

Atomic image around Zn in GaAs:Zn using multiple energy X-ray holography

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X-ray fluorescence holography has two types of experimental techniques, which have given successfully the atomic images. One is called "X-ray fluorescence holography" (XFH) and another is called "multiple-energy X-ray holography"¹⁾ (MEXH). The MEXH is the result of the optical reciprocity theorem applied to the XFH. We applied the MEXH to determine the zinc (Zn; 0.02 wt%) doped into gallium arsenide (GaAs) site.

The Zn $K\alpha$ X-ray fluorescence intensity was measured as a function of azimuthal and polar angles of a detector, and the resulting holographic pattern was obtained, as shown in Fig. 1. Real space atomic images around Zn was obtained by Fourier transformation from the hologram. The reconstruction in Fig. 2 is an environment of Zn atom on (001) plane with cubic base grid. Blurry four atoms on the grid lines at distance of 2.0 Å from the center were observed in Fig. 2. This image was superposition of two different As layers above and below the emitter. Corner atoms on the grid could be identified at the distance of up to 5.6 Å. These atoms were correspond to the Ga atoms on (001) plane.

1) T. Gog, P. M. Len, G. Materik, D. Bahr, C. S. Fadley and C. Sanchez-Hanke, Phys. Rev. Lett., 76,

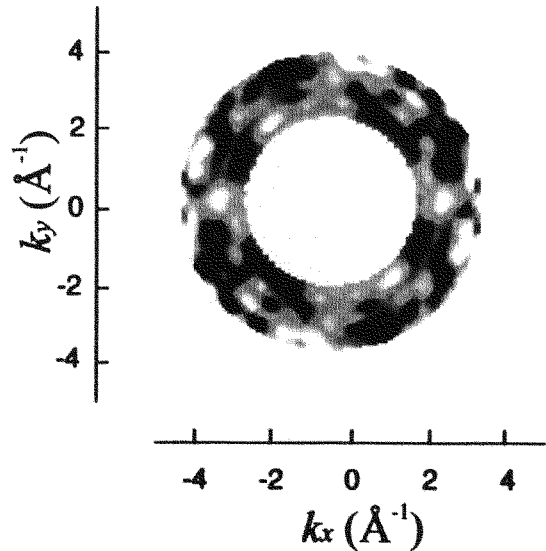


Fig. 1 Hologram of Zn $K\alpha$ X-ray fluorescence

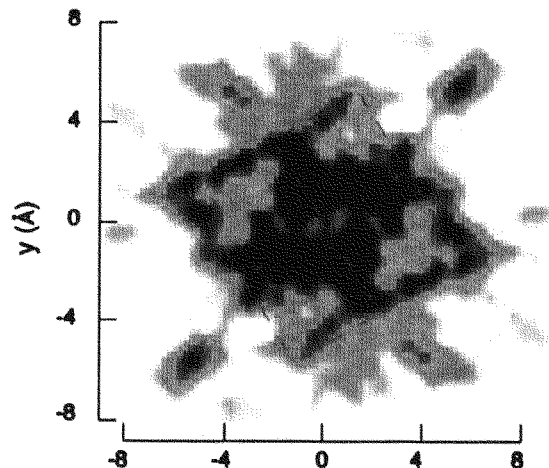


Fig. 2 Atomic image around Zn