and wavelengths were chosen to be 1.

Polishing and chemical etching, were about 32. Sasaki*, of synchrotron radiation

was found in the middle of the thermal diffuse spot on diffraction photographs of a

X-ray films. In diffraction patterns, the excess line depends on the wavelength of X-rays. A pure excess line

the Bragg reflection had reflection widths close to the

value for ideal crystals. The photographs were taken on incident angles deviating by 0.5°-0.4°

from the Bragg angle of the 220 reflection. The specimen-

film distance was 45 cm. Exposure times were about 10-30 minutes for cosmic-ray films and 1-4 hours for medical

X-ray films. In diffraction patterns, the excess line depends in the middle of the thermal diffuse spot and the excess intensity developed continuously X-ray scattering from the monochromator. The excess line width deviates by wavelength of X-rays. A pure excess line was observed at 1.54 a°.

The excess-defect structure was not affected by incident angles. The excess line can be attributed to the anomalous transmission of the thermal diffuse waves which satisfy the Bragg condition for the 220 reflection in propagating through absorbing perfect crystals. This shows a remarkable contrast to the case of defect lines from mosaic crystals.

Results Fig. 1 compares moiré patterns recorded on photographic films at different orientations. For pattern (a), the photographic film is nearly perpendicular to K. Regarding the fringe directions in the right-side region of the pattern, the slopes of fringes in (a) are larger on the right side of the arrow-indicated position, while on the left side the slopes in (b) are larger. It is easy to see that such two patterns are not in the relation of the projections of a two-dimensional figure. Table 1 gives the analysis of δK for the fringes around marks a and b in Fig. 1. (The x- and z-axes are perpendicular and parallel to the diffraction plane, respectively, and the y-axis is normal to the plane of incidence). This analysis confirms that the direction of δK is greatly deviated from that of δxK (11.7-14°). Comparison of the analysis of δK with the presumed distribution of δK suggests δK = 2πΩ. To clarify the whole of the phenomena, much more study must be done. Nevertheless, from the results as far obtained, it is clear that the rule δK = 0 does not hold in the moiré interference. It is indicated that crystal moiré is an inelastic phenomenon.

δxx δxy δxz δK = 0.2, 2.5, 0.3, 39°,

Table 1. Upper row: (a) δx = 6.6°; (b) δx = -9.4°,

for 2.5. The x-coordinate vector (X, Y): coordinate system is

the values are 10° for the observation of a single

angle between the X- and x-axes, (2m/d) = (d: lattice

tion spacing). The films were set vertically x = tan⁻¹(δxy/δK).


A fine excess line was observed across the 220 thermal diffuse waves at a perpendicular angle to the X-ray beam. These observations were made using a monochromated X-rays of synchrotron radiation (Y. Kashihara et al., J. Phys. Soc. Jpn. 1996, 65, 4172). Properties of the line were investigated under various experimental conditions. The wavelengths were chosen to be 1.5405 a° and 1.15 a°. The X-ray beam was collimated with slits in the cross section 0.3 mm × 2.3 mm. Specimens of crystal plates were prepared by polishing and chemical etching, were 0.1-0.3 mm thick. Their surfaces were parallel to the (111) plane. The crystals were perfect so that the rocking curves of the Bragg reflection had reflection widths close to the theoretical value for ideal crystals. The photographs were taken on incident angles deviating by 0.5°-0.4° from the Bragg angle of the 220 reflection. The specimen-film distance was 45 cm. Exposure times were about 10-30 minutes for cosmic-ray films and 1-4 hours for medical X-ray films. In diffraction patterns, the excess line was found in the middle of the thermal diffuse spot and the excess intensity developed continuously X-ray scattering from the monochromator. The excess line width deviates by wavelength of X-rays. A pure excess line was observed at 1.54 a°. The excess-defect structure was not affected by incident angles. The excess line can be attributed to the anomalous transmission of the thermal diffuse waves which satisfy the Bragg condition for the 220 reflection in propagating through absorbing perfect crystals. This shows a remarkable contrast to the case of defect lines from mosaic crystals.

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tion spacing). The films were set vertically x = tan⁻¹(δxy/δK).

11.7.15 EXPERIMENTAL STUDY ON THE DIFFRACTION OPTICS OF CRYSTAL MOIRE. By K. Yoshimura, Faculty of Engineering, Toyama Uni. Kup, Japan.

Introduction Moiré fringes observed in crystal diffraction have been regarded as far as to be the projection of the intensity distribution on the exit surface of the crystal in the direction of the wave propagation. The character of the projection agrees with a common restriction, δxK = δKx, i.e. |F| = |F'|, where vectors of interfering waves; δKx, δKz mean of K and F', upon the interference between elastically scattered waves. However, several considerations suggest an idea that moiré patterns are not such a projection, but an observation of equiphase surfaces (δF = δF') = n (δF): difference in the reciprocal lattice vector F: position vector of an observation point (X, Y, Z) which extend three-dimensionally in space. This idea was tested by the following experiment.

Experimental Moiré patterns were observed in X-ray topography, using a double crystal arrangement of parallel setting for Si 220 with N煦 Kn radiation. A monolithic bi-crystal with a narrow gap (total thickness 3.5 mm; gap width 260 μm) was prepared for the specimen. Lattice distortion δF was introduced by putting a Tg weight on the top of the specimen. Moiré patterns were recorded simultaneously on two or three photographic films set at different orientations and/ or different photographic films from the same specimen. As far as a moiré pattern is produced by interference between two waves, observed moiré fringes can be regarded to be of equiphase surfaces (δF = δF') = 2m and an observation plane. The wave-vector difference δK was determined on this assumption by analysing moiré patterns on different photographic films as mentioned above.

11.7.16 DYNAMICAL EFFECTS IN GRAZING INCIDENCE DIFFRACTION OF X-RAYS IN SI

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X-rays incident on a surface under grazing angle may undergo total external reflection and excite an interior wave field damped exponentially into the bulk. These evanescent waves are a sensitive probe to study the structure of the near surface region. We measure Bragg-diffraction intensity (220-reflection) under grazing incidence conditions. We focus on the dependence of intensity on the angle of glancing exit which allows the study of the dispersion surface with high resolution. Detailed comparison of various experimental scans through reciprocal space with predictions of the dynamical theory yields excellent quantitative agreement. Ion implantation induces characteristic changes in the Bragg-profiles through the presence of amorphous or strongly disturbed surface layers. Bragg-profiles of Si-Si-Ga layered structures exhibit features related to the periodic variation of susceptibilities. Experimental results on both problems are discussed within dynamical theory.