15C/2000G046

Image Contrast of Lattice Defect in X-ray Topography by Resonant Scattering.

Riichirou NEGISHI[1]*, Masami YOSHIZAWA[1], Shengming ZHOU[1], Isao MATSUMOTO[2], Tomoe FUKAMACHI[1], Takaaki KAWAMURA[3] and Masayasu TOKONAMI[1]
[1]Saitama Inst. of Tech, [2]KEK-PF, [3]Yamanashi Univ.

X-ray topography by atomic resonant scattering has been measured for the first time. X-ray topographies of GaAs have been taken using 200 reflection near the K-absorption edges of Ga and As. Figure 1 shows the real and imaginary parts of Fourier coefficient χ_{hr} and χ_{hi} for GaAs 200 reflection near the edges. We put $\chi_h\chi_{-h} = \overline{\chi}_h^2(u+iv)$ with $\overline{\chi}_h = (|\chi_{hr}|^2 + |\chi_{hi}|^2)^{1/2}$, $u = (|\chi_{hr}|^2 - |\chi_{hi}|^2)/\overline{\chi}_h^2$, $v = (1-u^2)^{1/2}\cos\delta$ and δ is phase difference between χ_{hr} and χ_{hi}. At the energy point marked by an arrow A, $\chi_{hr} \neq 0$ and $\chi_{hi} = 0$ then $(u,v) = (1,0)$; at B, $\chi_{hr} = 0$ and $\chi_{hi} \neq 0$ then $(u,v) = (-1,0)$; at C and D, $|\chi_{hr}| = |\chi_{hi}|$ then $(u,v) = (0,-1)$ for C and $(u,v) = (0,1)$ for D. The values of the X-ray polarizabilty at these energy points of A~D are quite typical. The observed topograhs of diffracted beams at A~D are shown the Fig.2(a)~(d). We focus on the linear defect image running from upper left to lower right. The darker contrast corresponds to stronger X-ray intensity. The dark linear image in Fig.2(a) with $(u,v) = (1,0)$ changes into double white linear images in Fig.2(b), (c) and (d), respectively. This contrast change stems from anomalous transmission of the Borrmann effect. The upper line is brighter in (c) while the lower line is brighter in (d), which can be explained by the asymmetry of the rocking curve of transmitted beam.[1)]

It is noted that the image contrast and its change are clearly observed even from a thinner crystal than usual by using resonant scattering. We will investigate the possible application of the image contrast caused by the atomic resonant scattering to analysing the defect image in a nearly perfect crystal.

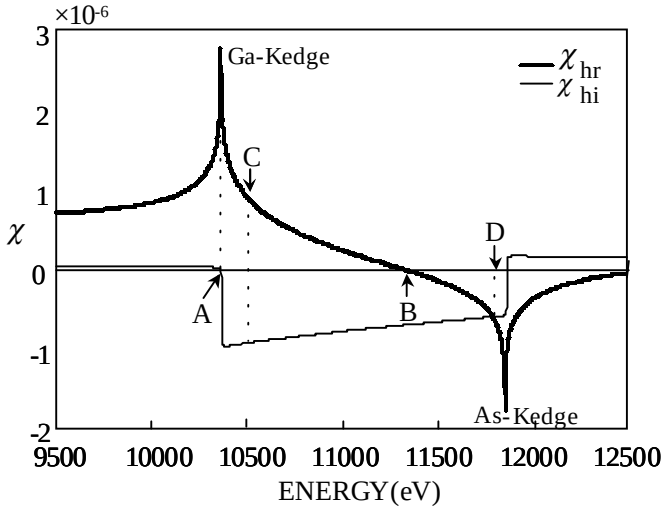
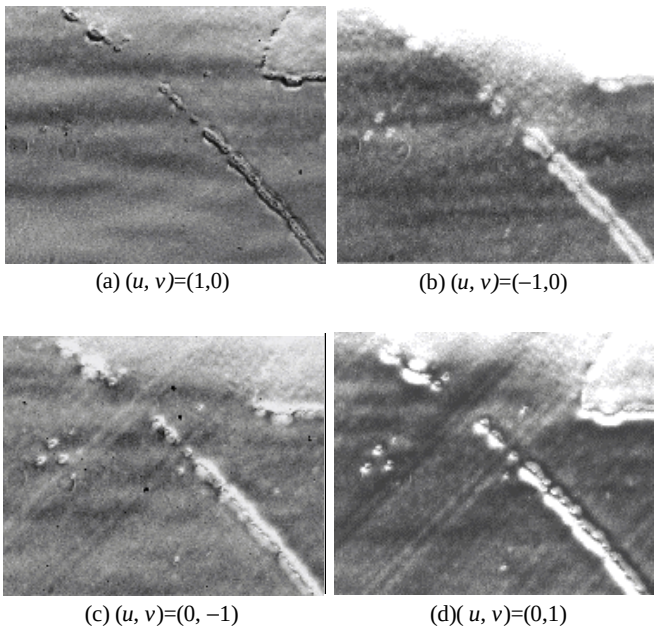


Fig.1 χ_{hr} and χ_{hi} for GaAs 200 reflection near K-absorption edges of Ga and As.



(a) (*u*, *v*)=(1,0) (b) (*u*, *v*)=(−1,0)

(c) (*u*, *v*)=(0, −1) (d)(*u*, *v*)=(0,1)

Fig.2 Diffracted-beam images of GaAs 200 reflection by resonant scattering X-ray topography.

1) T. Fukamachi et al. :Acta Cryst. A**52**(1996)669-674.

*negishi@sit.ac.jp