Development of Ultra-high Density Solid State Detector Array for Rapid and Sensitive XAFS

Hiroyuki Oyanagi*, Masashi Ishii**, Chul-Ho Lee*, Naurang.L. Saini***, Yuji Kuwahara#, Akira Saito#, Yasuo Izumi## and Hideki Hashimoto###

*Electrotechnical Laboratory, 1-1-4 Umezono, Tsukuba 305, Japan
**JASRI, Kamigori, Ako-gun, Hyogo 678-12, Japan
***Universita di Roma ""La Sapienza", Dipartimento di Fisica, 00185 Roma, Italy
#Osaka University, 2-1 Yamadaoka, Suita, Osaka 565, Japan
##Tokyo Institute of Technology, 2-12-1 Ookayama, Meguroku, Tokyo 152, Japan
###TORAY Research Center,1-1-1 Sonoyama, Otsu-shi 520, Japan

We report on the initial test of undulator tuning for the beamline BL10XU at Spring-8. The optics of BL10XU is quite simple, i.e., major optical components are a rotated-inclined double crystal monochromator designed by Ishikawa and a double flat mirror. One of a standard in-vacuum type undulator (U032V) designed by Kitamura is installed. On varying an undulator gap from 9.6 mm to 22 mm, a wide energy range (5-30 keV) is covered, using the first and third higher harmonics. On going to a higher energy with a smaller K_y value, the brilliance decreases while the band width increases. Since a typical energy range of ~1 keV is required as a routine EXAFS scan, both monochromator and undulator gap should be controlled during a scan; an undulator gap is varied so that a monochromator acceptance can track the undulator peak.

Higher harmonics and background radiation are minimized by a double flat mirror with a variable critical energy. For higher energy range (16-30 keV), the fundamental radiation is used while for lower energy range (5-16 keV), the third higher harmonic radiation is tuned. Since the speed of magnet positioning for an in-vacuum type undulator is limited, an undulator gap is tuned when the intensity is reduced by 30%. For tuning the absorption edge, the cut-off energy of mirror is varied so that the higher harmonics.

Figure 1 shows the variation of incidence photon intensity (i0) and an Ru K-edge EXAFS spectra taken for $RuPr_4P_{12}$ powder sample as a function of photon energy. At a sharp rise of intensity due to undulator tuning, no glitches are observed. This shows that undulator tuning at certain intervals can provide glitch-free transmission spectra. We also found that the observed energy resolution at Cu K-edge was less than 1.5 eV. We find that reflectivity calculated by a dynamical theory for a Si(111) reflection becomes larger than a symmetric case by a factor of two; the full wdth at half maximum (FWHM) values for rocking curves are 14.9 arcsec at 8 keV for Si(111). Owing to a grazing-incidence angle of 1° in an asymmetric double-crystal (+, -) rotated inclined configuration, the power density on the first crystal surface ~5 W/mm^2 is reduced to 1/57.3. We have calibrated the energy of the undulator peak vs gap value for 1st and 3rd higher harmonics over an allowed gap control region. According to the emprical table, a curve fit was performed and the gap position is controled referring to a 4th order polynomial function.

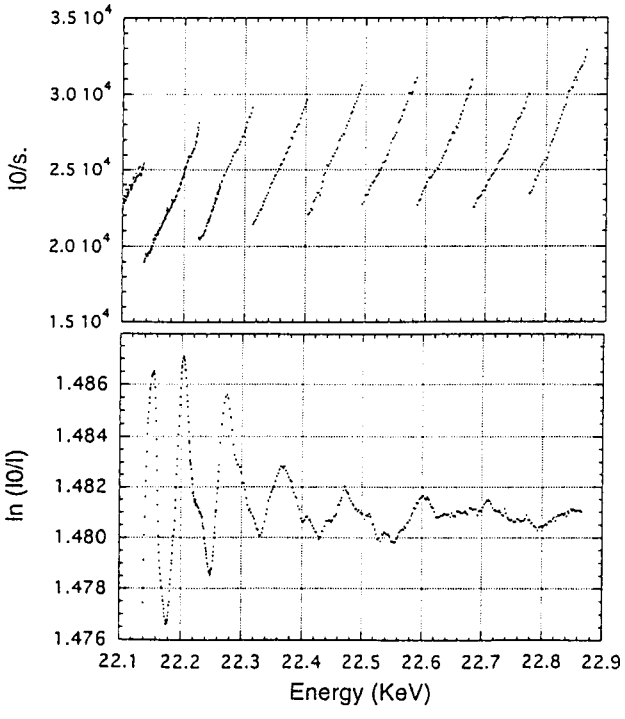

Fig. 1 I0 and EXAFS as a function of energy.