Innovation
Collaboration
Research Excellence

AUSTRALIAN INSTITUTE *for* INNOVATIVE MATERIALS

UNIVERSITY OF WOLLONGONG AUSTRALIA

The Australian Institute for Innovative Materials is a purpose-built facility helping to advance materials research, innovation and application.

Innovative ideas are found at the intersection of different approaches to a problem and that is why at the University of Wollongong we connect different disciplines and encourage innovation through collaboration and interaction.

Located at the University of Wollongong's Innovation Campus, the purpose-built Australian Institute for Innovative Materials houses the flagship research groups – the Intelligent Polymer Research Institute and the Institute for Superconducting and Electronic Materials – bringing together chemists, engineers, physicists, biologists and materials scientists under one roof to interact, collaborate and innovate. It also houses the University's Electron Microscopy Centre.

The University of Wollongong is a world leader in multi-functional materials research. Researchers at the Australian Institute for Innovative Materials are driven by a desire to develop and explore new materials that have special features, can improve performance or have new applications.

Throughout our 60-year history the University of Wollongong has built an international reputation for world-class research and are one of Australia's best research institutions, ranking in the top 1% globally for research quality. Independent research performance indices (Excellence in Research Australia 2015) ranks the University of Wollongong at well above world standard (five stars) in:

- Macromolecular and Materials Chemistry
- Materials Engineering
- Physical Chemistry
- Manufacturing Engineering
- Medicinal and Biomolecular Chemistry
- Inorganic Chemistry
- Analytical Chemistry

At the Australian Institute for Innovative Materials we connect world-class researchers, state-of-the-art research and prototyping facilities to help transform multi-functional materials research into commercial reality.

Will Price
Executive Director

AUSTRALIAN INSTITUTE FOR INNOVATIVE MATERIALS

What are innovative materials and why are they important?

New materials and new applications for those materials will continue to drive advances that improve productivity in existing industries and help create new ones. They have shaped the world in which we live and they will shape the future as they are discovered, developed and applied to meet some of society's greatest challenges – climate change, health and energy technologies.

New materials need new production technologies

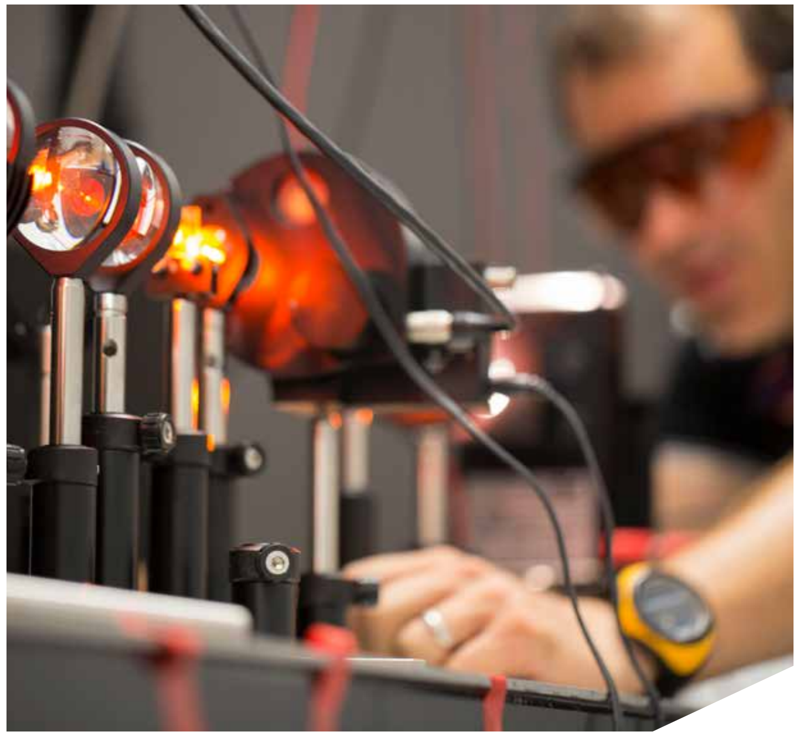
Metal alloys like stainless steel, polymers like PVC, the "plastic" casing of mobile phones and the batteries and electronics making them work are all examples of innovative materials and their application.

New and innovative materials have driven, and have been driven by, the development of revolutionary technologies. Through time, new and innovative materials have also helped items to become smaller, stronger, lighter and more powerful.

Researchers at the Australian Institute for Innovative Materials are at the cutting edge of developing and applying new and innovative materials and the new and innovative methods that are needed to produce them. The Australian Institute for Innovative Materials is the first Australian facility that bridges the gaps between research breakthroughs, prototyping and commercialisation.

To take new materials from fundamental research, through the proof of concept stage and into real world applications, novel fabrication, processing and manufacturing methods also need to be developed.

Helping to transform research into reality is important in bringing end-users closer to new discoveries and enhancing fundamental research. At the Australian Institute for Innovative Materials fundamental research, new processes and production technologies and the commercialisation of multifunctional materials are integrated and inform each other to advance the research and its application.



multidisciplinary research at the Australian Institute for Innovative Materials brings together biologists, clinicians, chemists, physicists, engineers, microscopists and materials scientists.

The Intelligent Polymer Research Institute

Led by Australian Laureate Fellow, Professor Gordon Wallace FAA; FATSE, the Intelligent Polymer Research Institute is a research strength of the University of Wollongong and the lead node in the Australian Research Council Centre of Excellence for Electromaterials Science.

Professor Wallace established the world's first intelligent polymer research laboratory and is a recognised world leader in the development of these materials.

Researchers work with materials in the nano-domain, with particles as small as one billionth of a millimetre, where electronic conductivity is vastly higher than in larger structures. Their challenge is to make materials at these nanodimensions and assemble them into larger structures that retain their special characteristics to provide improved functionality.

New developments in nanoscale materials offer the potential for groundbreaking improvements. Key areas of research for the group include intelligent polymers and nanostructures; new electrode materials and functional electrolytes; spinning nanostructure fibres; electromechanical actuators; chemical and mechanical sensing networks; organic and inorganic batteries; nano biotechnology and biomaterials; cellular interactions; and medical devices for diagnostic and therapeutic use.

The Institute for Superconducting and Electronic Materials

The Institute for Superconducting and Electronic Materials is a world leading research institute dedicated to developing new and innovative technologies to generate, transport and store energy and improve the efficiency of electronic devices.

The Institute is led by Australian Research Council Professional Fellow and Fellow of the Australian Academy of Technological Science and Engineering and ranks among the leading research groups globally in the fields of superconducting materials and lithium ion battery research.

Researchers and students at the Institute have a strong track record of research publication with more than1350 referred papers and their publications have attracted more than 11,000 citations.

The lead research partner of the vehicle electrification program for the Australian Automotive Cooperative Research Centre, the Institute is working with Australian and international industry partners to develop batteries for electric vehicles that have a longer life and a shorter charge time.

The Institute's research program is also working on new materials and technologies for applications including medical equipment, telecommunication technologies, biomedical applications and turning waste heat into a usable source of energy. Researchers with the Institute for Superconducting and Electronic Materials work to advance scientific knowledge and discovery and to apply it to solving real-world problems.

Research teams at the australian institute for innovative materials are working in areas including energy generation, transmission and storage; health and medical bionics; and fundamental materials research and discovery.

Energy research – helping power our future

Superconducting wires

Emerging superconductor technology has the potential to be used in wire metal coils for magnetic resonance imaging (MRI) machines, fault current limiters, power cables, motors, generators, transformers and energy storage devices. The Institute for Superconducting and Electronic Materials has developed new manufacturing techniques for superconducting wires that improves performance and reduces cost while increasing the ease of production.

Photovoltaic Research

The Intelligent Polymer Research Institute's Professor David Officer is a leading authority on organic photovoltaic solar cells that operate in ambient light. Increasing solar cell efficiency and focusing on inexpensive raw materials using existing manufacturing techniques and equipment inexpensive solar energy with very low capital cost will soon be a reality.

Titanium dioxide is one of the most promising semiconductor materials for use in photovoltaic and photocatalytic applications; however, the performance is affected by the shape and size of the nanostructures. In collaboration with Korean colleagues, researchers at the Institute for Superconducting and Electronic Materials have recently developed a novel approach for the synthesis of titanium dioxide nanostructures that could prompt further improvements in performance and efficiency.

Building better batteries – the energy storage solution

Energy storage solutions are critical for electric vehicles, renewable energy and bionic devices.

The Institute for Superconducting and Electronic Materials battery research program is focused on developing low cost, high power rechargeable batteries for electric and hybrid vehicle use. Breakthroughs have already led to increased energy capacity and power density; enhanced battery lifecycle; improved operational safety; and on-board charging mechanisms.

Novel energy storage is a critical requirement of next generation bionic devices. A research team led by the Intelligent Polymer Research Institute's Associate Professor Peter Innis has developed new flexible polymer batteries that will power products and add functionality to medical devices.

Fabricating bionic structures

Energy transfer from conventional electrodes to biological systems can assist in areas such as nerve regeneration, wound healing and bone regrowth through electrical stimulation of cellular behaviour.

Researchers in the Intelligent Polymer Research Institute and Centre of Excellence for Electromaterials Science are developing advanced fabrication methods for the manufacture of bionic structures.

Ink jet printing, 3D extrusion printing and wet-spinning methods are being adapted to produce biomaterials. These novel approaches to materials fabrication provide a high degree of reproducibility and control of the structure which are all critical in determining the final device performance.

This has led to the development of a hand-held "bio pen" which allows surgeons to repair damaged and diseased bone material by delivering live cells growth factors directly to the site of the injury, accelerating the regeneration of functional bone and cartilage.

Graphene – An opportunity not to be missed

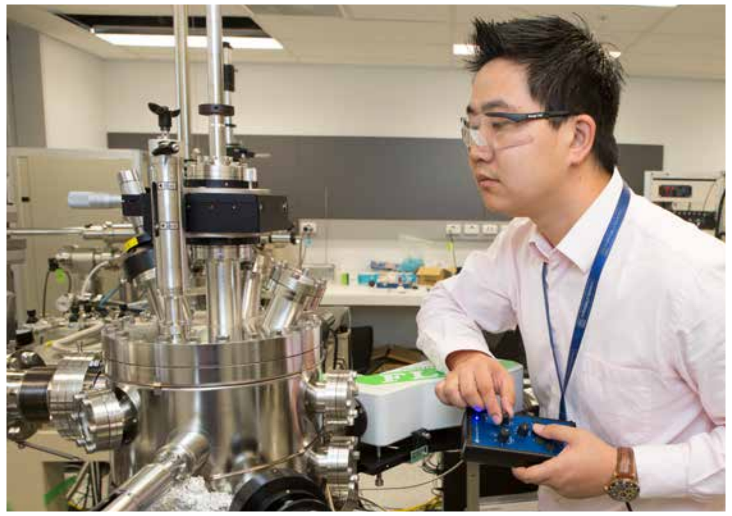
Individual sheets of carbon (graphene) have potential application in electronics, composites for construction or transport, electrodes for energy storage and conversion and even in the area of biomaterials.

University of Wollongong researchers have invented a simple process to produce graphene in solution. While this process is a major advance towards the development of low-cost graphene-based products, the next stage of development requires new processes to convert the graphene solutions into composite materials, electrode materials and biomedical devices for testing and demonstration purposes.

Silicene – The material of the future

A team from the Institute for Superconducting and Electronic Materials was the first group in Australia to successfully fabricate single-atom-layer silicene.

Theoretical calculations have predicted that silicene would contain exciting properties that could be used in a range of applications. However, its complicated formation chemistry and physics makes the fabrication of this material to be extremely difficult. Rich in possible applications from computer chips to aircraft parts, the group is also the first to have been able to conduct Raman spectroscopy investigation on the phonon modes using scanning near-field optical microscopy. The team will continue their efforts to advance their knowledge of the fundamental properties of silicene and how they can harness its properties.



University of Wollongong Electron Microscopy Centre

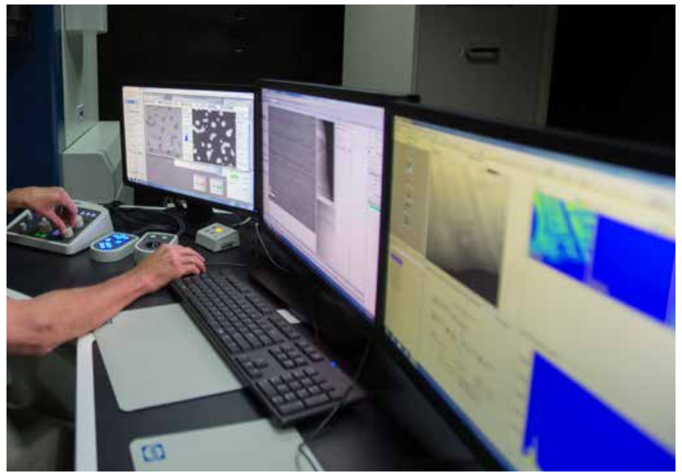
World-class research requires world-class characterisation facilities. As part of its more than 9,000m² of laboratory and office space, the Australian Institute for Innovative Materials facility houses the University's electron microscopes in a purpose-built electron microscopy facility containing seven microscopy suites, two sample preparation laboratories and analysis facilities.

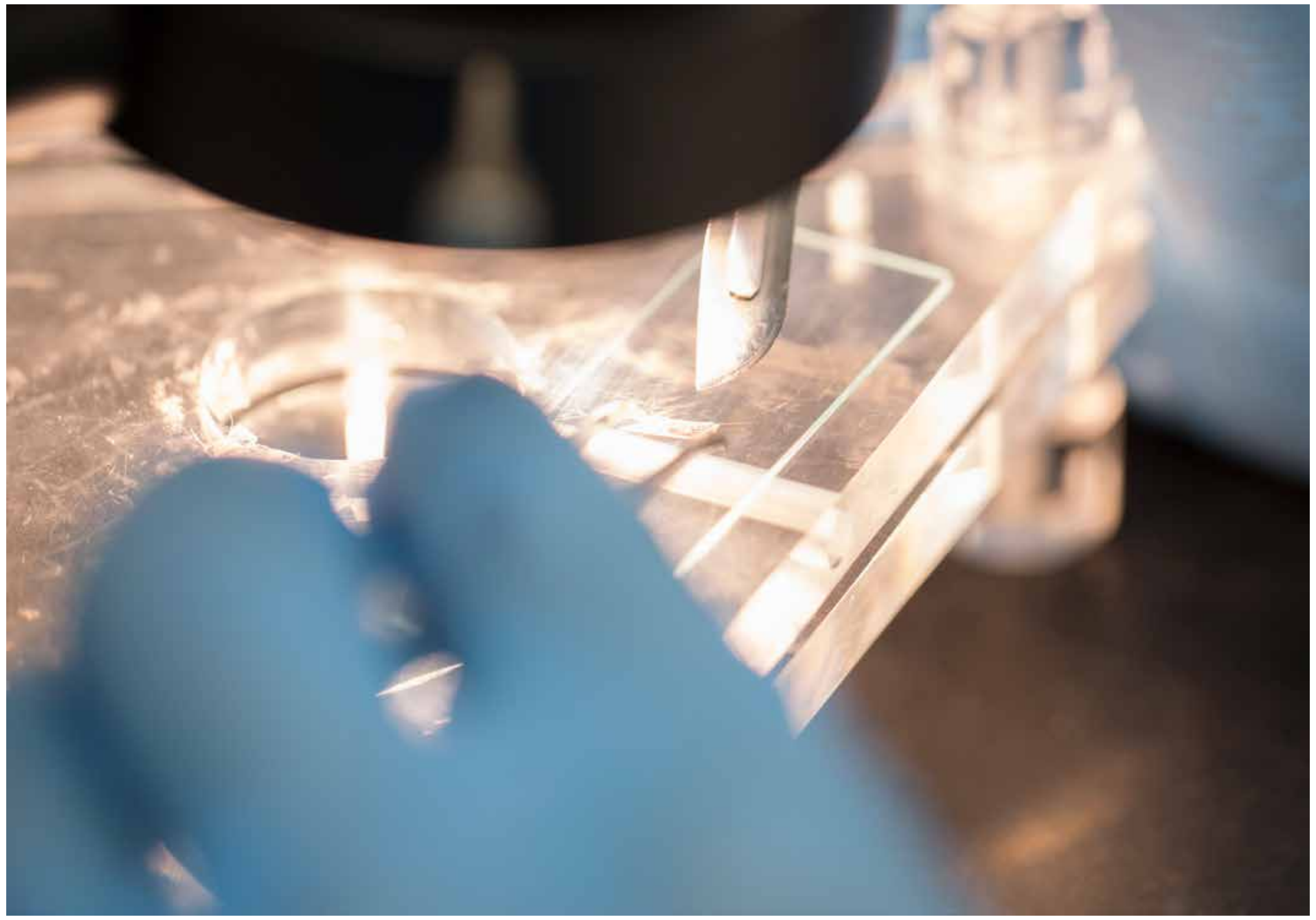
The Centre exceeds the requirements for the next generation of high resolution microscopes and their ancillary tools while minimising the environmental effects on the SEM, FEG-SEM and TEM instruments it houses.

The Centre includes a JEOL ARM-200F aberration corrected transmission electron microscope – only the second microscope in Australia to be fitted with an aberration corrector. This microscope can focus an electron beam to less than the diameter of an atom (about one millionth the thickness of a human hair), enabling the atomic structure of materials to be imaged at magnifications of up to 150 million times.

The facility also contains two state-of-the-art preparation laboratories housing precision cutters, quality grinding and polishing tools, room temperature and cryogenic microtomes and highly accurate ion polishing systems. The facility caters for characterisation of materials including metals, ceramics, polymers and biological specimens.

To add to the suite of characterisation facilities, which also include NMR, XRD and XPS instrumentation, the Australian Institute for Innovative Materials is also equipped with a three-chamber low-temperature scanning tunnelling microscope – the first of its type in Australia – which allows the examination and manipulation of materials at an atomic level.





The University of Wollongong at a glance

- Ranked in the top 2% of Universities in the World
- Ranked in the top 1% of Universities Globally for research quality
- Globally ranked in the top 20 best modern universities
- Strategically located between Sydney (1h drive) and Canberra (2.5h drive)
- 9 Campuses
- 2,100 full time staff
- 34,500 enrolled students
- Over 120,000 Alumni
- Over 210 academic and research collaborations globally
- Study Abroad and student exchange links with more than 160 international institutions

Located at the University of Wollongong's Innovation Campus

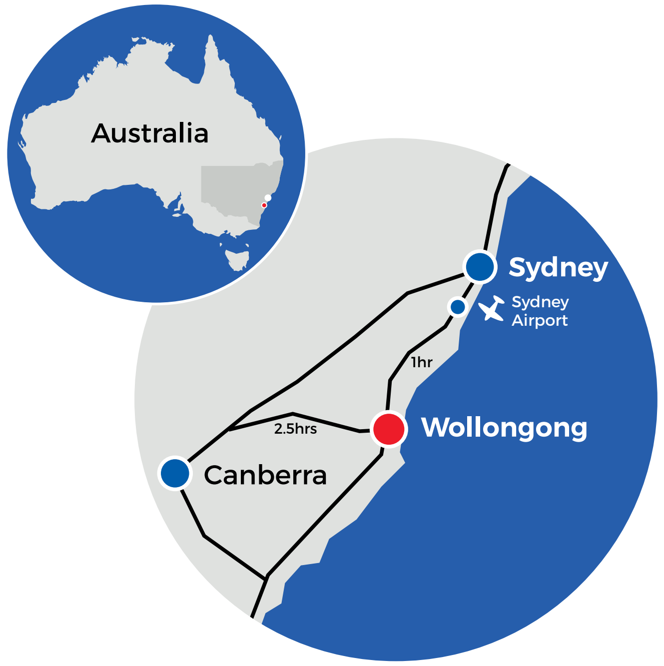
The University of Wollongong is ideal to establish or expand your presence in the Asia Pacific region with an Australian Base and high quality infrastructure. The Innovation Campus (iC) provides opportunities to partner with the University of Wollongong and its research teams and the ability to live and work in a beautiful coastal setting. The Innovation Campus is home to a growing number of industry clients, research institutes and the iAccelerate incubation hub for start-up companies.

iC Management, Operations and Leasing

For general information regarding the iC, its ongoing management, operations and leasing, please contact the iC Management Office on:

Email: info@innovationcampus.com.au

Phone: + 61 2 4221 5115



Get involved with research at the university of wollongong and the australian institute for innovative materials

The University of Wollongong and the Australian Institute for Innovative Materials offer unique opportunities to develop partnerships and collaborative arrangements, working with world-class researchers in state-of-the-art facilities.

For more information on collaboration, partnerships and other opportunities please contact:

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