Australian Synchrotron – Applications in Geochemistry, Mineral Exploration and Mineral Processing

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The Australian Synchrotron, opening in 2007, will be a national facility that will benefit a broad cross-section of Australian scientists and technologists, including the geoscience community. It is a state-of-the-art 3 GeV third generation light source where users will access and manipulate a major part of the electromagnetic spectrum, so enabling new research, development and innovation.

The initial suite of beamlines, described in the Australian Synchrotron's National Science Case [1], include capabilities for x-ray absorption spectroscopy (XAS), x-ray fluorescence (XRF), x-ray diffraction (XRD), small angle x-ray scattering (SAXS), x-ray imaging and infrared spectroscopy. Measurements can be performed on small sample regions in times as short as a fraction of a second with high resolution and excellent signal to noise. Experiments can be performed over a wide range of time, temperature and pressure regimes using custom-designed apparatus.

Synchrotron methods are being applied by Australian researchers to address a range of geological and mineralogical problems. Some of these examples will be discussed in detail, together with their potential in future applications. Summary information is provided below:

Microprobe methods are being used to characterise fluid inclusions in order to enhance a predictive modelling approach to mineral exploration.

X-ray diffraction and X-ray absorption spectroscopy measurements are being made under conditions that emulate ore formation and mineral processing operations.

Simultaneous, high resolution X-ray diffraction and high sensitivity X-ray fluorescence measurements are being performed on a range of geological and process materials in order to determine structure / property realtionships.

X-ray photoelectron spectroscopy and infrared spectroscopy are being used to characterise chemistry and structural relationships at mineral surfaces, providing important information for realising process improvements.

References

[1] Australian Synchrotron, The National Science Case for the Initial Suite of Beamlines, December 2003.