

«High pressure activity at the ESRF ID12 beamline»

F. Wilhelm and A. Rogalev

ESRF – The European Synchrotron, 71 avenue des Martyrs, 38000 Grenoble, France
wilhelm@esrf.fr

The scientific activity of the ESRF ID12 beamline is the investigation of the electronic and magnetic properties of materials exploiting the polarization dependence of the x-ray absorption near edge spectroscopy (XANES) in wide X-ray energy range (from 2 to 15 keV) [1]. X-ray magnetic circular dichroism (XMCD), that is the difference of XANES spectra taken with right and left circular polarization, is particularly interesting and allows to determine separately spin and orbital magnetic moments of the absorbing atoms in para-, ferri- or ferromagnetic systems. The combination of those spectroscopies with recent advances in high pressure technology has offered unique possibilities in understanding the physics of materials under pressure. Instrumental developments [2] at the ID12 beamline made now possible to study under pressure the XANES of light elements having absorption edges at photon energies below 4 keV, e.g. chlorine, sulphur and even phosphorus [3]. Further, XMCD experiments could be performed at high pressure in combination with low temperatures down to 2.7K and high magnetic field up to 8T.[4]. Selected examples showing the possibilities of the high pressure setups available at the beamline ID12 will be presented.

References

- [1] - A. Rogalev, J. Goulon, C. Goulon–Ginet, and C. Malgrange, “Instrumentation Developments for Polarization Dependent X-ray Spectroscopies” in: Beaurepaire E., Kappler J.P., Krill G., Scheurer F. (eds) *Magnetism and Synchrotron Radiation. Lecture Notes in Physics* **565**. Springer, Berlin, Heidelberg (2001).
- [2] - F. Wilhelm, G. Garbarino, J. Jacobs, H. Vitoux, R. Steinmann, F. Guillou, A. Snigirev, I. Snigireva, P. Voisin, D. Braithwaite, D. Aoki, J. P. Brison, I. Kantor, I. Lyatun, A. Rogalev, *High Pressure Res.* **36**, 445 (2016).
- [3] - V. Yannello, F. Guillou, A. A. Yaroslavtsev, Z. P. Tener, F. Wilhelm, A. N. Yaresko, S. L. Molodtsov, A. Scherz, A. Rogalev, M. Shatruk, *Chem. Eur. J.* **25**, 5865 (2019).
- [4] - F. Wilhelm, J.-P. Sanchez, D. Braithwaite, S. M. Ramos, E. N. Hering, G. Lapertot, and A. Rogalev, *Phys. Rev. B* **99**, 180409(R) (2019).