adelaide.edu.au

seek LIGHT | ammrf | BioSA

Adelaide Microscopy, the University of Adelaide's Centre for Advanced Microscopy and Microanalysis, is a central facility providing enabling technologies to the research students and staff of the University.

Adelaide Microscopy assists in making The University of Adelaide a world class research intensive University. It provides a cost effective method for students to value add to their experience studying at The University of Adelaide, and relieves research staff of the responsibility of maintaining advanced microscopy platforms, allowing them to concentrate on achieving excellence in their research goals.

It provides access to researchers from other Universities, Publicly Funded Research Institutes and Industry on a fee-for-service basis.

Laser Ablation ICP-MS

The laser ablation ICP-MS system is used for micro-sampling of solid material for trace element, predominantly cation analysis. It consists of a UP-213 NdYag New Wave pulsed solid state laser (UP-213 New Wave) coupled to an Agilent 7500cx ICP- Quadrupole Mass Spectrometer. Detection limits reach into the ppb range allowing for true trace element analysis of a wide variety of solid material, including geological and biological samples. Advances in LAICPMS now include mapping samples for trace elements and their isotopes using a new 193nm Resonetics Excimer Laser coupled to an Agilent 7700 ICP-MS.

Solution ICP-MS

The Solution ICP-MS is an Agilent 7500cs ICP-MS. It is used to detect trace levels of metallic cations in bulk solution. The Agilent 7500cs is equipped with a Helium/Hydrogen collision cell, allowing for the removal of matrix interferences common in samples of complex matrices. The extreme sensitivity of the instrument allows theoretical detection limits in the ppt range on samples including, but not limited to, geological and biological solutions.

Cameca SXFive Microprobe

CAMECA SXFive Electron Microprobe with five Wavelength Dispersive Detectors, (four large crystal spectrometers + one conventional spectrometer), Bruker SDD detector, optical zoom and sample navigation. Capable of high speed x-ray mapping, Cathodoluminescence (CL), with Probe for EPMA software.

Cameca SX-51 Electron Microprobe

The Cameca SX51 Electron Microprobe is a very powerful tool using certified standards and x-ray analysis to accurately quantify major and minor element concentrations in a polished sample at the spatial resolution of an electron beam instrument. Using four Wavelength Dispersive Spectrometers (WDS), it allows for superior x-ray energy resolution over typical EDS detection using a Scanning Electron Microscope (SEM). The extended stage movement allows for x-ray mapping in which the spatial distribution of elements can be recorded over a large area. Elemental mapping provides valuable information on changes in concentration, zonation, diffusion and elemental migration. Microanalysis using the Electron Microprobe can be applied to a wide range of materials including: geological samples , biomaterials (bone and teeth) and engineered materials (metals and ceramics).

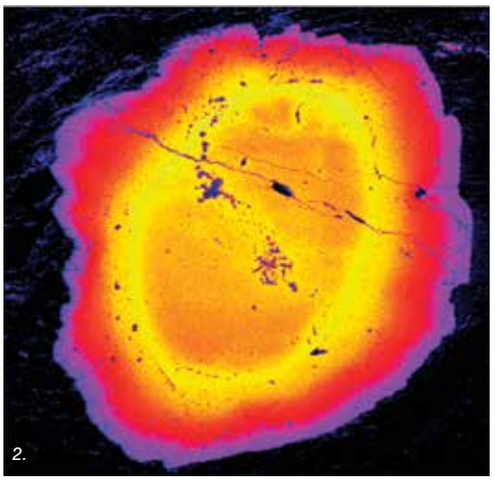
NT-MDT Ntegra Atomic Force Microscope

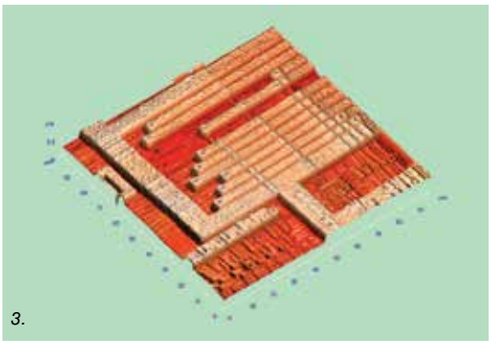
The Atomic Force Microscope (AFM) is primarily used to measure and analyse surface topography and morphology, providing nanoscale height measurements. The AFM is used for relatively small and flat samples - the maximum scan area is 100 x 100 microns and it can scan features up to 10 microns in height. Data collected provides information on the height of surface features, which allows both 2D and 3D imaging of a sample surface. Examples of applications include the analysis of optical fibres, CDs and DVDs, nanoparticles, nanotubes, DNA and cells. There is limited sample preparation involved and samples can be imaged in air. The two main modes used are contact and semi-contact modes.

Ntegra Solaris Scanning Near-Field Optical Microscope

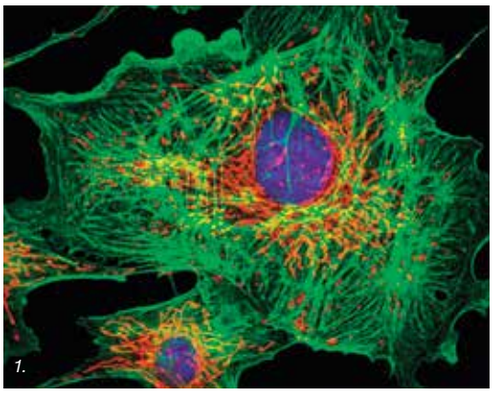
The Scanning Near-Field Optical Microscope (SNOM) has a scanning range of 100 x 100 microns (x,y) and 5 microns (z). Its main application is in measuring the transmission of light through optical fibres.

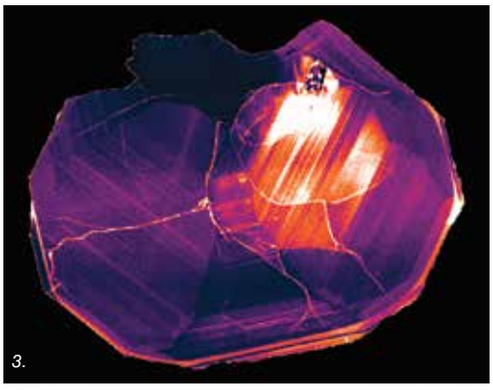

1.

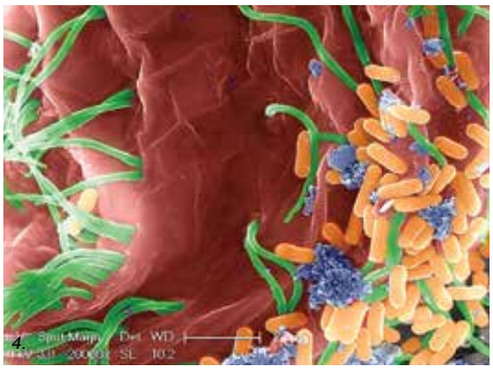

2.


3.

1. ICP-MS
2. Elemental map of zoning in a Garnet (Cameca SX51)
3. AFM image of an integrated circuit (part of a memory chip)







1. *BPAE cells DAPI, BODIPY FL phallacidin and MitoTracker Red (Confocal)*
2. *Cancer cells tagged with a luciferase gene (IVIS)*
3. *CL image of a Zircon (SEM)*
4. *'Inside a Ciliate's World' High magnification image of the exterior of a Colpoda sp. ciliated protozoan cell (red). Cilia (green), with many extracellular Listeria monocytogenes cells (brown), and co-culture debris (blue) present. (Philips XL30) - courtesy of Rethish Raghu.*

IVIS Lumina XRMS Series III

The IVIS Lumina is an imaging system for 2D fluorescent, bioluminescent, Cerenkov and x-ray imaging with advanced spectral unmixing filters. A real-time in vivo imaging system that offers users the flexibility to image fluorescent and bioluminescent reporters to visualise, monitor and record specific genetic and cellular activity within a living organism. Bioluminescence Imaging is a high throughput, high-sensitivity, low-noise and non-invasive technique which captures, quantifies and analyses the light emitted by a living organism as the result of a chemical reaction where chemical energy is converted to light energy. This technique can be used to track gene expression and monitor the spread of a disease.

Leica SP5 Spectral Scanning Confocal Microscope

The Leica SP5 Spectral Scanning Confocal Microscope is a research-grade confocal microscope with the ability to tune the detection of fluorescent emission from a sample. It also has advanced features that allows it to be used for high-resolution confocal imaging as well as techniques such as FRAP, FRET and FLIM. Equipped with four lasers, it has seven excitation wavelengths:405 nm (pulsed), 458 nm, 476 nm, 488 nm, 496 nm, 514 nm, 561 nm and 633 nm. The microscope stage is inverted, and a heating stage is available for live cell work.

Nikon A1R Laser Scanning Confocal

The Nikon A1R laser scanning confocal is a research grade confocal microscope with DS-Ri1 CCD camera capable of high resolution imaging. It has three solid state lasers (405nm, 561nm and 640nm) and a multi-line Argon gas laser (457nm, 488nm, 514nm).

Philips XL20 Scanning Electron Microscope

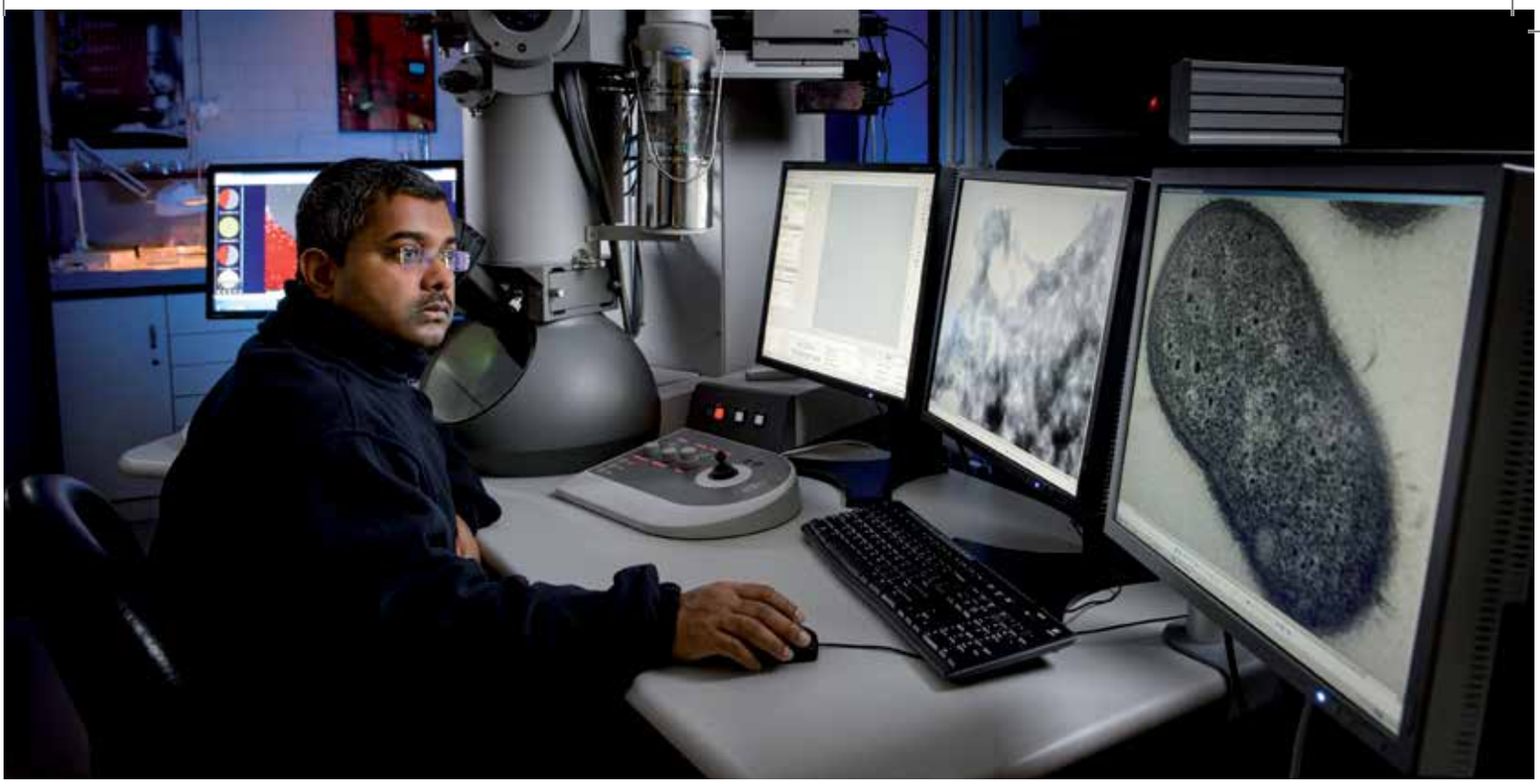
The Philips XL20 Scanning Electron Microscope is equipped with a tungsten filament electron source and is used for imaging of sample surfaces. A solid state backscattered electron detector enables mean atomic number imaging and the thin film EDS detector allows for X-ray analysis.

Philips XL30 Field Emission Scanning Electron Microscope

The Philips XL30 Field Emission Scanning Electron Microscope offers high-resolution imaging, as well as low kV imaging for non-coated or insulating materials. A solid state backscattered electron detector enables mean atomic number imaging and the thin film EDS detector allows for X-ray analysis. Equipped with an Oxford Cryo-transfer and fracture stage, it makes possible the preparation of biological and other hydrated samples without loss of integrity. The HKL Electron Backscattered Diffraction Pattern camera allows for microstructural studies of a range of materials.

FEI Quanta 600 SEM MLA System

Quanta 600 Scanning Electron Microscope with the Mineral Liberation Analysis (MLA). A tungsten SEM fitted with two large area Silicon Drift Detectors for fast large scale mapping and a Gatan Cathodoluminescence (CL) detector.



FEI TITAN Themis TEM

Aberration-corrected Titan Themis scanning transmission electron microscope (STEM) combines optics and oXEDS with powerful new software, a 16-megapixel CMOS camera, and an enhanced piezo stage to deliver rapid, easy access to atomic-scale information. Benefits include, fastest time to data with highest quality using new Velox™ Capture with multi-signal detection and Cs corrected optics, best STEM image quality up to 70 pico metres resolution with the new live Velox DCFI smart scanning technology, live measurements of intrinsic magnetic and electric fields enabled by Velox DPC multi-signal scanning technology, fastest navigation from mesoscopic to atomic length scale enabled by the new 4k x 4k Ceta 16M instant-zoom camera, easy, quantitative analysis data enabled by Velox Scripting with CPython with an increased pole piece separation to enable TEM tomography.

FEI Tecnai G2 Spirit TEM

Operating at voltages of 20-120kV, the G2 Spirit is equipped with a FEG LaB6 emitter and BioTWIN lens design. This makes the G2 Spirit ideally suited to high contrast imaging of delicate light element biological materials typically found in life sciences. Imaging is done via an in-column Olympus-SIS Veleta CCD camera.

Installed options include cryo blades for cryo EM work, and capability for single and dual-axis 3D tomography using the Xplore 3D software. Analytical capabilities come via an EDS system comprising an Apollo XLT SDD running EDAX's TEAM software.

Philips CM100 TEM

The Philips CM100 Transmission Electron Microscope has a maximum accelerating voltage of 100kV. It is equipped with a SIS MegaviewII CCD Camera and Soft Imaging System analysis image analysis software. This TEM is used primarily for biological samples and some materials samples when highest resolution is not required.

Philips CM200 TEM

The Philips CM200 TEM is a high resolution Transmission Electron Microscope capable of operating up to 200kV. Attachments include a full cryo setup with an EDAX EDS system and Gatan 678 Image Filter and P/EELS, and Gatan 832 SC1000 CCD camera, allowing for full imaging and analytical capability. This makes it ideal for high resolution imaging and analysis of nanotechnology samples including nanoparticles and nanotubes. It is also used routinely for imaging of biological and mineralogical samples.

FEI Quanta 450 FEG SEM

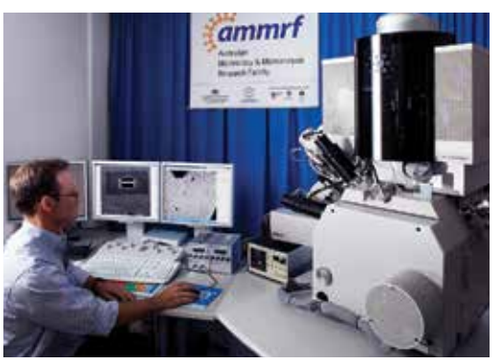
The FEI Quanta 450 is a high resolution Field Emission Scanning Electron Microscope capable of operation in three different modes - Environmental SEM (ESEM), Low Vacuum and High Vacuum. As well as a standard sample stage, the instrument also has cooling, heating and tensile stages.

The Quanta 450 is used to image and analyse surface topography, collect backscattered electron images and characterise and determine a sample's elemental composition through x-ray detection using a SDD EDS detector.

ESEM mode allows in situ imaging of wet samples, which is ideal for plant material and other biological specimens. It can also be used for in situ observation of processes such as hydration and dehydration, corrosion and crystallisation.

Low vacuum mode allows for imaging and characterisation of non-conductive samples. High vacuum mode allows for high resolution imaging of surface topography (up to 1000000x magnification). The stage has a lateral movement range of 100mm and a vertical movement range of 60mm.

Applications for the Quanta 450 are wide ranging and include imaging and microanalysis of metals, semiconductors, materials and their defects, coatings, particles, fibres and geological and biological samples.



FIB/SEM

FEI Helios NanoLab DualBeam FIB/SEM

FEI Helios NanoLab DualBeam FIB/SEM is a high performance Scanning Electron Microscope coupled to a Ga+ Liquid Metal Ion beam. The outstanding imaging capabilities of this instrument are due to novel FESEM technology based on TEM column design. Its key capabilities are high resolution secondary electron imaging, nano-machining, cross-section structural images, 3-D microscopy and analysis, orientation imaging microscopy and TEM sample preparation. The DualBeam is equipped with a EDAX Genesis system for X-ray elemental analysis and TSL OIM data collection system for electron back-scattered diffraction analysis. These techniques allow the sub-surface region of a material to be dynamically investigated by high-resolution scanning electron microscopy.

SkyScan 1072 X-ray Micro Computer assisted Tomography System

X-ray Tomography allows the non-destructive imaging of samples in 3 dimensions. Samples are rotated in the x-ray beam and radiographs are recorded at discreet intervals. Software reduces these radiographs to tomograms which are sliced views through the sample on the axis of rotation. The tomograms can then be viewed as a 3 dimensional block of data. Thresholding of the tomographic images can highlight various densities in the sample and 3 dimensional images of the sample can be recreated of material of specific x-ray density. Samples need to have changes in x-ray density of 5% or greater to be able to threshold grey levels. The size (mean diameter) of the sample determines the resolution. A three millimetre diameter sample should achieve a 3 micron resolution.

SkyScan 1076 in-Vivo X-ray Micro Computer assisted Tomography System

Using a similar principal to the Skyscan 1072, the In-Vivo scanner allows imaging in 3 dimensions of live small animals, exposing it to a rotating the x-ray source and camera. This system offers fixed resolutions of 9,18 and 36 micron. Using a live animal model changes in the animal over time can be recorded and quantified. Bone loss due to tumour growth is a typical application studied, followed by bone regrowth after the application of drug therapies. The study of the skeleton is relatively easy as bone offers a good contrast. With the use of radio opaque dyes it is possible to study the vascular system, and the vital organs. The system allows monitoring of the animal (heart rate, breathing and temperature) during scanning. X-ray dosage is minimised by short scan times and low x-ray emissions. The system has application to non-live animal experiments and can handle samples up to 68mm in diameter and 200mm long. The density of the sample must allow x-rays to be transmitted through it.

Multiphoton SHG LaVision Biotec TriM Scope

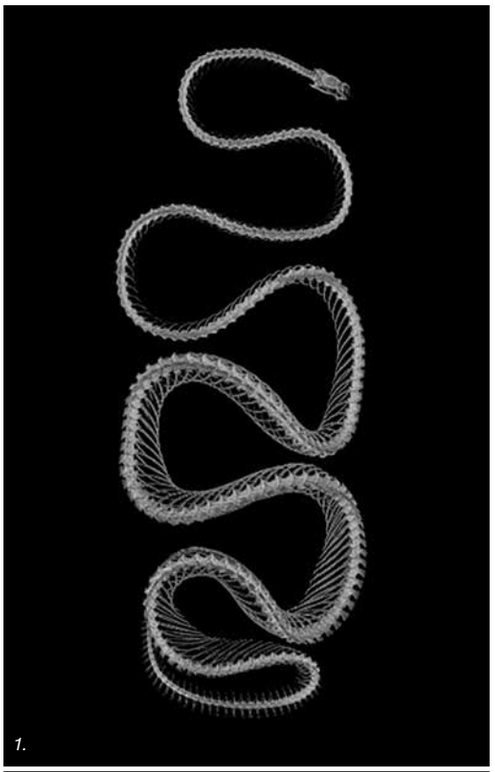
Multiphoton fluorescence microscopy (MFM) also known as two-photon microscopy uses pulsed long wave-length (infra-red) laser light to excite fluorophores within the specimen being observed. The longer wavelength (typically infra-red) excitation lasers have a low energy and are useful for visualisation of cell and tissue structure and function. Typically inorganic crystals and some biological samples, such as collagen, give rise to intense second harmonic light when irradiated with a laser allowing high quality imaging without altering the samples with fluorescence probes (required for standard fluorescence microscopy) therefore, the molecules shouldn't suffer the effects of phototoxicity or photobleaching.

Laser Micro Dissection (LMD) - multiple systems

Laser Microdissection (LMD) is a technique used by researchers for contamination free isolation of pure cell populations in preparation for PCR (Polymerase Chain Reaction) and RT-PCR. It is useful for investigations related to DNA, RNA, protein analysis, metaphase chromosomes and living cells. LMD can also be used to isolate subpopulations of cells for embedment in resin and subsequent ultrastructural examination under the Transmission Electron Microscope. It uses a focused laser beam as a cutting tool under direct microscopic visualisation. The excised material is then accessible for further analysis.

Micromeritics Gemini 2390 BET Surface Area Analyser

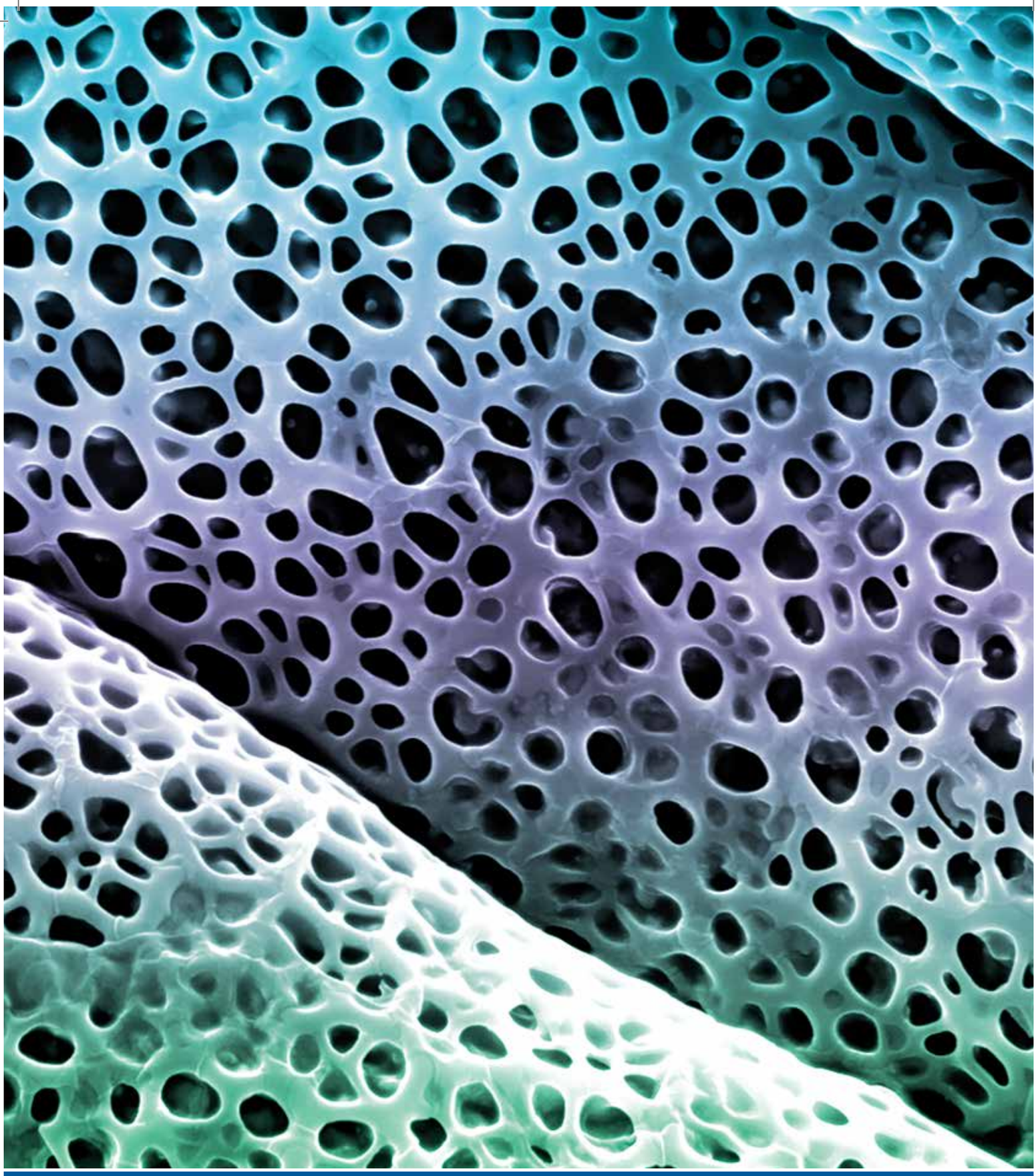
The Micromeritics Gemini 2390 BET Surface Area Analyser is used for the determination of surface area and porosity in materials. The instrument utilises nitrogen gas physisorption to accurately and reliably produce surface area and porosity results. Using a static volumetric technique to adsorb gas onto a sample surface, the instrument is capable of determining single and multi-point BET and Langmuir surface areas, total pore volume and BJH pore size distributions using adsorption isotherms.



1.

2.

1. Graceful Small-headed Sea Snake (Skyscan 1076)
2. Fossil Nautiloid Cephalopods (Skyscan 1076)



Pollen from ***Rosmarinus officinalis*** (Rosemary) (SEM)

For further enquiries

Ground Level, Medical School North
Frome Road
The University of Adelaide
SA 5005 AUSTRALIA

Telephone: +61 8 8303 5855
Facsimile: +61 8 8303 4356
Email: microscopy@adelaide.edu.au

adelaide.edu.au
facebook.com/uniofadelaide
twitter.com/uniofadelaide
youtube.com/universityofadelaide

CRICOS 00123M © The University of Adelaide. Published July 2015 2472-4

SOUTH AUSTRALIA