HERFD-XAS : A NEW POWERFUL STRUCTURAL TOOL IN ENVIRONMENTAL & GEOCHEMISTRY SCIENCES

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The study of the speciation of highly-diluted elements by X-ray absorption spectroscopy is experimentally extremely challenging, especially in geochemistry, environmental bio-geochemistry and Earth sciences. Here we present an innovative synchrotron spectroscopy technique, namely high energy resolution fluorescence detected X-ray absorption spectroscopy. Within this approach, measuring the XAS signal in fluorescence mode with a Crystal Analyser Spectrometer (CAS), with a ~1 eV energy resolution, for photons energy ranging from 4 to 18 keV. Due to this new tool many restrictions on sample concentrations and multi-fluorescence interferences may be overcomed (Proux et al. 2017). On the BM30b beamline (ESRF, Grenoble, France), we developed a CAS in the Johann's geometry (Llorens et al., 2012). This spectrometer is now on a dedicated beamline (BM16) and opened to regular users since January 2017.

The new opportunities brought by this high resolution spectroscopy are *i)* the possibility to study ultra-diluted elements by filtering with a great efficiency the background photons and *ii)* to improve the sensitivity of the measurement with the acquisition of better resolved XANES spectra. This is a major technological advance with strong benefits for the study of highly-diluted elements with XAS, up to the ppm level compare to the typical 10-20 ppm that can be conventionaly measured. CAS opens new possibilities to explore the speciation of a target chemical element at natural concentration levels, which is critical in the fields of environmental and bio-geochemistry sciences.

Llorens et al. (2012) *Rev. Sci. Instrum.* 83:063104
Proux et al. (2017) *J. Environ. Quality* (in press).