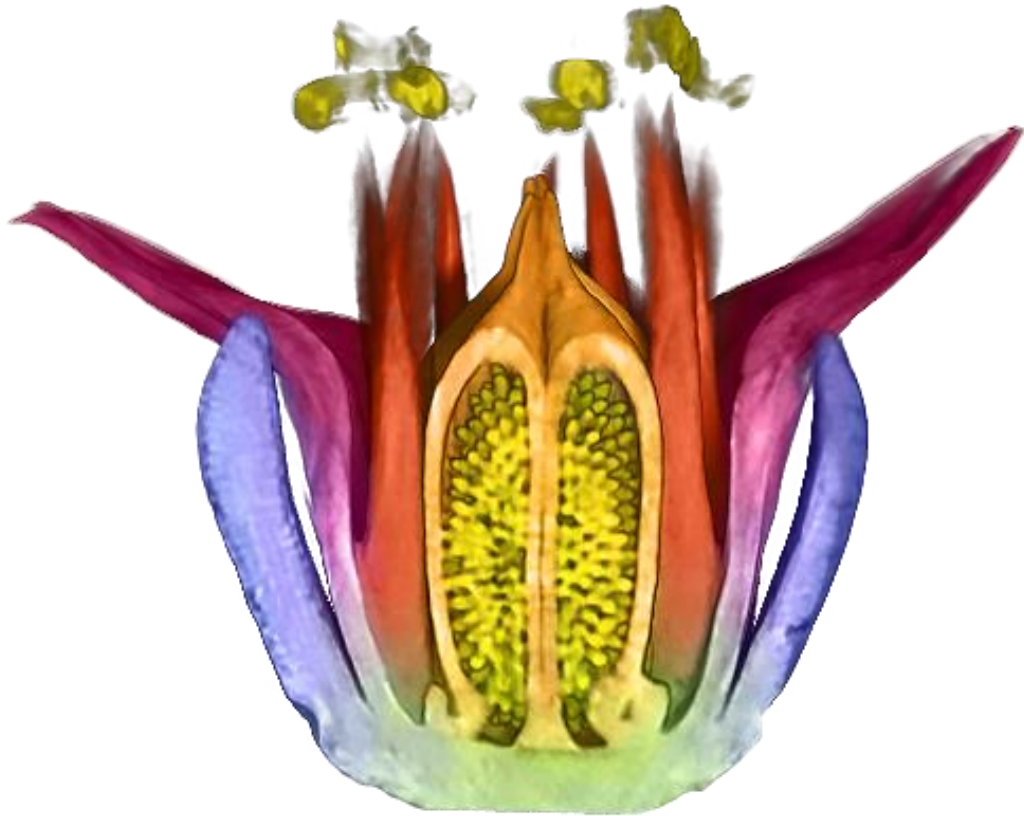


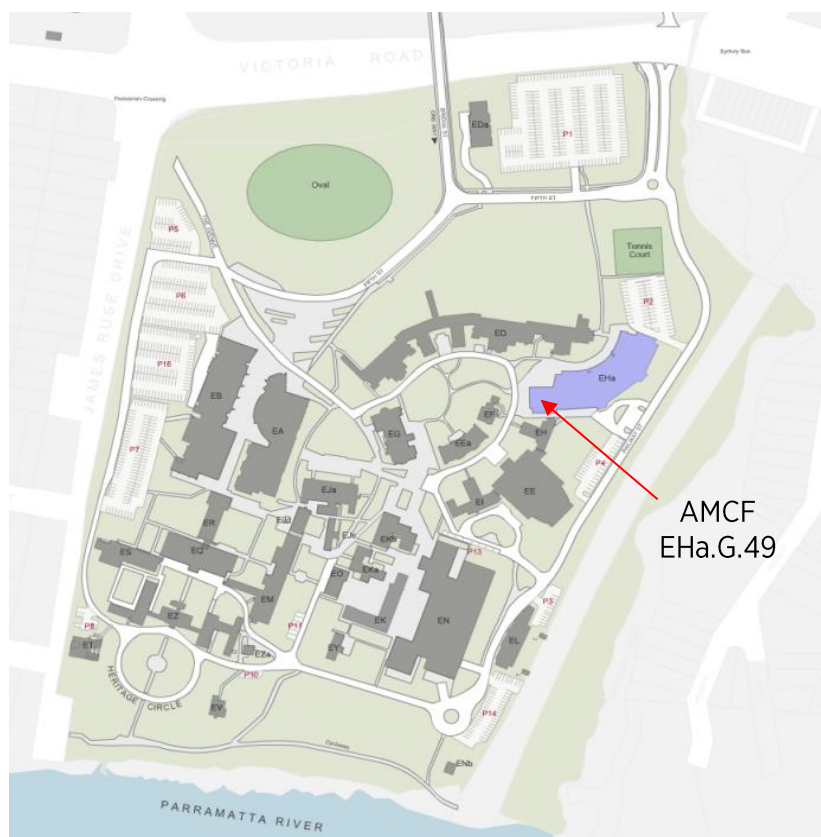
WESTERN SYDNEY
UNIVERSITY



AMCF

Advanced Materials Characterisation Facility

Newsletter: July 2022



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Front Cover Image:

Colourised micro-CT image of a succulent flower showing an axial cross section view.

Back Cover Image:

A beautiful colourisation of spheres on the exochorion of a hatched spider egg.

9th Edition Newsletter, July 2022

Editors: Laurel George, Richard Wuhler and Daniel Fanna.

The AMCF is a part of the:

Research Infrastructure

Research Services

Office of the Deputy Vice-Chancellor (Research, Enterprise and International)



FROM THE FACILITY RESEARCH MANAGER

By the time you receive this newsletter, we will be nearing the end of July! I have no idea what has happened to the last 6 months. This year began with many users trying to catch up on their incomplete analysis after disruptions due to COVID restrictions last year. Let us try to forget 2020/2021! Despite COVID restrictions, the AMCF has been flat-out looking after users and running many samples for our researchers and HDR students.

Over the last 12 months, there have been a number of upgrades and new software placed on instrumentation. More importantly, last year we were very lucky to obtain an older micro-CT scanner. This has proven to be very popular with users from HIE, Science (SoSc) and Engineering (SoEDBE). It is amazing what nature has to show when we perform scans on its internal structure. Just have a look at the front image of this newsletter. It is starting to give the researchers many ideas on how designs in nature provide a solution to many engineering problems or a better understanding of natural materials. Look out for the story on micro-CT in this edition of the newsletter.

The latter half of this year will be continue to busy as we plan to run various introductory workshops on the use of our instruments and running advanced masterclasses on specialised instrumentation. Currently, we are running smaller group training. As always, we are happy to show anyone our facility. Do not hesitate to contact us for a walk through our labs (subject to COVID restrictions).

A handwritten signature in blue ink, reading "Richard Wuhrer".

Dr Richard Wuhrer
Facility Research Manager,
AMC Facility
26/07/2022

RECENT ACTIVITIES

HIE talks

Dr Richard Wuhrer was invited by the Hawkesbury Institute for the Environment (HIE), to present his talk “*Characterisation of Materials and Everything Else in the AMC Facility*”. This presentation covered the capabilities of the AMCF’s instrumentation. While the focus was on SEM investigations, microanalysis of samples and x-ray mapping (XRM) of natural materials, there were many examples of applications and discussions on how the AMCF instruments are being utilised in different disciplines of science, engineering, biology, environmental studies and chemistry. The AMCF was also included in a keynote presentation by WSU’s own Associate Professor Scott Johnson from HIE, for a graduate school in the Netherlands.



Ric presenting his talk at HIE, introduced by HIE PhD student Ximena Cibils-Stewart.

SoEDBE Visits

On 25th March 2022, Dr Richard Wuhrer was keynote speaker at the School of Engineering, Design and Built Environment (SoEDBE) Research Seminar and presented on this month’s theme of “Materials Characterisation”. This was organised by Edward Huang who is a current PhD candidate in Engineering. In his presentation, Ric spoke about the array of specialist research facilities and the wide range of high-end scientific equipment that we use to support the research and industry communities at WSU. He introduced the AMCF’s instrumentation and characterisation techniques used for the analysis of micro- and nano-scale structures. Included in the presentation was information on imaging and microanalysis instrumentation (SEM, EDS, XRM), thermal characterisation techniques (TGA, DSC, TMA), vibrational spectroscopy (FTIR, Raman, UV-Vis) and X-ray analysis techniques (XRD, micro-CT), as well as supporting sample preparation equipment. At the end of the presentation, Ric answered questions from the audience on quantitative X-ray diffraction of soil samples and characterisation techniques for 3D printing technology.



Engineering PhD student and AMCF intern Edward Huang (left) with Ric (right), who both presented at the 2022 SoEDBE Research Seminar.

Ric also gave a presentation to the SoEDBE in December 2021 at their HDR Conference on “*Advanced Materials Characterisation – Analytical Techniques Aiding a Better Understanding of your Material*”. The increase in invitations to talk at various schools is a great sign that everyone is getting back in the lab after multiple lockdowns. Researchers are keen to get back to our facility and try new techniques. Fun times ahead!

Autumn 2022 Graduations

This year WSU has begun holding graduations on campus again and it is great to see all the gowns and grins. It is especially rewarding when some of the researchers who have used the AMCF stop by to get photos with their favourite instruments on their special day. Well done to all the Autumn 2022 graduates.



Newly minted Dr Matthew Van Leeuwen (left), and Hamid Fatemi (right) who graduated with a Bachelor of Engineering.

WSU Giving Day

The AMCF was pleased to be involved in the annual WSU Giving Day. We provided some of our scanning electron microscope (SEM) images, which were printed and set up unlabelled outside PSQ1. The “Guess the Image” installation was attended by participants on the day, including WSU’s very own Chancellor Professor Peter Shergold AC.

The highly successful day raised \$2,629,465, which will be used to support student scholarships, programs and research at WSU.



Image No. 6 was a coloured SEM micrograph of plant material, while Image No. 8 was of spider fangs taken by our own VC, Professor Barney Glover.

Generator Backup has Arrived

Advanced instrumentation such as that housed in the AMCF facility, are very sensitive to power surges and outages. Currently all our instruments are connected to universal power supplies (UPS's), which use batteries to keep the instruments going for short periods of time during a power outage, long enough for staff to get in and shut instruments down properly. Sometimes there is not enough time to shut down instruments, and consequently there are major issues to get instrumentation running again. The new generator is now backing up the facility in case of power outages, particularly if power is out for a number of hours or even days.



The generator, which will look after both the AMCF and SoSc, placed out the back of Building EHa. Thank you to everyone involved with making this happen.

Women in Science and Engineering Talk

The AMCF had the opportunity to showcase the many women who are taking advantage of the AMCF capabilities, with Dr Laurel George presenting via zoom to the WISE (Women in Science and Engineering) Club at John Therry Catholic College. The presentation was followed by an interview of Laurel with many questions on what it's like to research, work on and maintain instruments in an analytical characterisation laboratory. This was then followed by a game of "Guess the SEM Image" with students. We are looking forward to connecting face-to-face with school groups again soon.



A lovely thankyou card and calendar.

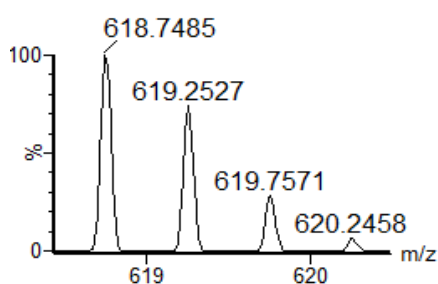


Some of the women having a great time and doing awesome research at the AMCF

Left to right, (Top) Tia Richardson, Denise Duff, Celine Neukomm, Vimala devi Seenivasagham, Julia Ryeland, **(Middle Top)** Ximena Cibils-Stewart, Alina Bekmukhametova, Zahra Nouri Emamzadeh, Leslie Gough, **(Middle Bottom)** Rani Carroll, Ruby George, Sonyia Juarez, Darcy Burns-Dunn, Dr Rebecca Vandegeer, **(Bottom)** Bianca Russom, Dr Shamila Salek, Dr Hayley Green, Dr Laurel George, Katherine Morrison and Rebekah Olden.

RESEARCHERS AT THE AMCF

Lorraine Peacey
School of Science



RESEARCH

PhD student Lorraine Peacey is researching the protein GnRH. This protein is found in the brain and is associated with hormones and reproductive health. GnRH has been found not only in humans and other mammals, but a wide range of species, meaning their function has been retained throughout evolution. The function of this protein is well known, but the mechanisms controlling its release are not well understood. Lorraine is particularly interested in the interaction of GnRH with metals, such as copper, nickel and zinc. It is possible that when the GnRH binds to metals, the metals help protect the protein from enzyme degradation.

IMPACT

By elucidating the structure of these ancient proteins and how they bind to metals, this research could help give a greater understanding of how they are involved in reproductive health, and how they could be fine-tuned to help solve reproductive issues.

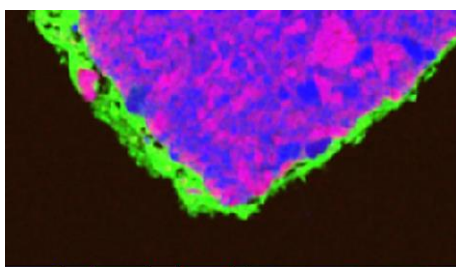
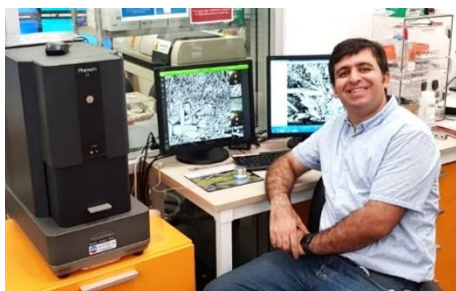
SUPERVISORS

Dr Chris Jones, Dr Feng Li and Professor Janice Aldrich Wright

INSTRUMENTS

Lorraine has been making good use of our **Mass Spectrometer** to characterise her protein and identify how it is bound to metals.

Dr Bijan Markhali
School of Engineering, Design and Built Environment



RESEARCH

Dr Bijan Markhali is a research assistant with Dr Mariam Darestani's group in the School of Engineering, Design and Built Environment. Bijan is researching materials which could be used to absorb contaminants (e.g. phosphorous, amines and PFAS) from water. To do this he is looking at how organic and inorganic substrates could be modified so their surfaces become more absorbent.

IMPACT

This technology is aimed at improving water quality and ecosystems at both small and large scales. At the moment the group is working with industry partners and is in the process of scaling up. For example, larger scale projects could involve cleaning up large bodies of water such as lakes that have been affected by excess fertilizer run-off from local farms.

INSTRUMENTS

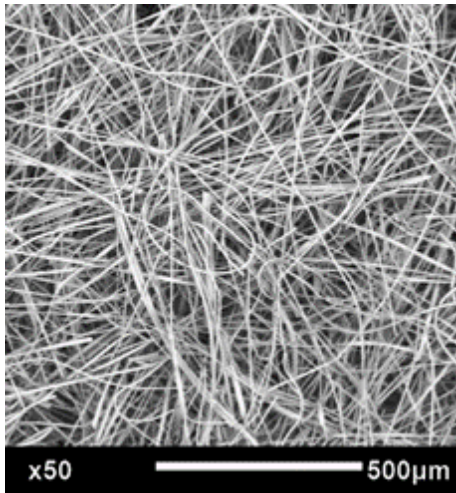
Bijan and his group have been making great use of the AMCF's instruments, using:

SEM/EDS: For elemental analysis and imaging surface morphology.

FTIR: To confirm surface modifications.

TGA/DSC: To check the thermal stability.

XRM: To map the position of elements.



RESEARCH

Md. Delwar Hossain is a PhD candidate researching and developing fire-testing protocols for lightweight cladding composites used on buildings. The fire risk rating of cladding composites is currently based solely on the percentage of materials used in its core. In his work, Delwar has been using material characterisation and small-scale thermal testing to better understand the flammability properties of these building materials and the gases that evolve during a fire.

IMPACT

Extraction of kinetics data from thermal testing can aid in the development of models that can explain and predict how various materials burn. Delwar expects that by applying these models to real-world fire simulations, he will be able to build a better fire testing framework and to provide improved classification of a material's fire risk, resulting in more fire-safe structures.

SUPERVISORS

A/Prof. Swapan Saha (WSU), Dr. Md Kamrul Hassan (WSU) and Dr. Anthony Chun Yin Yuen (UNSW).

INSTRUMENTS

Delwar has been busy at the AMCF, making good use of:

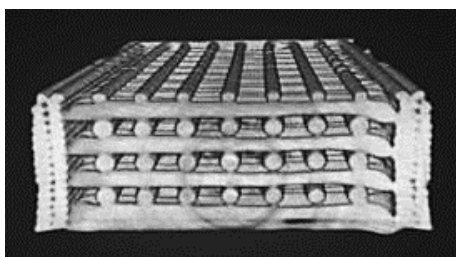
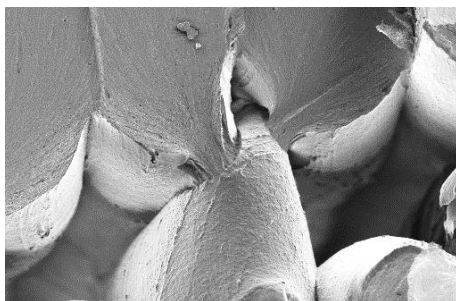
TGA/DSC: Test the combustion and pyrolysis of materials

Evolved Gas FTIR: To identify what gases are coming off

Kinetics Software: To extract and model kinetics data

SEM/EDS: Imaging and elemental analysis

FTIR: Confirm materials in composites



RESEARCH

Material science engineer Nima Zohdi, is a PhD student working on 3D printing of polymers and polymer nanocomposites using Fused Deposition Modelling (FDM) 3D printers. Nima's research is focused on investigating the influence of machine parameters and the reinforcement of polymers with nano-additives on the mechanical, thermal, and electrical properties of 3D printed parts, and how they vary along different axes. Nima will then use these results to build numerical models and rules for printing materials.

IMPACT

By having a better understanding of the factors which influence the final properties of a 3D printed part, and designing modified rules of mixture (m-ROM), Nima's work can help researchers and manufacturers choose the optimum 3D printer conditions needed to produce parts with better mechanical, thermal and electrical properties for both polymer and polymer nano-composite parts.

SUPERVISORS

Prof. Richard Yang, Prof. Yang Xiang and Dr Qinghua Zeng.

INSTRUMENTS

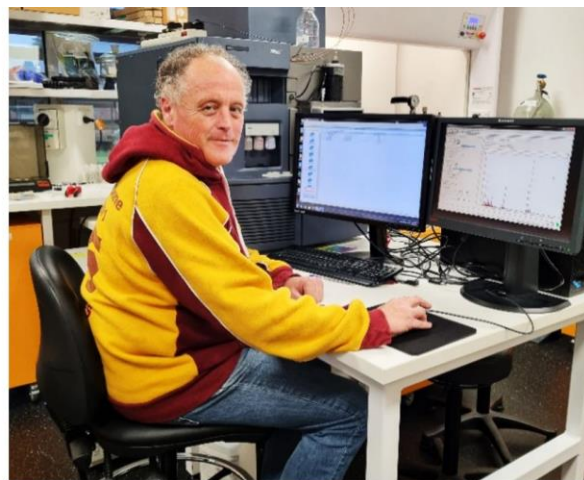
Nima has been using these AMCF instruments: **Zeiss FEG-SEM**, **Hitachi FlexSEM 1000 II**, **Phenom XL SEM** and **Jeol 6510 SEM** to image 3D printed parts as well as the nano-additives' surface morphologies. **FTIR** and **Raman** to confirm additive surface modifications, **TGA/DSC** to check the thermal stability, **Micro CT imaging** to look at internal air voids and layer adhesion.

RESEARCHER FOCUS:



Professor Priti Krishna

Professor Krishna (shown left) is the Foundation Chair of Agriculture at WSU, and has expertise in a diverse range of related fields within the plant sciences. Her recent work with the highest impact involves researching the role of phytohormones in plant stress tolerance, heat shock protein complexes in plant disease resistances and aiding the development of a nutraceutical industry for sea buckthorn in Ontario, Canada.



Dr Richard Thomas

Dr Richard Thomas is a senior lecturer in Sustainable Agriculture at WSU. His expertise is in agricultural geochemistry and precision image analysis for agricultural applications. His current research project, conducted in collaboration with AMCF, combines these research areas through a study of photonic films used in greenhouse production.

RESEARCH

Prof. Krishna and Dr Thomas lead a productive research group in agricultural technologies in the SoSc (Science). Currently they are conducting research into luminescent light emitting agricultural films (LLEAFs). These films, when placed over greenhouses, can shift the light spectrum of natural light to one that encourages more plant growth. It has been shown that these films can be used to enhance the phenolic content in fruits and leaves and can also affect other aspects of plant development.

The current research project aims to determine the effects of light spectral modifications on fruit nutritional qualities, and how the nutritional quality of berries could be optimised. The project seeks to develop production conditions that will maximise the nutraceutical traits in a blueberry fruit, a fruit which is rich in dietary fibre, vitamin C, polyphenols and phenolic acids.

IMPACT

It is hoped that the research conducted on these agricultural films, and the plants grown under them, will help to increase the international competitiveness of the Australian fruit industries.

USE OF AMCF INSTRUMENTS

Dr Thomas and Prof. Krishna have been using a full suite of instruments at the AMCF to characterise their film compounds, including: Scanning Electron Microscopy (**SEM**), X-Ray Diffraction (**XRD**), Fourier Transform InfraRed spectroscopy (**FT-IR**), Mass Spectrometry (**MS**), UV-Visible spectrophotometry (**UV-Vis**), Simultaneous Thermal Analysis (**STA-TGA/DSC**), and cold-stage Dynamic Scanning Calorimetry (**DSC**).

RECENT PUBLICATIONS and PRESENTATIONS

JOURNALS

1. Alina Bekmukhametova, Mir Muhammad Nasir Uddin, Jessica Houang, Chandra Malladi, Laurel George, Richard Wuhrer, Shital K. Barman, Ming J. Wu, Damia Mawad, and Antonio Lauto, (2022), "Fabrication and characterization of chitosan nanoparticles using the coffee-ring effect for photodynamic therapy", *Lasers in Surgery and Medicine*, 54(5), 758-766.
2. Johanna Wong-Bajracharya, Vasanth R. Singan, Remo Monti, Krista L. Plett, Vivian Ng, Igor V. Grigoriev, Francis M. Martin, Ian C. Anderson, and Jonathan M. Plett, (2022), "The ectomycorrhizal fungus *Pisolithus microcarpus* encodes a microRNA involved in cross-kingdom gene silencing during symbiosis", *Proceedings of the National Academy of Sciences*, 119(3), e2103527119.
3. Philip Nikolic, Poonam Mudgil, David G. Harman & John Whitehal, (2022), "Untargeted lipidomic differences between clinical strains of methicillin-sensitive and methicillin-resistant *Staphylococcus aureus*", *Infectious Diseases*, 54(7), 497-507.
4. Michael Radzieta, Timothy J. Peters, Hugh G. Dickson, Allison J. Cowin, Lawrence A. Lavery, Saskia Schwarzer, Tara Roberts, Slade O. Jensen, Matthew, (2022), "A metatranscriptomic approach to explore longitudinal tissue specimens from non-healing diabetes related foot ulcers", *APMIS, Journal of Pathology, Microbiology and Immunology*, 130, 383-396.
5. Sam Macartney, Richard Wuhrer, Laurel George, Leigh R. Sheppard, "Preparation of aluminium doped Ta₃N₅ films via nitridation of sputtered tantalum oxide films", *Materials Chemistry and Physics*, 287, 126110.
6. Kash A. Bhullar, Michael M. Horgan, Ashley Le, David Fania, Richard Wuhrer, Valentin Razmovski-Naumovski, Kelvin Chan, Patrice Castignolles, Marianne Gaborieau, (2022), "Assessing the quantification of acetylation in konjac glucomannan via ATR-FTIR and solid-state NMR spectroscopy", *Carbohydrate Polymers*, 291, 119659.
7. Hyun sung Min, Alexander R. Craze, Takahiro Taira, Matthew J. Wallis, Mohan M. Bhadbhade, Ruoming Tian, Daniel J. Fanna, Richard Wuhrer, Shinya Hayami, Jack K. Clegg Christopher E. Marjo, Leonard F. Lindoy and Feng Li, (2022), "Self-Assembly of a Rare High Spin FeII/PdII Tetradecanuclear Cubic Cage Constructed via the Metalloligand Approach", *Chemistry*, 4(2), 535-547.
8. Md Delwar Hossain, Swapna Saha, Md Kamrul Hassan, Anthony Chun Yin Yuen, Cheng Wang, Waseem Hittini, Laurel George, and Richard Wuhrer, (2022), "Testing of aluminium composite panels in a cone calorimeter: A new specimen preparation method", *Polymer Testing*, 106, 107454.
9. Scott N. Johnson, Ximena Cibils-Stewart, Jamie M. Waterman, Fikadu N. Biru¹, Rhiannon C. Rowe and Susan E. Hartley, (2021), "Elevated atmospheric CO₂ changes defence allocation in wheat but herbivore resistance persists", *Proceedings of the Royal Society B*, 289(1969), 25363.
10. Rebecca K. Vandegeer, Chenchen Zhao, Ximena Cibils-Stewart, Richard Wuhrer, Casey R. Hall, Susan E. Hartley, David T. Tissue, and Scott N. Johnson, (2021), "Silicon deposition on guard cells increases stomatal sensitivity as mediated by K⁺ efflux and consequently reduces stomatal conductance", *Physiologia Plantarum*, 171(3), 358-370.

11. Matthew Paul Van Leeuwen, Michelle Rosemarie Toutounji, Jitendra Mata, Rachelle Ward, Elliot Paul Gilbert, Patrice Castignolles, and Marianne Gaborieau, (2021), "Assessment of starch branching and lamellar structure in rice flours", *Food Structure*, 29, 100201.
12. Yingying Guo, Y. X. Zhang, Khin Soe, Richard Wuhler, Wayne D. Hutchison, and Heiko Timmers, (2021), "Development of magnesium oxychloride cement with enhanced water resistance by adding silica fume and hybrid fly ash-silica fume", *Journal of Cleaner Production*, 313, 127682.
13. Scott N. Johnson, Jamie M. Waterman, Richard Wuhler, Rhiannon C. Rowe, Casey R. Hall, and Ximena Cibils-Stewart, (2021), "Siliceous and non-nutritious: Nitrogen limitation increases anti-herbivore silicon defences in a model grass", *Journal of Ecology*, 109(11), 3767-3778.
14. Alexander R. Craze, Hikaru Zenno, Michael C. Pfrunder, John C. McMurtrie, Shinya Hayami, Jack K. Clegg, and Feng Li, (2021), "Supramolecular Modulation of Spin Crossover in an Fe (II) Dinuclear Triple Helicate", *Inorganic Chemistry*, 60(9), 6731-6738.
15. Kash Bhullar, Richard Wuhler, Patrice Castignolles, Marianne 'Marion' Gaborieau, (2021), "Molecular insights into industrial polymers from solid-state NMR to design bio-based adhesives", ISMAR/APNMR conference, *22nd International Society of Magnetic Resonance Conference 9th Asia-Pacific NMR Symposium (APNMR9)*.

KEYNOTE PRESENTATIONS

16. Marianne 'Marion' Gaborieau, Kash Bhullar, Richard Wuhler, Patrice Castignolles, (2021), "Aspects moléculaires de polymères industriels permettant la conception d'adhésifs biosourcés" Marion gave the keynote talk/presentation on to 49e édition du Colloque National du GFP se déroulera quasi intégralement en format virtuel du 15 au 19 novembre 2021, <http://gfp2021.univ-lyon1.fr/fr>
17. Associate Professor Scott Johnson gave keynote talk/presentation to a graduate school in the Netherlands and presented information about AMCF.

CONFERENCE PRESENTATIONS and POSTERS

18. Kash Bhullar, Richard Wuhler, Patrice Castignolles and Marianne 'Marion' Gaborieau, (2021), "Aspects moléculaires de polymères industriels permettant la conception d'adhésifs biosourcés", The French Polymer National Conference, France August/September 2021. Presented by Marianne 'Marion' Gaborieau.
19. Patrice Castignolles, (2021), "Separation science and bio-based polymers", ESPCI Paris Science et Lettres, Laboratoire Sciences Analytiques, Bioanalytiques et Miniaturisation, Paris France 2021. Presentation by Patrice Castignolles.
20. Kash Bhullar, Richard Wuhler, Patrice Castignolles and Marianne 'Marion' Gaborieau, (2021), "Molecular Insights into Industrial Polymers from Solid-State NMR Spectroscopy to Design Biobased Adhesives", Presentation, ISMAR-APNMR-NMRSJ-SEST, <https://www.ismar-apnmr2021.org/program.html>

INSTRUMENT NEWS

AMCF Micro-CT Scanner

The AMCF attributes a lot of its research success to the variety of complementary characterisation techniques on offer at a single location. Our most recent addition has been a second-hand Skyscan 1072 micro-computed tomography (micro-CT) scanner.

A micro-CT is similar to a medical CT scanner found in hospitals, however, instead of having a resolution in the order of millimetres, a micro-CT can resolve material features in the order of micrometres. This non-destructive technique passes X-rays through a sample, collecting a series of 2D X-ray images. Using software, these images are then stitched together to generate a virtual 3D model of the sample, complete with volumetric information about the external and internal microstructure.

For example, the visualisation and measurement of complex internal structures, such as plant root systems, blood vessels, invertebrate digestive tracts and more, is possible. This is all favourable for medical and biosciences. For engineers and material scientists, micro-CT can allow for non-destructive complex volumetric measurements that would not be feasible to obtain with other techniques. Such measurements include particle size, porosity, packing efficiency and also the ability to identify internal features of interest such as defects and fibre orientation. Additionally for industry, there has been considerable interest in micro-CT to probe sources of material failures and to characterise the influence of new manufacturing methods on their products.

At the AMCF, researchers have access to Dragonfly software which can be used to process micro-CT scans. In addition to the capabilities mentioned above, Dragonfly can be used to generate impressive 2D/3D images and movies of samples, including short 2D/3D renders of a sample's internal structure. 3D virtual models can even be printed into 3D physical objects.

If you would like to learn more about micro-CT or have a sample that you would like analysed, please talk to the AMCF team and we can assist you. On the following page we have a collection of image highlights that have been captured on our Skyscan 1072 micro-CT by AMCF staff and users.



Bruker SkyScan 1072 CT Scanner

X-ray Source: Tungsten

Operation Voltage: 20 - 80kV

Operation Current: 0.8 - 100μA.

Specimen Size: Up to 15mm diameter and 22 mm in height.
Max sample weight of 100 g.

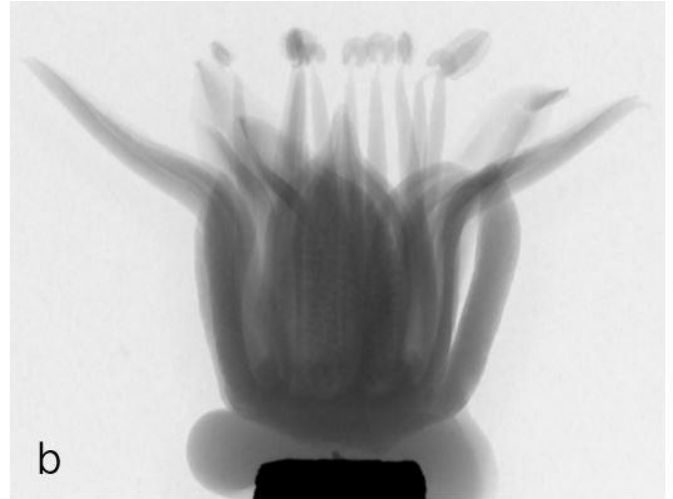
Magnification: x15 - x120 (depending on sample size)

Filters: Nil or 1 mm aluminium

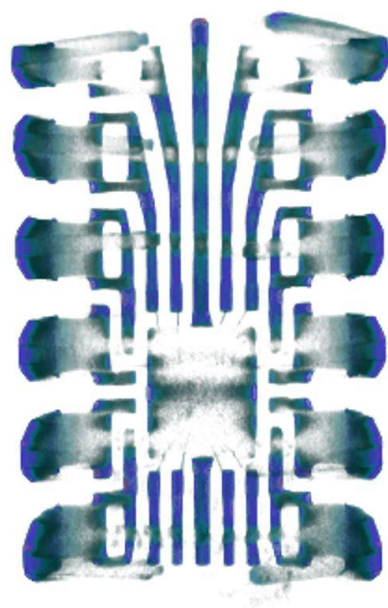
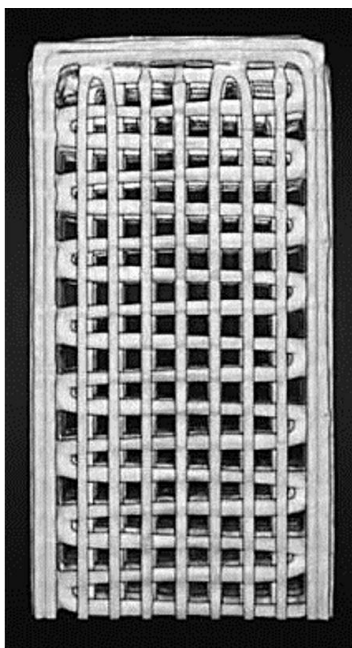
Spatial Resolution: 5-20μm depending on sample material, and instrument parameters.

Software: Skyscan operating software for data Acquisition, NRecon for reconstruction and Dragonfly for processing.

Advantages: Non-destructively probe the internal structure of samples and produce 2D and 3D visualization. Great for biological and other low atomic mass materials.



A test scan of a succulent flower imaged on our Skyscan 1072, including: a) a photograph of the flower, b) a 2D X-ray image, c) a 3D model of the exterior and d) the 3D model sliced to show some of the internal structures.



Micro-CT scans of *left*: a 3D printed sample from PhD student Nima Zohdi, *middle*: a computer chip, and *right*: a tic.

Instrument Software Upgrades

There have been a number of upgrades and new software placed on instrumentation in the AMCF over the past 12 months, including:

- A new computer for the operation of micro-CT scanner.
- Specialised micro-CT processing software installed on the instrumentation computer as well as the facility's processing computer.
- The XRD's processing Eva software has been updated to version 6, with the latest PDF4+ 2022 XRD database also installed.
- Moran Scientific Pty Ltd upgraded software on the SEM/EDS/XRM instrumentation. This upgrade means larger sized X-ray maps can now be completed.
- Software upgrades on the thermal instrumentation (DSC, TMA and STA-Multi) to the latest version of Netzsch's Proteus (version 8.0).
- The AMCF recently purchased Netzsch's Peak Separation software and Kinetics software analysis packages. This software is complementary to the Proteus software system. The Peak Separation software can also be used with data from other instruments, such as Mass Spec, FTIR, NMR, Raman, EDS and more.

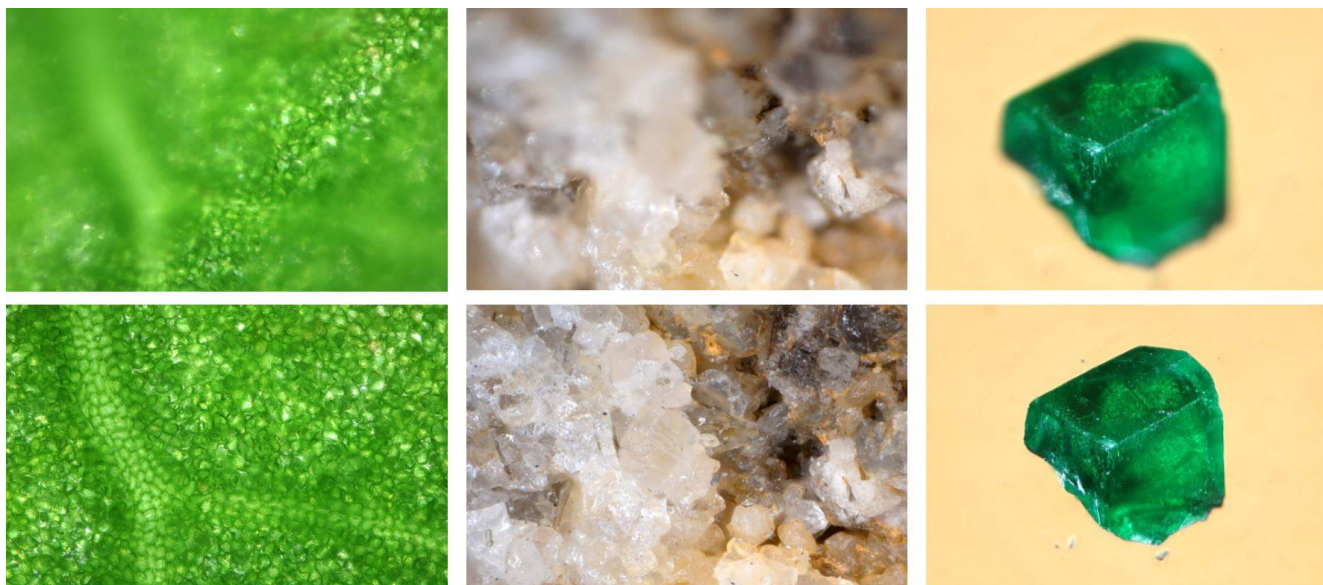
Optical Instrumentation

The AMCF has recently welcomed a Nikon Eclipse 50i optical microscope as a long-term loan from Dr Leigh Sheppard (SoEDBE). This compound optical microscope allows samples to be illuminated from below (transmitted) or above (reflected), and unlike our other compound microscopes, this system can operate in brightfield and darkfield. We were so impressed with this microscope that we decided it was to be the first microscope to have a camera upgrade. We now have a Canon EOS RP full frame mirrorless connected and the associated imaging software installed.

With new hardware comes the need to try out new processing software. In addition to the full Adobe suite of programs, including Lightroom and Photoshop, we've acquired Helicon Focus which can be used to generate amazing focus-stacked images. Shown below are a series of three images with a comparison between a single frame and the image stack of about 15 to 150 individual images. We will keep facility users posted for further updates as we hope to upgrade the camera systems on our other optical microscopes.



Microscope/camera setup in



Comparisons of single images (top) and after imaging stacking of many photos using Helicon Focus (bottom). Samples from left to right include: the underside of a Nandina leaf, a mineral sample dominated by quartz, and MRes student Hyun Min's CuL metal ligand crystal.

STAFF NEWS

Tia Richardson Onboard

In what is somewhat long overdue, we would like to officially welcome Tia Richardson on board as a full-time member of the AMCF team. Tia started working in the AMCF one day a week as an intern during her Master of Research project through the School of Science supervised by Dr Jason Reynolds.

Tia began working with us full time after her Master's thesis submission in 2020. During COVID lockdowns Tia's value to the facility was felt when AMCF staff and the odd expert users became the only personnel that were allowed into the facility. For everyone else, samples had to be sent to the facility and run by facility staff. This created quite an extra workload!

Since joining the AMCF team Tia has honed her analytical skills developed during her internship. Most recently, she has taken on the micro-CT, becoming an expert in running samples and data processing which is no easy task.



**Daniel, Laurel, Tia and Ric. Your friendly AMCF team,
at your service!**

FIJI/ImageJ Training

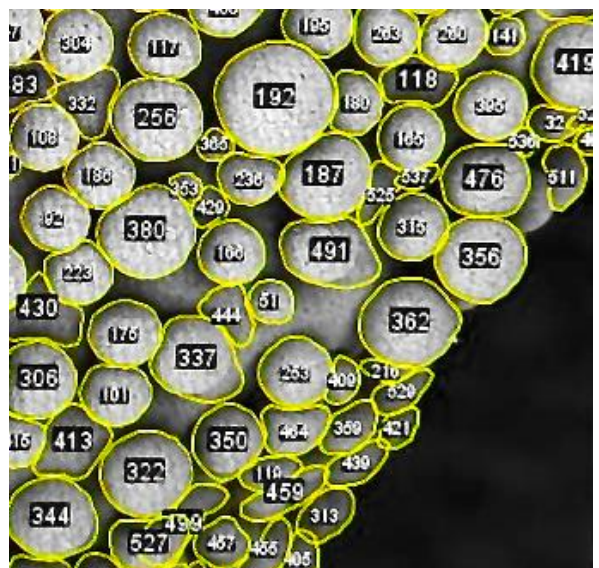
Daniel Fanna and Laurel George attended a workshop run by Light Microscopy Australia and presented by Cameron Nowell from Monash University, on the image analysis software FIJI/ImageJ. As a result they obtained training on many of the software's extensive features, including image analysis, cell counting, segmentation, batch processing, writing macros and much, much more. They were also introduced to the free software Ilastik, which uses user input and machine learning algorithms to teach the program to classify and count particular objects in an image.

If you are interested in these programs and how to use them, come and talk to the friendly AMCF staff. We have copies of the workshop manuals and demo images that you can practice on.

Both FIJI/ImageJ and Ilastik are free to download. You can find them at the following websites:

<https://imagej.net/software/fiji/downloads>

<https://www.ilastik.org>



Using FIJI and Ilastik to count spheres in Daniel's spider egg image (see back page of this Newsletter).

