X-ray absorption spectroscopy under extreme pressure and temperature.

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Laser heating coupled with the diamond anvil cell opens a huge *P-T* field (over 300 GPa and 5000 K) for static experimental studies of matter under extreme conditions. Melting is among the most interesting phenomena to explore with the LH DAC, which is of a great interest for condensed matter physics, technology, and planetary sciences. Although LH DAC is now combined with various in-situ synchrotron methods, direct information regarding melts' properties is very limited, and even melting detection is not always obvious [1].

X-ray absorption spectroscopy is a powerful tool to study electronic properties and local structure in matter, independently of its crystalline state. The energy-dispersive XAS beamline ID24 at the ESRF provides a unique possibility to obtain a XAS spectrum in a DAC within fractions of a second [2,3], making it a unique tool to study melting phenomena under extreme conditions. Discontinuous changes in XAS spectra are a good indication of melting onset (Fig. 1). In addition, by analyzing the EXAFS spectral part, information on the dynamical properties and local structure in both, hot solid and melt can be obtained.

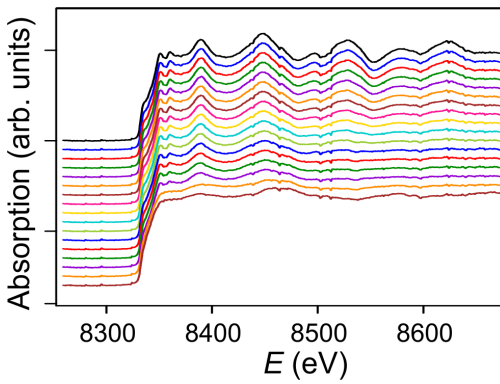

Fig. 1. Ni K-edge EXAFS spectra of pure Ni at 64 GPa and elevated temperatures – from room temperature (top) to ~3200 K (bottom).

[1] Salamat et al. (2014) *Coord. Chem. Reviews* **277-278**, 15-30. [2] Pascarelli et al. (2006) *J. Synch. Rad.* **13**, 351-358. [3] Kantor et al. (2014) *J. Synch. Rad.* **21**, 1240-1246.