



SATELLITE WORKSHOP - Photon Science

In situ energy-dispersive XRD and imaging on materials in the Large Volume Press at P61B

Tuesday, 23 January 2024

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 ($3^\circ < 2\theta < 10^\circ$), including vertical positioning for cubic compression ($3^\circ < 2\theta < 20^\circ$) with one detector. During sample deformation ($p < 15$ GPa), stresses from lattice microstrains can be measured with both detectors at $2\theta = 5^\circ$ 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. A suite of data processing software can be found on the beamline website. Proposals can be submitted to P61B for beam time (normal access) and for time without X-rays (fast access). Details on the status, development and future of the beamline at PETRA IV will be presented at this dedicated workshop. We hope this meeting offers an opportunity for you to connect with fellow scientists in the field and with the invited speakers.

Organisers: R. Farla, S. Bhat

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PROGRAMME

		Chair: S. Bhat
13:30	Introduction	S. Bhat
13:40	In situ X-Ray Diffraction Studies of Gigapascal Hydrogenations: Recent Updates from P61B	D. Beyer
14:00	In situ investigation of diamond growth from graphite and nanographene	J. Liang
14:20	Measuring elastic-wave velocities on P61B: Benchmarking and possibilities	A. Neri
14:40	Coffee break	Chair: R. Farla
15:00	Relating micro-seismicity, phase transformation and stress evolution during multi-anvil 6-6 deformation experiments with white beam XRD to characterize the physics behind deep earthquakes	J. Gasc
15:20	High Pressure and Temperature Stress Measurements Using a Novel Method at P61B	N. Dolinski
15:40	Coffee break	Chair: S. Bhat
16:00	Part 1: Status and development of P61B	R. Farla
16:20	Part 2: Outlook for PETRA IV	
16:35	Discussions (Software/Hardware/New techniques...)	All participants
16:45	Wrap- up and closing remarks	Chair: R. Farla