X-ray fluorescence holography--some recent developments

S. Marchesini [1, *], L. Zhao [1, 2], J. J. Bucher [1], D. Shuh [1],
L. Fabris [1], W. C. Stolte[1], M. West[1], M. J. Press [1], Z. Hussain[1]
C. S. Fadley [1, 2]
[1]Lawrence Berkeley National Laboratory
[2] UCDavis

X-ray fluorescence holography (XFH) is a relatively new experimental tool for directly determining the local atomic structure in three dimensions and in an element-specific way. For example, recent studies have demonstrated the ability to image a first-row element in the presence of a transition metal [Tegze et al, Nature 407, 38 (2000)], and to study the local atomic environment in a quasicrystal [Marchesini et al, Phys. Rev. Lett. 85, 4723 (2000)].

A new experimental system for XFH at the Advanced Light Source has been developed, optimized for the energy range of this source. We use fast acquisition electronics, synchronization of the rapid motor movement and data acquisition to suppress beam instabilities, a high speed (MHz-level) germanium solid state detector to enable high count rates and discriminate against both elastically scattered photons and other fluorescent x-rays. By placing the sample and its goniometer inside a vacuum chamber, we have the possibility of measuring low energy fluorescent photons(<6 keV). In particular, by tuning the photon energy on and off core resonances, it should be possible to perform ``true color'' imaging of the atomic species around a given type of emitter.

The first holograms of this kind obtained at ALS will be presented. This work was supported by DOE contract No. DE-AC03-76SF00098.

* SMarchesini@lbl.gov