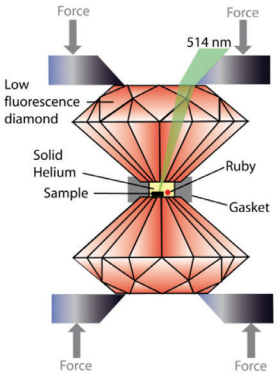
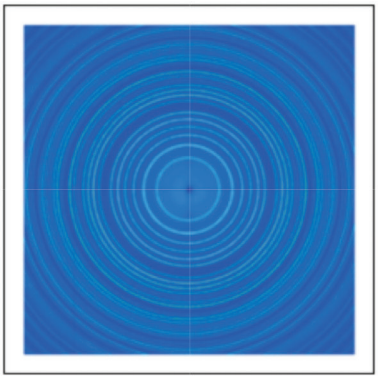
Diffraction | X-ray Powder Diffraction | X-ray Diffraction | X-ray Pair Distribution

I15 Technical Information

I15 –X-ray Diffraction at High Energy

I15 is dedicated to high energy diffraction and scattering experiments and the study of materials under extreme conditions. Techniques such as single crystal, powder diffraction and X-ray pair distribution function (XPDF) are used to understand the structures of materials. A combination of high X-ray flux, energy and small beam size make the beamline ideal for *in situ* work. High-energy X-rays can penetrate into complex sample assemblies, and can be focused to a few μm. This then allows experiments such as detailed mapping of structural order or disorder, chemical fingerprinting, and single crystal structure determination.





Beamline Specification

Techniques	Single Crystal/Powder Diffraction and XPDF
Energy Range (keV)	20 - 80
Beam specification	Monochromatic wavelengths in both focused and unfocused modes
Energy resolution (DE/E)	1.0 x 10^{-3}
Beam Size (h x v) (at sample position)	Variable, from 4 x 9 μm to 80 x 80 μm
Q range(beam in centre of detector)	33 $Å^{-1}$ at 75 keV
Flux at sample at 50 keV (ph/s)	10^{11}
Temperature range	< 1000 K / IR laser heating in the range T~3000-5000 K
Pressure range	0 – 100 GPa
Detector & Analyser	Image plate (MAR345) Perkin Elmer flat panel 1621 EN detector Pilatus 100K Atlas CCD Oxford diffraction detector 6-circle Newport diffractometer

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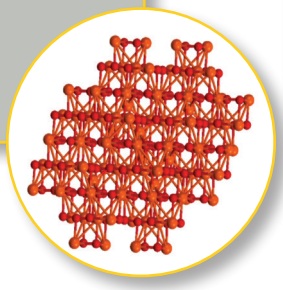
I15 Applications

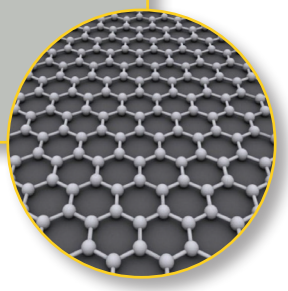
Solid State Physics

- Studies of new complex structures and physical behaviour of metals under extreme pressures at very low or high temperatures;
- Exploring the process of transition from single crystal to powder behaviour in materials;
- Investigating properties of materials under stress-strain environments to determine the strain tensor in minerals, rocks, metals, ceramics and composites.



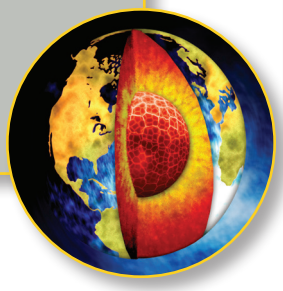
Material Science

- Studies of novel materials such as polymeric and framework forms of CO_2 and N_2, layered forms of C_3N_4, new dense nitrides, low-dimensional silicides, icosahedral borides etc;
- *In situ*, time-resolved studies of HT solid-state metathesis and self propagating synthesis reactions under high magnetic and electric field;
- Investigations of liquid-liquid phase transitions.



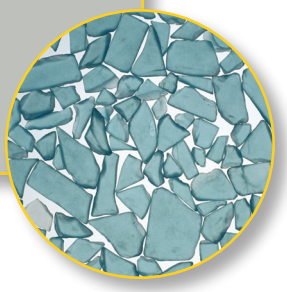
Earth & Planetary Science

- Understanding of the geophysics, mineralogy and petrology of the deep Earth and other planets;
- Exploring changes in mineral structure and properties during melting and chemical reactions;
- Studying mineral and rock deformation relevant to deep planetary interiors;
- *In situ*, time-resolved investigations of the interactions between minerals and fluids.



Amorphous Materials

- Pair Distribution Function (PDF) studies to understand local structure and determine the structure of novel materials;
- Time resolved *in situ* PDF to study local structure changes during chemical reactions;
- Exploring batteries, energy storage materials, catalysis and pharmaceutical materials.



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