charge Carrier Lifetime in Polymer/Fullerene Solar Cells at HOPV15 conference, Rome, Italy, 10-13 May.
12.	Cook, M. (2015) Sub-scalp seizure monitor for epilepsy management at the Antiepileptic Drug Trials XIII Conference (Shark Tank Competition), Florida, United States, 13-15 May.
13.	Mozer A., Clarke T. (2015), Photodegradation in encapsulated silole-based polymer:PCBM solar cells investigated using transient absorption spectroscopy and charge extraction measurements at E-MRS conference, Lille, France, 11-15 May.
14.	Fang J., Xie Z., Wallace G., Wang X. (2015), Carbon Fibre Microelectrodes for Neuroscience Applications at The Fiber Society's Spring 2015 Conference, Shanghai, China, 24-27 May.
15.	Zheng T., Yue Z., Tomaskovic-Crook E., Wallace G., Crook J., Higgins M.(2015) Electroceutical Materials: Wireless and Targeted Electrical Stimulation of Cells at The Australian Society for Medical Research, NSW Scientific Meeting, Powerhouse Museum, Sydney, 1 June.
16.	Paull B., Gupta V., Sandron S., Talebi M., Nesterenko P. (2015) 3D printed titanium capillary columns with internal monoliths at HPLC2015, Geneva, 21-25 June.
17.	Gupta V.; Talebi M.; Beirne S.; Deverell J.; Sandon S.; Nesterenko P.N.; Thompson F.; Wallace G.G.; Paull B., ORAL 3D Printed Titanium Micro-Bore Columns Containing Polymer Monoliths For Reversed-Phase Liquid Chromatography; in 42nd International Symposium on High Performance Liquid Phase Separations and Related Techniques (HPLC 2015), Geneva, Switzerland, 21-25. June
18.	Gupta, V. (2015) Exploring multi-microchannel capillaries for production of higher pressure electro-osmotic pumps housed within 3D printed polymer platforms, HPLC 2015, Geneva, 21-25 June.
19.	Sanz Rodriguez, S., Poynter, S., Curran, M., Haddad, P.R., Nesterenko, P.N., Paull, B. (2015) Capillary ion chromatography with on-column focusing for ultra-trace analysis of organic and inorganic species in volume limited Antarctic ice core samples, HPLC2015, Geneva, 21-25 June.
20.	Gupta V.; Smejkal P.; Nesterenko P.N.; Paull B.; POSTER "Exploring Multi-Microchannel Capillaries For Production Of Higher Pressure Electro-Osmotic Pumps Housed Within 3D Printed Polymer Platforms"; in 42nd International Symposium on High Performance Liquid Phase Separations and Related Techniques (HPLC 2015), Geneva, Switzerland June 21-25.
21.	Nesterenko, P.N., Duffy, E., Paull, B. Preparation and characterisation of trimodal porous graphitic carbon monolithic composites containing detonation nanodiamonds and thermally induced nano-carbons, 12th International Conference on Advanced Carbon Nanostructures (ACNS2015), St. Petersburg, Russia, 29 June-3 July.
22.	Gilbert F (2015) Experimental use of invasive technologies in the Brain: The case of Predictive and Advisory Brain Devices at the International Bioethics Retreat, Paris, 1-3 July.
23.	Gilbert F, Cook M (2015) Are predictive Brain Implants an Indispensable feature of Autonomy? at Australasian Association of Philosophy (AAP) conference, Macquarie University, Sydney, 5-9 July.
24.	Higgins, M. (2015) at 6th International Nanomedicine Conference, Sydney, 6-8 July.
25.	Hutchison, K. (2015) presentation outlining the pacemaker case study and its implications for artificial organs at the Australasian Association of Philosophy (AAP) Conference, Macquarie University, Sydney, 7 July.

ACES Conference Presentations	
26.	Mutlu R, Alici G (2015) Effect of Flexural Hinge Type on A Fully Compliant Prosthetic Finger, in Advanced Intelligent Mechatronics (AIM), 2015 IEEE/ASME International Conference, Busan, Korea 7-11 July.
27.	Macdonald, N. (2015) Presentation on 3D printed microfluidics given at ACROSS Annual Gathering 2015, Hobart, 9-10 July.
28.	Coote, M. (2015) Effect of Lewis acids on radical polymerization – catalysis versus stereocontrol 35th Australasian Polymer Symposium, Gold Coast, Australia, 12 -15 July.
29.	Mitchell R. T., P. Wagner, D. L. Officer (2015) Synthesis of amphiphilic porphyrin arrays for use in artificial photosynthetic systems at the 12th International Conference on Material Chemistry, York, UK, 20-23 July.
30.	Brzeczek A., K. Piwowar, W. Domagala, K. Walczak, P. Wagner (2015) Systematic extension of the donor units in BODIPY dyes toward deep red and near infrared light emission at the 12th International Conference on Material Chemistry, York, UK, 20-23 July.
31.	Wagner P., K. Wagner, D. L. Officer (2015) Spiropyran – a Colourful Mystery at the 12th International Conference on Material Chemistry, York, UK, 20-23 July.
32.	Cabot, J.M.; Breadmore, M.C.; Paull, B (2015) Thread-based electrofluidics at ACROSS the gathering II, Hobart, Australia, 2-3 August.
33.	Macdonald N.P.; Breadmore, M.C.; Paull, B. (2015) 3D printing for microfluidic applications at ACROSS the gathering II, Hobart, Australia, 2-3 August.
34.	C. D. Simpson, N. L. Haworth, S. Ciampi and M. L. Coote, External and Intramolecular Influences on Spiropyran - Merocyanine Interconversion, Virtual Conference on Computational Chemistry (VCCC-2015), 1-31 August 2015 (Virtual Presentation).
35.	NL Haworth, Q Wang, ML Coote, Predicting pKa – beyond small, rigid molecules, 250th ACS National Meeting, Boston, Massachusetts, USA, 16-20 August, 2015.
36.	Gupta V.; Talebi M.; Beirne S.; Deverell J.; Sandon S.; Nesterenko P.N.; Thompson F.; Wallace G.G.; Paull B., POSTER "3D Printed Titanium Columns With Internal Monolithic Phases For Liquid Chromatography"; in 18th European Conference on Analytical Chemistry (Euroanalysis 2015), Bordeaux, France, 6-10 September.
37.	Gilbert F.(2015) Invasive Brain Technologies for Treatment of Psychiatric conditions: Old and New Ethical Concerns at 17th International conference on Philosophy, Psychiatry and Psychology, Teatro del Lago, Chile, 29-31 October.
38.	Fang, Jian (2015) Carbon Fibre Microelectrodes for Dopamine Sensing at ATC-13 Asian Textile Conference, Geelong, 3-6 November.
39.	Tomaskovic-Crook, E., Puckert, Zhang, Higgins, Wallace, Crook (2015) Poster: Application of Methacrylate Gelatin for Neural Induction of Human Induced Pluripotent Stem Cells, Australasian Society for Stem Cell Research 2015 Conference, Stem Cells in the Hunter Valley, 8-10 Nov, 2015.
40.	Gu, Tomaskovic-Crook, Kapsa, Cook, Zhou, Wallace, Crook (2015) Poster: Bioprinting 3D Functional Neural Tissue Using Human Neural and Induced Pluripotent Stem Cells, Australasian Society for Stem Cell Research 2015 Conference, Stem Cells in the Hunter Valley, 8-10 Nov, 2015.
41.	Rahim, Tomaskovic-Crook, Wallace, Crook (2015) Poster: Effects of Conductive Polymer Mediated Electrical Stimulation on Neural Differentiation of Human Induced Pluripotent Stem Cells, Australasian Society for Stem Cell Research 2015 Conference, Stem Cells in the Hunter Valley, 8-10 Nov, 2015.
42.	Begic, Srdan (2015) Presented at Metal-Air battery research group meeting, Deakin University, November.
43.	Hancock, L. (2015) 'Regional Trade or Climate Chirade? Convergences, divergences and challenges of Australia's and India's Energy and Renewables Policies' presented at Regional Studies Association Winter Conference, Great Transformation: Recasting Regional Policy, 19-20 November.
44.	Bakarich, S. (2015) '3D/4D Printing Hydrogel Composites: A Pathway to Functional Devices' presented at Symposium C on tough, smart and printable hydrogels at the MRS conference in Boston, 30 November 2015.
45.	Warren, H. (2015) 'Tough, Actuating, Conducting Hydrogels from PNIPAm, Alginate and Carbon Nanofibres' at MRS conference in Boston, 30 November 2015.
46.	Higgins, M.J. (2015) Presented "Biomolecular Interactions at Organic Electrode Interfaces" at the 2015 MRS Fall Meeting & Exhibit, Boston, Massachusetts, 30 November-4 December.
47.	Wang, C. (2015) Poster Three Dimensional Organic Conductors with Tunable Properties for Energy Storage at the Theo Murphy Australian Frontiers of Science, Melbourne 9-11 December.



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