XFH study of dilute system using cooled APD

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X-ray fluorescence holography (XFH) is a relatively new experimental tool for determination of a local atomic structure around a specific element. Analysis of local structure around impurity in single crystal is one of most important applications of XFH. Thus, we have developed XFH setup for the dilute systems, which enables us to record a hologram within few hours. A cooled avalanche photo diode (APD) is one of suitable detector for this purpose, because it has 10 % energy resolution and fast counting system at the countrate of 10^8 cps. In the present study, we carried out the XFH measurement of dilute system using the cooled APD.

The measured sample was $Si_{0.999}Ge_{0.001}$ single crystal. The incident energies were 14.5 – 17.5 keV with 0.5 keV steps. Radiations from the sample were detected by the cooled APD. Photon signals were processed by fast amplifier, signal divider, discriminator and scaler. By scanning the discriminator's threshold, we determined lower and higher levels of pulse heights of Ge fluorescent X-rays and elastic scatterings. We collected the intensity of Ge fluorescence and elastic scatterings simultaneously. Figures 1 (a) and (b) show the 2D maps of the fluorescence and elastic scattering intensities measured at the incident energy of 15.0 keV. Comparing these, it is found that the pattern in Fig.1 (a) is overlapped by that in Fig. 1 (a). This is due to a long tail at the energy region below the main peak of the elastic scattering. But, it is possible to calibrate true hologram pattern from the patterns in Figs. 1 (a) and (b). Figure 1 (c) shows the calibrated hologram pattern. From the observed holograms, atomic images around Ge were successfully reconstructed.

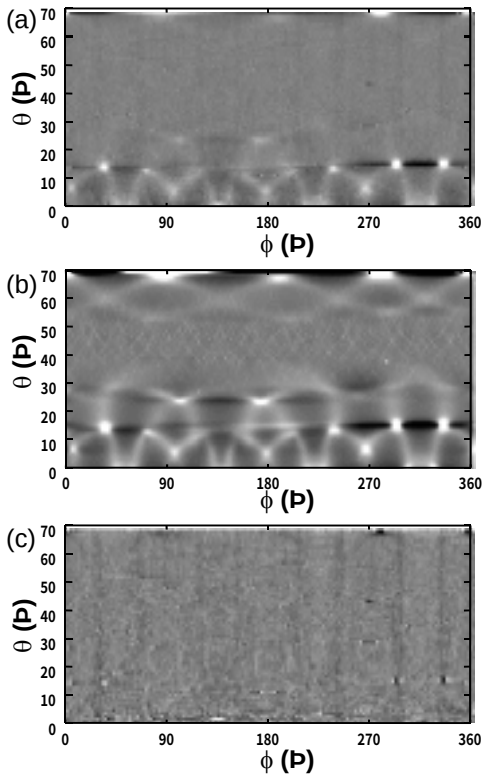

Figure 1. 2D maps of intensity variations.