A Feasibility Examination of Multiple-Energy X-ray Holography in BL09XU

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Recently it has been proved by some groups that X-ray holography method is likely to overcome the phase problem of X-ray crystallography and provide a direct 3-dimensional image of atomic arrangement.[1-3] The method has two versions related by reciprocity: one is X-ray fluorescence holography (XFH) in which fluorescent X-rays act as object and reference waves and the other is multiple-energy X-ray holography (MEXH) in which incident X-rays act as those waves.

We tried the latter method in BL09XU using a multi-axis diffractometer for surface and interface investigations which had been installed at the end of the last fiscal year.

The schematic view of the experiment is depicted in Fig.1. X-rays of wavelength 1A were used to excite fluorescent X-rays from a sample crystal, Ge(111). A pyrolytic graphite crystal was set between the sample and the detector to select only GeKα radiation. The intensity of GeKα radiation was measured at various azimuth angles ϕ from -60° to $+60^\circ$ with $\Delta\phi = 4^\circ$ while both of θ_{in} and θ_{out} were fixed at 10° Although a three-fold intensity curve that reflects the symmetry of the sample crystal is expected in theory, such a modulation was not observed. Moreover the intensity changed more rapidly than the decay of the ring current. Now we are investigating plausible reasons for those results, for example instability of the detector system, and preparing for the next machine time.

One positive result is a high yielding rate of fluorescent X-rays that exceeds 10^4 cps and fairly satisfies the criterion for accurate imaging, i.e. 4×10^6 counts in every pixel.[1] BL09XU is a promising X-ray source for MEXH and FXH.

References

[1] M.Tegze and G.Faigel: Nature **380** (1996) 49.
[2] C.S.Fadley and P.M.Len: Nature **380** (1996) 27.
[3] T.Gog et.al. :Phys. Rev. Lett. **76** (1996) 3132.

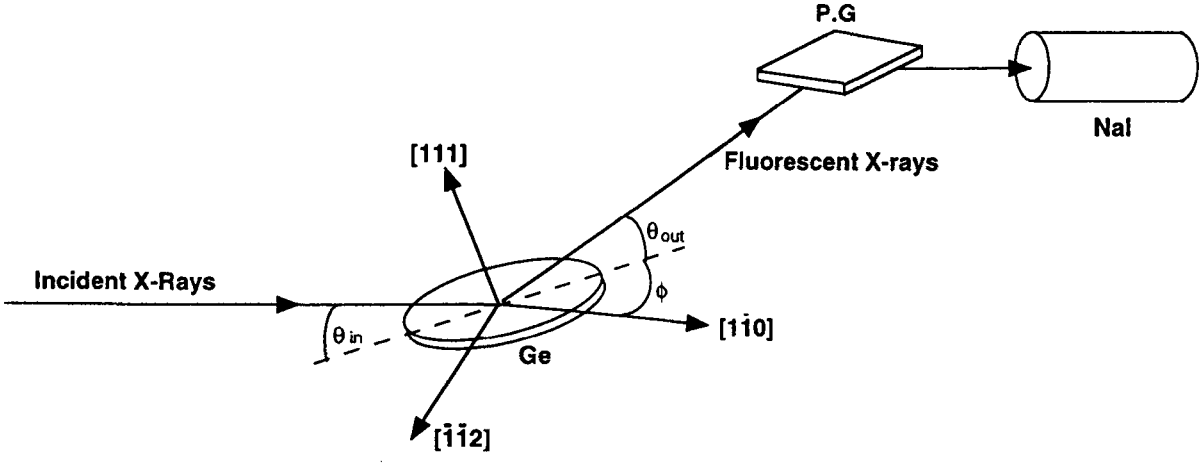

Fig.1. A schematic view of the experiment.