A Sensitive XAFS study using tunable X-ray undulator

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In this paper, we report the built up of the high-brilliance XAFS apparatus at an undulator beam line BL10XU. A computer control of undulator deflection parameter and a double crystal monochromator has achieved an energy range of 5-30 keV with a high energy resolution ($\triangle$ E/E < 2x10-4). A continuous spectroscopic scan over a 1keV range and a wide edge-tuning in 5-30 keV range have been done. For minimizing the tuning time, the gap is tuned to match the peak intensity at a certain criterion (30% loss in intensity). For a high throughput fluorescence data acquisition, a 100-pixel Si detector has been developed which allows a total 20MHz count rate. A combination of these features is expected to provide the local structure beyond the present limits in concentration in a static sense or a time-resolved information[1].

We have built up the three axis goniometer where a sample mounted on a closed cycle He cryostat can be oriented vertically or horizontally, which allows any orientation geometry with respect to the electric field vector. It is noticed that the polarization dependence is important in surface-sensitive experiments[2] using a grazing-incidence geometry in which vertical and horizontal sample orientations provide the information on radial distributions around an excited atom parallel and perpendicular to the surface normal, respectively. This system also allows us to measure the X-ray standing wave [3].

As for the application we show the Pr L_3 edge fluorescence spectrum of PrR_4P_{12} at 30 K. It is reported that PrR_4P_{12} shows metal-insulator (M-I) transition at around 60 K. We are now investigating the temperature dependence of a local structural change around the Pr atom concerning the M-I transition.

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