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Australian
Microscopy & Microanalysis
Research Facility

Flagship: High-resolution SEM microanalysis facility

Unique suite of field-emission scanning electron instruments for materials analysis

The suite of field emission scanning electron microscopes at the Electron Microscope Unit at the University of New South Wales provides a high-throughput, high-precision facility able to structurally characterise materials and to detect and quantify elements at very high spatial resolution. High-resolution SEM imaging completes this comprehensive imaging and analysis platform.

Contact and information

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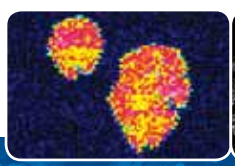
Scientific Drivers

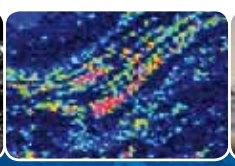
The suite enables the integrated analysis of elemental composition, crystallographic orientation and the light emitting properties of matter. Such capabilities are essential to materials research and can be applied to studies of geological materials, inclusions and grain boundaries in metals, coal, ceramics, glasses and plastics.

The facility comprises:

- A JEOL JXA-8500F field-emission electron probe microanalyser – only the second in Australia and the first installed at an Australian university. This is equipped with four wavelength dispersive spectrometers (WDS) for high-sensitivity chemical analysis of elements as light as beryllium, as well as a JEOL silicon-drift detector (SDD) for energy dispersive X-ray spectroscopy (EDS).
- A JEOL JSM-7001F field-emission scanning electron microscope equipped for high-sensitivity elemental, crystallographic and defect structure analysis by using SDD-EDS, electron backscattered diffraction (EBSD) and cathodoluminescence (CL).
- A field-emission scanning electron microscope, dedicated specifically to high-resolution imaging, which complements the analytical instruments and operates with sub-nanometre spatial resolution.

The Schottky field-emission sources of the two current SEMs maintain stable, fine, high-brightness beams down to very low beam energies, thus providing a vast improvement in the spatial resolution of X-ray microanalysis data when compared to conventional electron sources. Both instruments are fitted with SDDs, which increase the X-ray count rate by up to two orders of magnitude over older style detectors. These features combine to produce instruments that are much faster and more accurate in the collection of X-ray microanalysis data, especially when collected in the form of elemental maps. The speed of acquisition of structural information via EBSD analysis is also significantly increased due to the high brightness of the field-emission sources. The speed, resolution and the capability for automated multi-analysis sample characterisation enables this facility to drive and support novel research with maximum efficiency.





A sampling of the research enabled by these instruments includes:

- Semi-quantitative elemental and crystallographic mapping of sub-micrometre features in a fraction of the time previously required.
- Chemical characterisation of biological and beam-sensitive materials.
- Studies of crystallographic texture and grain growth.
- Quantitative and structural analysis of thin films.
- Analysis of discrete growth bands in shell, otoliths and coral.
- Cathodoluminescence spectroscopy.
- Microanalysis of archaeological material such as ceramics, pigments, lithics, bone, metal artefacts and glazes.

Capabilities and the National Research Capacity

This suite of scanning electron microscopes and the microanalyser comprises a powerful and versatile group of instruments. It can be used for structural, chemical and crystallographic analysis of a wide range of materials including metals, semiconductors, ceramics, minerals, polymers and composite materials. With the EMU's highly-trained experts and technical support staff on site, and easy access for interstate and international visitors, the facility operates on a 24/7 basis at a genuinely national level.

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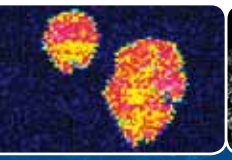
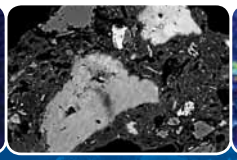
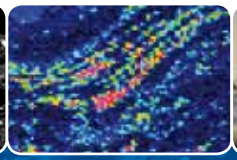

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