AIIM Highlights

AUTUMN 2021

UNIVERSITY
OF WOLLONGONG
AUSTRALIA

Located at UOW's Innovation Campus, the purpose-built Australian Institute for Innovative Materials (AIIM) houses two flagship research groups - the Intelligent Polymer Research Institute (IPRI) and the Institute for Superconducting and Electronic Materials (ISEM), as well as UOW's Electron Microscopy Centre (EMC). This internationally renowned materials research institute brings together over 100 chemists, engineers, physicists, biologists, materials scientists and more than 120 PhD students from across the globe to innovate, create, and inspire.

AIIM has 80+ world class laboratories, equipped with a range of instrumentation that can essentially address any need in terms of materials/structures design, fabrication, and high quality characterisation. Over the last several years AIIM has put a substantial effort into establishment and deployment of instruments that facilitate translational research, research commercialisation, and research upscaling.

Introduction To AIIM Highlights By Our Executive Director

I would like to extend a very warm welcome to you to the Australian Institute for Innovative Materials (AIIM) on Innovation Campus at the University of Wollongong!

As we start 2021 and look forward to the opportunities that the recovery from COVID offers, it is timely also to reflect on the year that was 2020. The experience of 2020 highlighted two very important things. Firstly, the central role that technology and innovation plays in solving major global problems. The speed at which COVID vaccines have been delivered has been quite unprecedented. In addition, in early stages of the pandemic, the call to arms to assist frontline workers in the health services showed the willingness to innovative. In this edition of AIIM highlights you can read about some of our efforts to supply personal protective equipment (PPE) to Local Health Authorities using Advanced 3D printing facilities. Secondly 2020 showed the importance of international collaborations through both the efforts to share knowledge during the COVID crisis as well as the difficulties with restricteld travel and border closures and the move to online – platforms.

In this 2021 Autumn AIIM Highlights you will see inspiring stories of current students, their work and why they chose to study here at AIIM. Post-graduate students here are of very high quality and come from many parts of the world as well as Australia. They are the life blood of AIIM and its outputs. The high standing of AIIM research is exemplified also by the six researchers who were named in the annual Clarivate Highly Cited Researchers which includes Researchers who are in the top 1% of their chosen field based on publication of highly cited papers over the last ten years.

AIIM is also very strong in its applied and translational work.

In this edition you can read about the new 3D bioprinting and fabrication technologies being developed through the Translational Research Inititative for Cell Engineering and Printing (TRICEP). Many of the outstanding facilities are part of the National Commonwealth Research Infrastructure Strategy (NCRIS) funded Australian National Fabrication Facility (ANFF) of which University of Wollongong is a Materials Node. These facilitates are open to all researchers and industry.

Whether you are a researcher, a company representative or member of the broader community, I am sure you will find something of interest in this edition of AIIM Highlights.

William E. Price
Executive Director and Professor

Why study at AIIM ?

ANSWERED BY SOME OF OUR CURRENT STUDENTS

Fanar Hussein Jawdat

TELL US A LITTLE ABOUT YOURSELF AND WHY YOU CHOSE THE AIIM FACILITY

I'm originally from Iraq/Baghdad.

My field of study is Laser and optoelectronics and I'm now in the writing stage of my PhD thesis, in ISEM innovation campus specifically in designing, modifications and characterizations of photocatalyst materials. I was interested in doing my research in a specific place which was related to my field of study and also in a quite and beautiful environment.

LIST SOME HIGHLIGHTS OF STUDYING AT AIIM THAT YOU WOULD SHARE WITH STUDENTS LOOKING FOR SOMEWHERE TO STUDY

I would highlight some of the important facilities that we are able to use especially the TEM specially if you would like to study in material science.

WHAT IMPACT WOULD YOU LIKE TO SEE YOUR RESEARCH HAVE ON THE WORLD

I would like to see my research applied in a real life application as a water purification system, that could help to improve the quality of the drinking water in poor countries around the world.

Alain Moriana

TELL US A LITTLE ABOUT YOURSELF AND WHY YOU CHOSE THE AIIM FACILITY

My field of Research is Materials Engineering & Applied Sciences, focusing on textured piezoelectric ceramics for SONAR and underwater acoustic application. I was born and raised in the Illawarra region. I am in my third year.

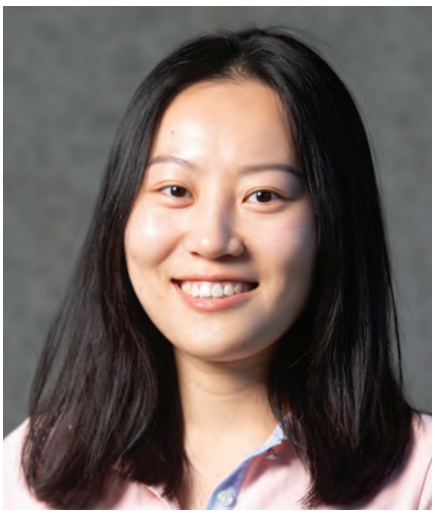
I chose the AIIM Facility as it I was able to combine academic and scientific findings and knowledge for real-world applications using the various materials and equipment found here. Also due to its proximity to the beach.

LIST SOME HIGHLIGHTS OF STUDYING AT AIIM THAT YOU WOULD SHARE WITH STUDENTS LOOKING FOR SOMEWHERE TO STUDY

A faculty designed for students to implement their research proposals, collaborate with other like-minded colleagues to discover potentially new materials and applications and even improve on existing ones.

WHAT IMPACT WOULD YOU LIKE TO SEE YOUR RESEARCH HAVE ON THE WORLD

I would like my findings and improvements to be used in different applications in order to increase their efficiency and even as a composite for potentially new and novel applications in differing fields.



Yumeng Du

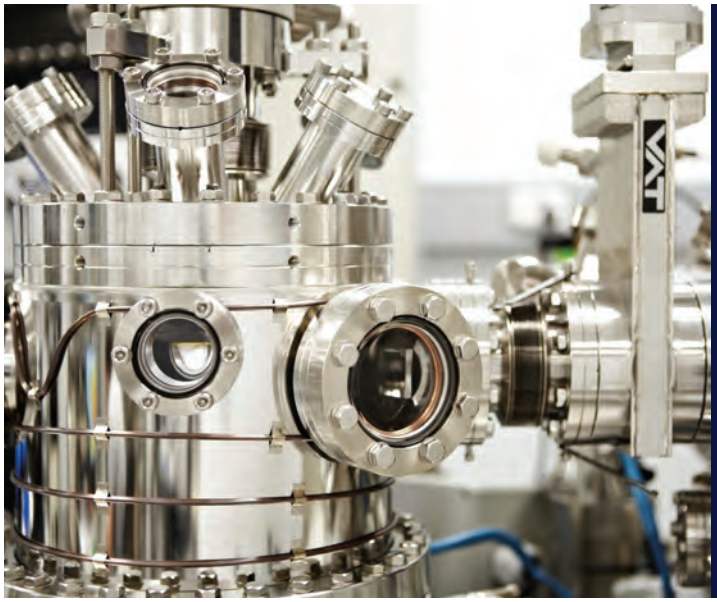
TELL US A LITTLE ABOUT YOURSELF AND WHY YOU CHOSE THE AIIM FACILITY

I am a second year PhD student in physics. My current focus is on synthesizing environmentally-friendly ferroelectric materials for use in catalytic applications to generate green energy.

I am from Northeastern China, where we encounter tough weather in winter, but enjoy the snow's beauty. In 2017 I accomplished my master's degree in electronics engineering at UNSW. Powerful and functional devices I've learned in the engineering field has aroused my curiosity to explore what kind of materials can support such performance. The very friendly and professional AIIM Research Team have offered me invaluable help to find a suitable position regarding to my interests and background

LIST SOME HIGHLIGHTS OF STUDYING AT AIIM THAT YOU WOULD SHARE WITH STUDENTS LOOKING FOR SOMEWHERE TO STUDY

I am satisfied with facilities, resources and platforms. If you are interested in piezo/ferroelectric materials to realize energy conversion or storage, welcome to our research team lead by Professor Cheng. At AIIM we strive to see our shared ideas and interests in state-of-the-art material technologies become a reality.



Interfaces the key in atomically thin, high-temperature superconductors

Discovery Could Unlock Elusive Mechanism Behind High-Temperature Superconductivity.

Systems studied include:

- elemental metals grown on semiconductors
- single-layer iron-based superconductors
- atomically-thin cuprate (copper based) superconductors

The review investigated the role of molecular-beam epitaxy (MBE), scanning tunnelling spectroscopy (STM/STS), scanning transmission electron microscopy (STEM), physical properties measurement system (PPMS), in fabricating and identifying atomically thin superconductors.

SUPERCONDUCTORS: A BACKGROUND

Atomically thin superconductors (whether iron based or copper based) are a type of high temperature (Type II or unconventional) superconductor in that they have a transition temperature (Tc) much higher than a few degrees Kelvin above absolute zero.

The driving force behind such Type II superconductors has remained elusive since their discovery in the 1980s. Unlike conventional superconductors, it is clear they cannot be directly understood from the Bardeen, Cooper, and Schrieffer electron-phonon coupling theory.

In successive discoveries, the transition temperature has been driven steadily higher, and in the last decade there has been significant advances in the use of atomically thin superconductors, both iron- and copper-based.

These new discoveries challenge current theories regarding the superconducting mechanism of unconventional superconductors and indicate promising new directions for realising high transition temperature superconductors.

“The ultimate goal of the research of superconductivity is finding superconductors with a superconducting transition temperature at or higher than room temperature,” Dr Li said

THE STUDY

The review paper Atomically thin superconductors was published in the journal Small in May 2020 (DOI 10.1002/smll.201904788). The authors acknowledge support from the Australian Research Council via the Centre of Excellence, Discovery and Future Fellowship programs.

The review investigated the role of molecular-beam epitaxy (MBE), scanning tunnelling spectroscopy (STM/STS), scanning transmission electron microscopy (STEM), physical properties measurement system (PPMS), in fabricating and identifying atomically thin superconductors.

NOVEL MATERIALS STUDY AT FLEET

The properties of novel, atomically thin materials are studied at FLEET, an Australian Research Council Centre of Excellence, within the Centre’s Enabling technology A.

The Centre for Future Low-Energy Electronics Technologies (FLEET) is a collaboration of over a hundred researchers, seeking to develop ultra-low energy electronics to face the challenge of energy use in computation, which already consumes 8% of global electricity, and is doubling each decade.

Each of FLEET’s three research themes are heavily enabled by these novel materials, including 2D topological materials (Research Theme 1), atomically thin semiconductors (as hosts for excitons in Research Theme 2, and for realising non-equilibrium topological phenomena in Research Theme 3).

For the ful story : https://www.uow.edu.au/media/2020/interfaces-the-key-in-atomically-thin-high-temperature-superconductors.php

British Consul General Visits Uow's Ground-Breaking 3d Bioprinting Initiative

Distinguished visitors shown new technologies under development at translational research initiative for cell engineering and printing.

The University of Wollongong (UOW) welcomed a visit from the British Consulate Sydney on Tuesday 15 September 2020. This included a trip for the delegates to TRICEP (Translational Research Initiative for Cell Engineering and Printing).

British Consul General Mr Michael Ward and Deputy Consul General Mr Jonathan Cook visited the research initiative, accompanied by ARC Centre of Excellence for Electromaterials Science (ACES) and TRICEP Director Distinguished Professor Gordon Wallace and TRICEP Associate Director Associate Professor Stephen Beirne.

Mr Ward and Mr Cook were introduced to the facility with a short presentation about the 3D bioprinting initiative, which is underpinned by an extensive and dynamic clinical connections network.

While touring the facility, the visitors were able to see a wide range of technologies under development at TRICEP, including the handheld printer to facilitate cartilage repair, the Axcelda Biopen, as well as a range of 3D printers such as the latest in-house built intuitive bioprinting and research-training platform, 3D REDI, which was launched late 2020.

"It is always a pleasure to host international guests and to showcase this exciting and unique initiative that we have embarked on here in Wollongong," Professor Wallace said.

TRICEP is a 100 per cent owned initiative of the University of Wollongong (UOW), drawing on both the expertise and facilities available within ACES as well as the Australian National Fabrication Facility (ANFF) Materials.

To read more about the TRICEP facility head to https://www.tricep.com.au/

Story and Photography By Sam Findlay.

Meet Research Assistant - Kalani Ruberu

TELL US A LITTLE ABOUT YOUR ROLE AT TRICEP

I am responsible for developing standardised protocols to print 3D structures. This protocol development work is not limited to the bioinks synthesised at TRICEP, but also for novel bioinks developed by others.

I am also responsible for the supply of printed 3D scaffolds with quality control data for researchers at the ARC Centre of Excellence for Electromaterials Science (ACES) and other external clients across the country.

Another aspect of my role is to train Master's and PhD students on 3D biofabrication techniques starting from induction to bioink preparation and to fabrication of high-quality 3D scaffolds with or without cells.

I come from a molecular biology and biotechnology background, bringing a wealth of experience in cell culture where I have worked with numerous human and animal cell lines. I also have expertise in carrying out cell characterisation assays, microscopy work and bacterial and viral assays. Apart from sterile techniques, I am experienced in extrusion-based 3D printing systems and co-axial fabrication of 3D scaffolds using various bioinks synthesised at TRICEP.

Associate Professor Konstantin Konstantinov Awarded 2020

Vice-Chancellor's Interdisciplinary Research Excellence Award as a leading CI of the Global Challenge Project

The Vice-Chancellor's Interdisciplinary Research Excellence Award recognises outstanding contributions to research by a team of UOW researchers collaborating across discipline boundaries, who have combined their expertise to produce achievements of outstanding international significance. The purpose of this Award is to recognise a ground-breaking research outcome that has involved collaboration and integration by a research team whose members are from two or more unrelated disciplines. The Award aims to encourage outstanding, innovative research that demonstrates the benefits of practical interdisciplinary cooperation.

Nominees are subject to a stringent selection criteria such as:

Significance, impact and excellence of the research and the benefits the research brings to the university (including but not limited to research funding, shared expertise, access to government funding, publications, enhanced reputation, the development of intellectual property and student scholarships), industry and the broader community.

Novelty of the conceptual or investigative approach (including the extent to which the research has

- combined different research paradigms).
- Strength of the interdisciplinary team, including collaboration and team work.
- Quality of the contribution to the training of research students and staff in a collaborative and interdisciplinary setting.

2020 saw Associate Professor Konstantin Konstantinov receiving the award as a leading CI of the Global Challenge project for his work on "Next Generation Sunscreens"

The project specifically looks at new generation sunscreens that are optimised for Australian extreme exposure conditions and reliable in-vitro test protocols for SPF and critical wavelength.The team is using advanced fabrication techniques and looks at introducing a new generation cost-effective sunscreen and development of new scientifically correct testing methods for evaluation of safe UV radiation exposures. Bringing a number of diverse disciplines together, these sunscreens will be designed to combat the extreme UV levels in Australia leading to improved health outcomes.

Two Uow Researchers Win Nsw Premier's Prizes

Distinguished Professors Antoine Van Oijen and Zaiping Guo honoured for research excellence

Two University of Wollongong (UOW) academics have been named as recipients of New South Wales Premier's Prizes for Science and Engineering in recognition of their pioneering research work.

Distinguished Professor Antoine van Oijen recieved the Prize for Excellence in Medical Biological Sciences and Distinguished Professor Zaiping Guo from AIIM recieving the Prize for Excellence in Engineering or Information and Communications Technology.

The Prizes reward leading researchers for cutting-edge work that has generated economic, environmental, health, social or technological benefits for NSW.

Professor Zaiping Guo, Excellence in Engineering

Professor Guo is a materials scientist with an exceptional track record in her field, which focuses on the applications of nanomaterials in energy storage and conversion technologies.

"This is truly an honour for me to receive this award. If you look at the list of the past awardees, they are all top outstanding scientists, making big impacts for NSW, Australia and the world," Professor Guo said.

"I'm very proud and very happy to be part of this list, and I feel I'm accepting this award on behalf of the amazing team of mentors, colleagues and students I've developed at the University of Wollongong."

Professor Guo is at the forefront internationally of efforts to develop next generation batteries that are safe, clean, high performing and low cost, with the aim of finding the most promising large-scale electrical energy storage solutions that will support the transition to renewables.

Professor Guo's research offers enormous potential for applications in future green energy use in NSW, reducing our dependence on fossil fuels, and facilitating a more sustainable state and nation.

Her accomplishments include developing new nanoscale electrode materials to use in sodium–ion batteries, aqueous rechargeable zinc batteries and lithium ion batteries.

2d Materials To Benefit Renewable Energy Market

With close to half-a-million dollars from the Australian Research Council (arc) discovery project scheme, a team of researchers at the Institute For Superconducting And Electronic Materials (ISEM) is planning to tackle one of the main challenges holding back australia's renewable energy market – inefficiencies in generating and storing renewable energy.

The team, led by Distinguished Professor Shi Xue Dou and Chief Investigators Dr Wenping Sun and Dr Ji Liang, also from AIIM UOW, is aiming to develop a cutting-edge electrocatalyst technology platform based on two-dimensional materials technology that could have substantial benefits for sustainable energy production and conversion. Professor Dou, one of the world's most influential scientists in energy materials, superconducting and electronic materials research, says the project has multiple objectives and will have benefits for Australia's scientific capabilities as well as the economy and the environment.

The project, titled Controlling and Understanding Interface Chemistry for Energy Conversions, will unfold over three years with the first phase of work focused on the creation of an electrocatalyst technology platform based on novel two-dimensional (2D) material architectures. Such materials could have applications in processes such as water electrolysis for hydrogen production and electrochemical carbon dioxide reduction reaction for producing high-value chemicals, currently performed using noble metal-based materials (such as materials based on gold or silver) which, though considered state-of-the-art electrocatalysts, are costly and suffer from activity degradation.

Professor Dou's team, in their search for multi-metal 2D material-based electrocatalysts, will test various configurations of noble and non-noble metals.

"2D materials possess high surface-to-volume ratios and good structural stability, and they show great potential for electrocatalysis applications and other energy applications," Professor Dou explains.

"The success of this project would not only shed light on the rational design and synthesis of nanostructures with well-defined interfaces and surfaces for electrocatalysis applications but also accelerate the development and commercialisation of renewable technologies across Australia." Australia has an abundant land area and renewable energy resources for building industrial-scale electrochemical energy conversion plants (water electrolysis plants and devices for electrochemical carbon dioxide reduction, for example). These energy conversion systems would allow intermittent renewable electricity to be utilised more efficiently. Furthermore, electrochemical synthesis of useful fuels and chemicals from CO2 can make full use of renewable electricity as well as greatly reduce CO2 emissions."

Ultimately, the success of this project could accelerate the establishment of a low-carbon industry in Australia and enhance national research capacity in energy materials as well as renewable energy technologies.

MARKET FOR 2D MATERIALS

Scientists have identified several hundred 2D materials in the past decade and researchers worldwide are investing valuable time and money to uncover the thousands of more single-layer materials that may be out there waiting to be discovered. The desirability of such materials may be understood best in the light of graphene, the original and probably the best known 2D material, which was isolated in 2004. The global market value of graphene is predicted to reach US$1 billion in less than a decade, driven by demand for lightweight, renewable, durable and flexible materials across multiple industries.

Single-layer materials as a whole often satisfy many of these criteria plus more. Many have also been found to have high electrical, chemical and thermal conductivity, which makes them desirable in various applications and industries, including renewable energies. For the full story : https://magazine.uow.edu.au/research/newsletter/2020/UOW264607.html

Living Electrodes From Algae

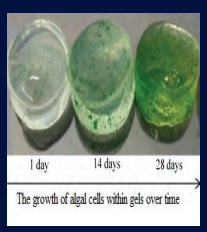
Technological advancements of electrodes have allowed tremendous new opportunities within the area of bioelectronics. For example, electrode technology is key for advancing biomedical applications such as soft robotics that interface prosthetics with the human body. .

Traditionally, bio–electronic interfaces have been constructed through the use of inert conductive materials, such as gold and platinum. New approaches being developed at UOW include the development of biological interfaced electrode, also known as “living electrodes”.

AIIM PhD student Mohammed Al-Mossawi and Professor Marc in het Panhuis in collaboration with Drs Holly Warren and Paul Molino from the ARC Centre of Excellence for Electromaterials Science and UOW Visiting Professor Paul Calvert have made living electrode materials by embedding green algae “Chlorella vulgaris” in a soft and conducting hydrogel.

This work offers new possibilities for addressing the biological–electrical interface beyond the use of traditional materials such as gold and platinum. For the full story. https://universe.uow.edu.au/research/living-electrodes-from-algae

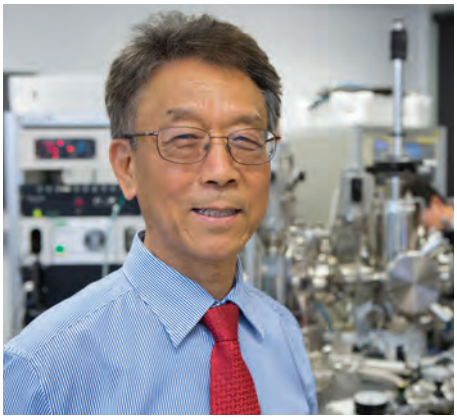
Phd student MohammedAl-Mossawi



Carbon-Free Energy Storage And Conversion Using Ammonia As A Mediator

Distinguished Professor Shi Xue Dou, from the Australian Institute for Innovative Materials, and a team including Dr Ji Liang and Dr Weijie Li secured $573,778 for a project to develop technologies for ammonia-mediated energy storage, hydrogen production, and electricity generation.

This should provide significant benefits for the harvest of clean energy, the safe utilisation of hydrogen, and the development of carbon-free fuels, which are essential for optimising Australia’s energy structure.



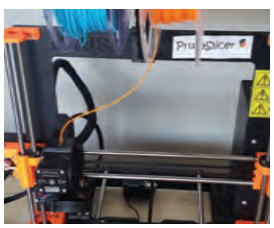
Uow Researchers Came Together To Protect Health Workers Against Covid-19

Researchers from the ARC Centre of Excellence for Electromaterials Science (ACES), TRICEP [the Translational Research Initiative for Cellular Engineering and Printing, supported by the Australian National Fabrication Facility (ANFF) Materials Node and MedTech and Pharma Growth Centre (MTPConnect)] and UOW Makerspace combined forces to provide local protective gear solutions during the global COVID-19 pandemic.

As people around the world looked at the use of 3D printing to create devices and structures that could help in the COVID-19 crisis, the UOW teams pooled their 3D printing capabilities to produce face shields to protect the region’s healthcare workers.

The groups worked closely with the Illawarra Shoalhaven Local Health District to determine what can be produced using local 3D printing capabilities, as well as refining designs and producing prototypes for final testing at Wollongong Hospital. The team scaled up production in collaboration with local industry and produced hundreds of the shields per week.

UOW Makerspace Manager Jessica Grozdanov said the face shields initiative highlight the importance of direct collaboration between initiatives like makerspaces, innovative manufacturing facilities and medical institutions to solve community challenges.For the full story: https://electromaterials.edu.au/2020/03/27/uow-researchers-come-together-to-protect-health-workers-against-covid-19/



Building New Local Industries One Bioprinter At A Time

ARC Centre Of Excellence For Electromaterials Science (ACES) researchers at the University Of Wollongong will lend their internationally-renowned expertise in bioinks to a new project to develop a 3D bioprinting system to treat burns during surgery.

The project, in partnership with start-up company Inventia Life Science and world-renowned burns expert Professor Fiona Wood, is one of 21 initiatives to receive support from the Federal Government's latest round of the BioMedTech Horizons program.

The team based at the AIIM Facility, will develop 3D bioprinting hardware and bioinks for skin regeneration that prints a patient's own skin cells directly onto burns. The revolutionary system, codenamed Ligõ, from the latin 'to bind', delivers multiple cell types and biomaterials rapidly and precisely to a wound. The Ligõ technology will create a new layer of skin where it has been damaged, to replace current wound healing methods where the skin is simply repaired. It is hoped the device will reach first-in-human trials within two years.

ACES Director Professor Gordon Wallace said the ACES team would provide critical input in the bioprinter and bioink development process.

"ACES is at the forefront of building new approaches to 3D printing, and this project will draw on this significant success we have had in this space in recent years," Gordon said.

"3D printing has emerged as the most exciting advance in fabrication in decades, and I'm excited to continue to build our local capabilities in this area to establish a new, innovative and sustainable industry for the Illawarra.

"Being part of this skin regeneration project will help to put Wollongong on the map for the commercial manufacture of bioprinting technologies."

The ACES team has had a strong working relationship with Inventia Life Science for a number of years. The start-up company based in Sydney has proven success in the translation and commercialisation of bioprinting technology.

The team is working towards the Ligõ technology being used in the operating theatre to potentially recreate functional and aesthetically normal skin. The system would achieve these results in a single procedure, minimising treatment costs, the length of hospital stays, and the risk of infection.

Inventia CEO and co-founder Dr Julio Ribeiro said the Federal Government support would help the team to further accelerate the project.

"When we started Inventia Life Science, our vision was to create a technology platform with the potential to bring enormous benefit to human health. We are pleased to see how fast that vision is progressing alongside our fantastic collaborators," Julio said.

Director of Burns WA Professor Fiona Wood was also excited to be involved in this collaboration, which combines a range of research strengths to achieve well-rounded outcomes

Separately, the team also received funding from the Medical Research Future Fund Stem Cell Therapies Mission to collaborate with stem cell expert Professor Pritinder Kaur from Curtin University to utilise this technology for bioprinting skin tissue directly onto model wounds .For the full story : https://electromaterials.edu.au/2020/07/28/building-new-local-industries-one-bioprinter-at-a-time/

Aces Strengthens Links With India

A lack of international travel is not stopping ACES researchers showcasing their latest advances in biofabrication across the world.

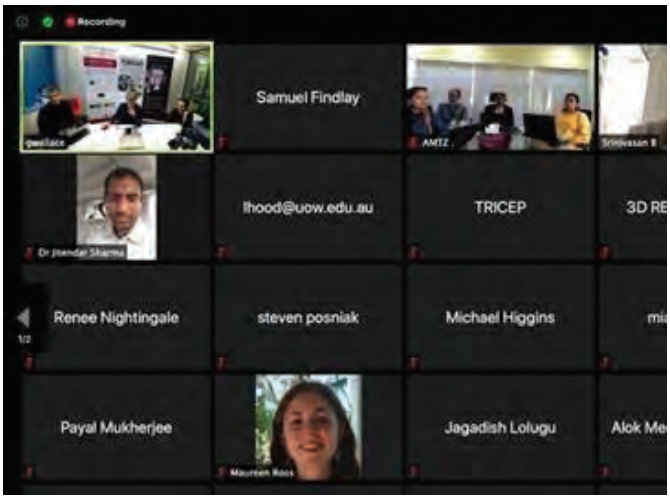
In pre-COVID times, the last week in June would have seen advanced medical technology collaborators from India join ACES researchers at the University of Wollongong's AIIM Facility to further 3D printing and bioprinting applications between India and Australia.

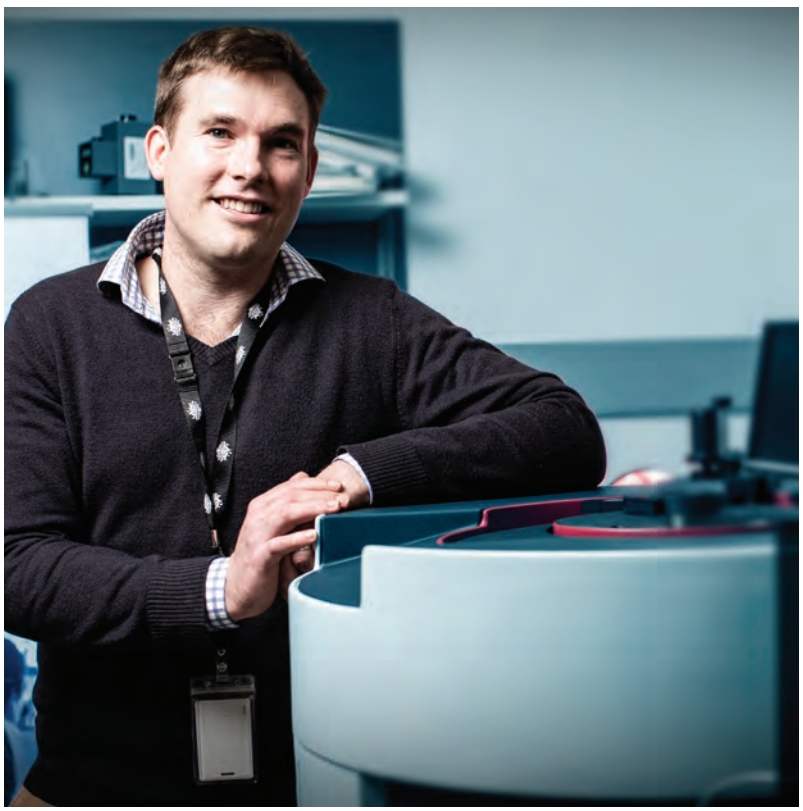
Instead, the team organised a week of online activities, including demonstrations and workshops, to discuss the latest developments in project work between the two countries.
The online events included demonstrations of ACES latest advances in customised 3D bioprinters, including 3D Genii, for printing prosthetic ears.

The 3D Genii is a 3D printer that can print implantable, flexible, customised prosthetic ears that match the colour and anatomy of the patient. The patient's ear is scanned using smart phone software, and the file is uploaded for printing. The customised printer is capable of high precision 3D printing of silicon rubber into complex shapes, such as those found in an ear. 3D Genii has been built specifically to deliver the substantial forces required in printing these materials.

The 3D printed ears research is part of an Australia-India Council (AIC) grant awarded in 2019. The project focuses on building bilateral partnerships to effectively translate 3D printing technologies, to provide prosthetics for patients with microtia (a congenital deformity of the ear). The AIC awards grants to projects that will build new innovative linkages and provide sustainable collaborations between Australia and India.

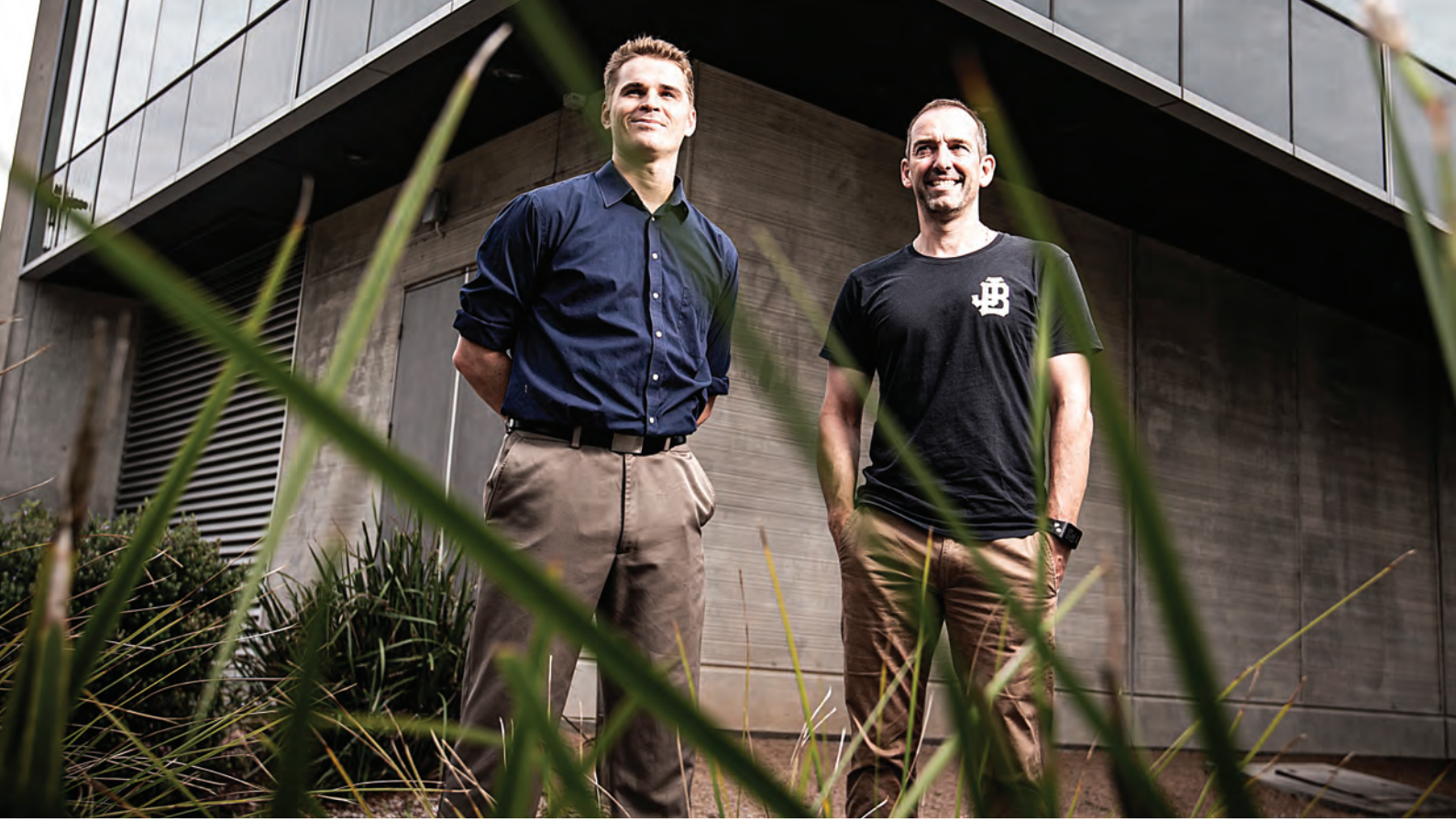
The online events follow the signing of a strategic collaboration between the University of Wollongong and AMTZ (Andhra Pradesh Medtech Zone), India's first integrated medical devices manufacturing zone. University of Wollongong Vice Chancellor Professor Paul Wellings and UOW Ambassador in India Adam Gilchrist visited AMTZ as part of the signing ceremony in September 2019. For the full story : https://electromaterials.edu.au/2020/06/30/aces-strengthens-links-with-india/





Team Led By David Cortie Awarded Arc Discovery Projects Grant

A team led by Dr David Cortie, from the Australian Institute for Innovative Materials, and including Dr Zengji Yue, Professor Zhenxiang Cheng, Professor Roger Lewis and Professor Chao Zhang, gained $315,000 for a study into phonon transport in solids. The phonon is the quantum particle representing a travelling vibration and is responsible for the transmission of heat in solids. Heat management is critical to many technologies for sustainable energy, electronics, protective equipment and energy-efficient buildings.



Podcast Brings Scientists And Entrepreneurs Together

Lab notes explores how industry and academia can better collaborate to bring new technologies to life

In a new series of their podcast Lab Notes, University of Wollongong scientist Professor Marc in het Panhuis and entrepreneur and AIIM Alumnus Dr Leo Stevens aim to demystify the business world for scientists and the academic world for business people.

Lab Notes celebrates Australian science, innovation and entrepreneurship, and aims to inspire inventive Australians.

In the first series, the co-hosts interviewed Australian research luminaries including 2005 Australian of the Year Professor Fiona Wood and 2017 NSW Scientist of the Year Professor Gordon Wallace, as well as up and coming entrepreneurs like Anastasia Volkova (FluroSat).

The second season of Lab Notes, launched Wednesday 17 February, explores how industry and academia can better collaborate, and to celebrate those who are bringing exciting new technologies to life. It features a new short episode format called "The Brief", which connects two concepts from science and business in 10 minutes.

The need for innovation by industry coupled with the ambition of governments to commercialise academic research is driving an ever-increasing level of interaction between entrepreneurs and scientist, said in het Panhuis, a Professor of Materials Science at UOW's Australian Institute for Innovative Materials.

They do, however, have different objectives and face different constraints, he added.

"Australia has an amazing pool of researchers and punches above its weight in fundamental discovery," Professor in het Panhuis said.

"However, we need to do more to translate research out of the university and into industry."

This podcast series is hoping to help entrepreneurs and scientists to better understand each other, and ultimately, foster the commercialisation of research, said co-host Dr Stevens, an entrepreneur and angel investor based in Wollongong and a UOW alumni.

"Recently there has been an outstanding growth in the Australian ecosystem," Dr Stevens said.

"We are hoping to capture the stories of successful Australian entrepreneurs who can become role models for the next generation." For the full stoy - https://www.uow.edu.au/media/2021/podcast-brings-scientists-and-entrepreneurs-together.php or to listen to the podcast - https://labnotes.podbean.com/e/entrepreneurs/

AUSTRALIAN INSTITUTE *for* INNOVATIVE MATERIALS | UOW AUSTRALIA

$2.15 Million Investment In Nsw's Fabrication Future

The Australian National Fabrication Facility (ANFF) has been awarded $2.15 Million by the New South Wales State Government's Office of the Nsw Chief Scientist and Engineer to invest in six sites across the state.

The ANFF Materials Node, headquartered at the University of Wollongong's AIIM Facility, will benefit from this investment, to strengthen the facility's advanced materials process, 3D printing and 3D bioprinting capabilitieS.

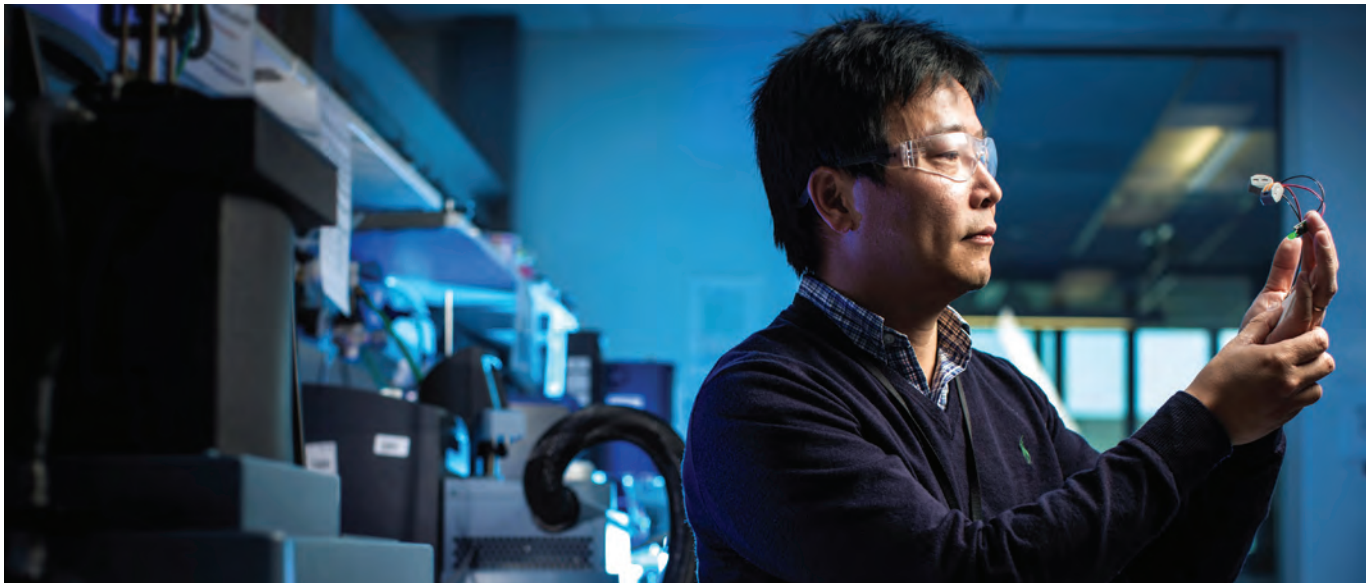
ANFF Materials Node Director Professor Gordon Wallace said this funding will assist the team to take the next steps towards manufacturing commercial opportunities through advanced materials and 3D printing.

"For the ANFF Materials Node, this announcement unlocks access to state-of-the-art materials synthesis and fabrication equipment," Gordon said.

ANFF, a project of the National Commonwealth Research Infrastructure Strategy (NCRIS), provides open access to micro and nanofabrication equipment and expertise at 21 locations across Australia, six of which are embedded with New South Wales universities: The University of Wollongong; The University of Newcastle; The University of New South Wales; The University of Technology Sydney; The University of Sydney; and Macquarie University. These sites assist academics, start-up companies and international technology leaders as they pursue cutting-edge research projects.

Plans for expansion of ANFF's capabilities in NSW that will leverage this funding including the building of industry-standard process lines to assist the commercialisation of novel semiconductor products, bioprinting, and quantum technologies; to enhance additive and subtractive manufacturing suites; and to acquire or upgrade advanced patterning, etching, and deposition equipment for specific materials, including diamond. This is in addition to supporting the operating costs of hundreds of pieces of existing equipment, approximately 40 staff, and a network of open access laboratory and clean room spaces that are used by hundreds of researchers and engineers each year.

Over the past few years, micro and nanofabrication capabilities available in NSW have been used to set a string of quantum computing records that have helped Sydney become a world-leading quantum hub; support internationally recognised expertise in the 3D printing of biological material for clinical applications; develop printable solar panels that could turn struggling printing companies into manufacturers of affordable clean energy technologies; and produce award winning communication technologies that could speed up download speeds without having to replace existing infrastructure. For the full story : https://electromaterials.edu.au/2020/02/03/2-15-million-investment-in-nsws-fabrication-future/



Six Uow Academics On Highly Cited Researchers 2020 List

‘Who’s who’ of international researchers ranks top 1% of scientists by citations for their field and year.

Six of the University of Wollongong’s (UOW) top academics have been named on the annual Highly Cited Researchers 2020 list from Clarivate.

The list identifies researchers who demonstrated significant influence in their chosen field or fields through the publication of multiple highly cited papers during the last decade. Their names are drawn from the publications that rank in the top 1 per cent by citations for field and publication year in the Web of Science citation index.

All six of the UOW researchers on the list are from the Australian Institute for Innovative Materials (AIIM).

Five of the researchers – Distinguished Professor Shi Xue Dou, Distinguished Professor Hua Kun Liu, Distinguished Professor Zaiping Guo, Distinguished Professor Yoshio Bando and Professor Shulei Chou – are from the Institute for Superconducting and Electronic Materials (ISEM) in AIIM. All five also appeared on last year’s Highly Cited Researchers list. Professor Guo is also a member of UOW’s School of Mechanical, Materials, Mechatronic and Biomedical Engineering within the Faculty of Engineering and Information Sciences.

The sixth highly cited researcher, Professor Jun Chen (pictured above), is from the Intelligent Polymer Research Institute (IPRI), another research centre within AIIM. He also appeared on the Highly Cited Researchers List in 2018.

“This result is further confirmation that AIIM is an absolute world leader in its field.”

Located on UOW’s Innovation Campus, AIIM takes a multi-disciplinary approach to research, bringing together biologists, clinicians, chemists, physicists, engineers and materials scientists. It was one of the first research facilities in Australia equipped to undertake ground-breaking research and also to develop the production processes, devices and prototypes that enable those research breakthroughs to be scaled-up for commercial application.

ISEM is a world-class research centre in superconducting and electronic materials science and technology. Its researchers are advancing developments in technologies including batteries for electric vehicles and energy storage; applied superconductivity for electrical and medical devices; energy conversion and transmission; spintronic and electronic materials for applications; terahertz science; and nano-structured materials.

Internationally recognised as a leader in electromaterials research, IPRI competencies lie in the design and synthesis of intelligent materials. IPRI is renowned for expertise in the group of multifunctional, stimuli-responsive materials – organic conducting polymers and carbons; used in diverse applications of energy and health.

The methodology that determines Clarivate’s “who’s who” of influential researchers draws on the data and analysis performed by bibliometric experts and data scientists at the Institute for Scientific Information at Clarivate. It also uses the tallies to identify the countries and research institutions where these scientific elite are based.

Institute for Scientific Information Senior Citation Analyst David Pendlebury said: “In the race for knowledge, it is human capital that is fundamental and this list identifies and celebrates exceptional individual researchers at the University of Wollongong who are having a great impact on the research community as measured by the rate at which their work is being cited by others.” Full story :www.uow.edu.au/media/2020/six-uow-academics-on-highly-cited-researchers-2020-list.php

Masters Student
Ane Albillos Sanchez

Masters Student Borja Sanz

Fish Skin For 3d Printing

Who would have thought fish skin could be used in 3D printing? Well, it just so turns out that a number of ACES researchers had that very thought, highlighting their findings in a recent paper published in Biomedicines.

The research paper explores using the collagen extracted from fish skin, provided by local seafood company Better Choice Fisheries, for coaxial printing that promotes neuromuscular junction formation – a critical step in nerve/muscle bioengineering.

The publication contained input from University of Wollongong (UOW) Biofabrication Masters Students Borja Sanz, Ane Albillos Sanchez as well as ACES researchers Bonnie Tangey, Dr Kerry Gilmore, Dr Zhilian Yue, Dr Xiao Liu and ACES Director Prof Gordon Wallace.

To find out more about the research and how the idea to use fish skin came about, we caught up with contributing author Dr Liu.

You were able to use fish skin for 3D printing. Could you explain a bit more about this research you conducted?

We explored the extraction, purification and modification of collagen from fish skin that would usually be thrown away as waste. Collagen is commercially available and normally a bovine extract, but after comparing the two, we found the quality of our fish collagen to be excellent.

We then took this a step further; modifying the collagen to make it amenable to 3D printing. This allowed us to print neural and muscle cells together to build neuromuscular junction constructs, which is difficult to achieve using traditional fabrication methods.

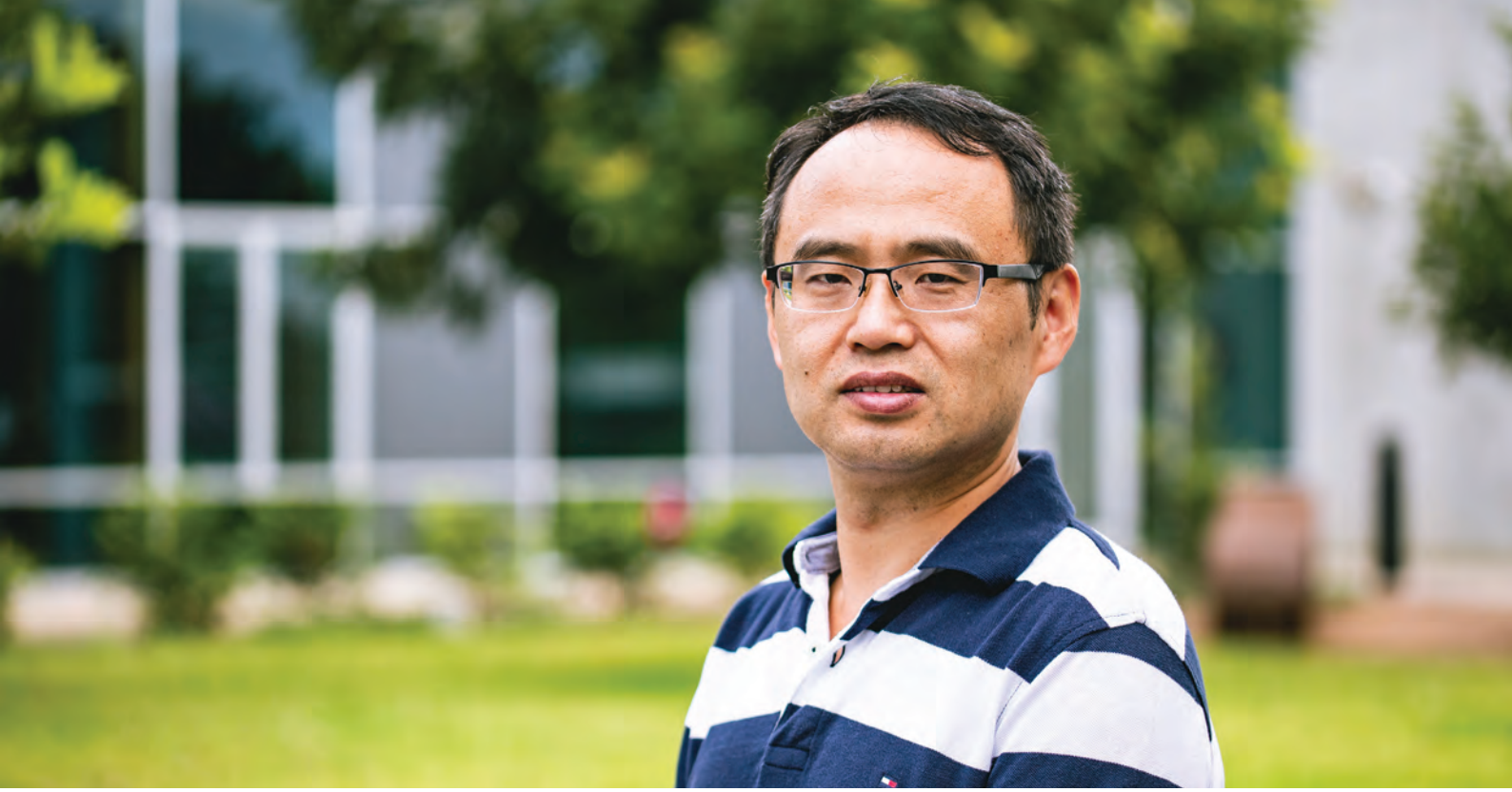
HOW DID IT COME ABOUT?

We started by searching for alternative sources of collagen. To modify collagen and make it printable, we needed large amounts of it, and the commercially available collagen, bovine as mentioned, was too expensive, so we decided to extract and purify it by ourselves.

Marine based collagen has a lot of advantages for tissue engineering applications compared to bovine and other terrestrial animals such as cows and pigs. The use of terrestrial collagen, as biomaterials in tissue engineering applications, is limited due to the risk of the transmission of zoonotic diseases like foot and mouth disease, bovine spongiform encephalopathy and avian influenza. There are also religious barriers to the use of bovine and porcine products in many cultures. With that in mind, fish collagen was a great alternative

WHAT IS THE FUTURE IMPLICATION OF THIS RESEARCH?

Marine based collagen has a potentially huge market for the food and beauty industry as well as being a very important material for tissue engineering for clinical applications. The next step is to standardise and scale up the extraction and purification process of marine collagen and translate it into a product. FOR THE FULL STORY : https://electromaterials.edu.au/2021/01/19/fish-skin-for-3d-printing/



Professor Shujun Zhang Named As IEEE Fellow

Honours conferred for outstanding records of accomplishment in his field

Professor Shujun Zhang from the Institute for Superconducting and Electronic Materials, Australian Institute for Innovative Materials, was recognised for his contributions to the development of advanced piezoelectrics for transducers. These will deeply impact our everyday lives, with applications in areas including medical imaging ultrasonics and acoustic transducers and sensors for health, safety and the sustainable development of society

The title of IEEE Fellow is conferred upon a person with an outstanding record of accomplishments in any of the IEEE fields of interest and is recognised by the technical community as a prestigious honour and an important career achievement.

The IEEE has more than 400,000 members in 160 countries, and is a leading authority on a wide variety of areas ranging from aerospace systems, computers and telecommunications to biomedical engineering, electric power and consumer electronics.

Professor Zhang's work is focused on the field of materials science and engineering. This includes research into dielectric, piezoelectric, ferroelectric and electrocaloric materials in different forms such as ceramics, textured ceramics, crystals, composites, polymers, and thick film.

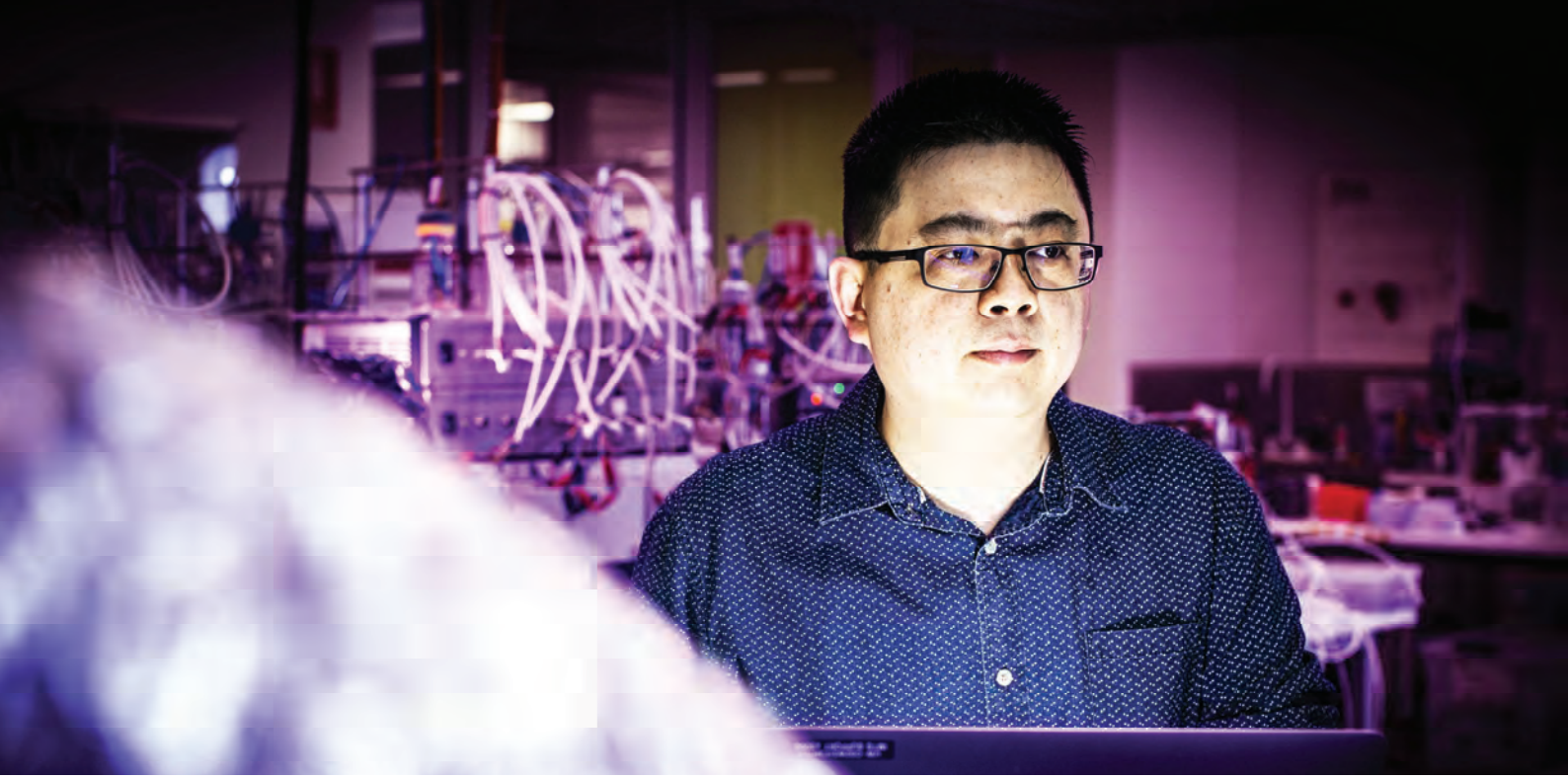
His current research focuses on the material design-fabrication-microstructure-property relationship of electronic materials for piezoelectric sensor, acoustic transducer and energy storage/harvesting applications.

Professor Zhang is a Fellow of the American Ceramic Society (2019) and was an Australian Research Council Future Fellow from 2015 to 2019.

The Australian's 'Research' magazine named him as the Australian Field Leader in Ceramic Engineering in (2019), and the American Ceramic Society awarded him the Ross Coffin Purdy Award in 2020 for "the most valuable contribution to ceramic technical literature".

Professor Zhang is the associate editor-in-chief of IEEE Transaction on Ultrasonics, Ferroelectric and Frequency Control, section editor-in-chief of MDPI's Crystals, and an associate editor of Science Bulletin, Journal of the American Ceramics Society and Journal of Electronic Materials.

Professor Zhang holds 10 US patents and has co-authored more than 500 papers in peer-reviewed journals. Since joining UOW in 2015, he has published more than 130 papers including 10 papers in Science, Nature and their sister journals.. For the full story : https://www.uow.edu.au/media/2020/professor-shujun-zhang-and-professor-willy-susilo-named-as-ieee-fellows.php



Dr Wei Kong Pang Wins Australian Synchrotron Research Award

Recognition for work developing battery technologies for next-gen energy storage

The Australian Nuclear Science and Technology Organisation (ANSTO) has awarded the Australian Synchrotron Research Award for early career researchers to Dr Wei Kong Pang from the University of Wollongong (UOW).

The Australian Synchrotron Research Award is awarded by ANSTO every year to an emerging leader in synchrotron research with less than 10 years of post-PhD experience.

Dr Pang is an ARC Future Fellow and Senior Research Fellow at the Institute for Superconducting and Electronic Materials (ISEM) at UOW.

His research focuses on understanding and developing rechargeable metal-ion battery technologies, including the atomic-scale characterisation of electrode materials.

“I am excited to receive the Australian Synchrotron Research Award for my work. I would not have been able to achieve this recognition without the great support of ANSTO, ISEM and UOW,” Dr Pang said.

“For me, the award is a reward for work well done, and encouragement for doing more.

“Mechanistic studies offer an in-depth understanding of battery materials, with the application of synchrotron techniques playing an important role and allowing rational improvement, stimulating the development of next-generation energy storage.”

Professor Peele said that Dr Pang had made significant advances in understanding the relationship of structure to chemistry in metal-ion battery technologies using a variety of X-ray scattering methods and other techniques.

“I am absolutely delighted that we were able to recognise Dr Pang for his outstanding work using our powder diffraction beamline. We are all aware of the enormous potential of metal-ion batteries and Dr Pang has been a powerhouse in this area,” Professor Peele said.

The Australian Synchrotron is a world-class research facility in Melbourne used by more than 5000 scientists a year. By accelerating electrons at the speed of light around its 216-metre circumference, the synchrotron produces intense beams of light more than a million times brighter than the sun.

These beams are used via experimental facilities to examine the molecular and atomic details of a wide range of materials.

Advanced techniques are applied to research in many important areas including health and medical, food, environment, biotechnology, nanotechnology, energy, mining, agriculture, advanced materials and cultural heritage.

Professor Peter Lay from the University of Sydney was awarded the Australian Synchrotron Lifetime Contribution Award, which is granted every two years in recognition of outstanding contributions to synchrotron science in Australia.

For the full story: https://www.uow.edu.au/media/2020/dr-wei-kong-pang-wins-australian-synchrotron-research-award.php

2020 AIIM for GOLD Day

24th November, 2020

AUSTRALIAN INSTITUTE *for* INNOVATIVE MATERIALS

UNIVERSITY OF WOLLONGONG AUSTRALIA

On 24th of November 2020 AIIM hosted its annual "AIIM for GOLD Day" in the iC Event Centre, Innovation Campus.

The AIIM for GOLD day showcases the advances and outcomes of research projects funded by AIIM for GOLD internal funding scheme. Once again we have seen that even the smallest of ideas can be cultivated into exciting projects that lead to new findings, research directions, and unexpected collaborations

The quality of presentations was acknowledged by the members of judging panel (Prof. Clive Baldock, Prof. Jiazhao Wang, Prof. Attila Mozer) and was also reflected by them taking the time to find the winner.

After lengthy deliberations Dr. Johnson Chung and his team were the recipients of the main prize at AIIM GOLD Day 2020.

The presentations by AIIM researchers were competing for the main AIIM GOLD Day prize – Silver level EMC subscription worth $5,000. The six presentations were (in order of appearance):

1. **Dr. Caiyun Wang** - Copper-based catalysts for selective electroreduction of carbon dioxide to multi-carbon products
2. **Dr. Azdiar Gazder** - Phase orientation relationships: Seeing the big picture at the interphase boundary
3. **Dr. Johnson Chung** - Fabrication of high-resolution, flexible graphene/polycaprolactone scaffolds using melt-electro writing technique
4. **Dr. Andrew Nattestad** - Practical in situ ammonia sensors facilitating fundamental and proof-of-concept research into nitrogen reduction reactions
5. **Dr. Jon Knott** - Innovative organogels for low-cost sodium-ion battery separators
6. **Mr. Jiayi Chen** - Exploring the possible roles of g-C3N4 in electrocatalysis applications

Three ISEM students granted the 2019 Chinese Government Award Of Outstanding Self-Financed Students Abroad, China Scholarship Council.

The Chinese Government Award for Outstanding Self-financed Students Abroad was established by the China Scholarship Council in 2003, and it is considered to be the highest award given by the Chinese government to graduate students studying aboard. Recipients are chosen worldwide each year for their outstanding accomplishments in academia. 2019 saw three of AIIM's ISEM students gaining this award.Congratulations goes to Mingzhe Chen , Weihong Lai and Mengmeng Lao on this very special achievement.

Interested To Learn More About AIIM And How We Can Work Together ?

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