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In Situ Energy-Dispersive XRD and Imaging in the Large Volume Press at P61B

Friday 30 August 2024 12:00 (15 minutes)

The Aster-15 LVP can routinely generate high pressure (ca. 35 GPa) and temperature (ca. 3000 K) environments on samples for investigations using energy-dispersive X-ray diffraction (ED-XRD) and radiography in the high-energy range 30 –160 KeV at the Wiggler beamline station P61B. Specialised assemblies may generate even higher pressures. The station provides two highly positional Ge-detectors for XRD acquisition at user-defined pre-calibrated diffraction angles (3° < 2θ < 10°), including vertical positioning for cubic compression (3° < 2θ < 20°) with one detector. During sample deformation (p < 15 GPa), stresses from lattice microstrains can be measured with both detectors at 2θ = 5° or greater (at 0° and 90° azimuthal positions). This setup is enhanced using X-ray transparent cBN and sintered-diamond anvils. A movable beamstop is available to reduce background scattering. Furthermore, we offer additional in situ techniques, such as 1) acoustic emissions detection with 6 sensors, combined with deformation to study brittle processes in samples, and 2) ultrasonic wave speed measurements using a LiNbO3 transducer and a signal amplification system to study the physical properties of materials at pressures over 20 GPa in assemblies as small as 10 mm. Imaging experiments, such as falling sphere viscosimetry, are enhanced with an extremely bright scintillator: GAGG:Ce on the x-ray microscope (up to 1 kHz acquisitions). Finally, a suite of data processing software can be found on the beamline website. In summary, proposals can be submitted to P61B for beam time (normal access) and for time without X-rays (fast access). We will present details on the current status and development of P61B at PETRA III, as well as information about a future LVP beamline at PETRA IV.

I plan to submit also conference proceedings

No

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