Crystallography

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Interference fringes in Laue diffraction from lateral surface of a bent crystal

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Interference fringes in the Laue diffraction from a lateral surface of a Ge single crystal strip in the multiple Bragg-Laue mode were observed by Fukamachi *et al.*, [1,2]. As shown in Fig. 1(a), the fringes are caused by the interference between the internal (refracted) wave excited by the incident X-ray in both the Bragg-Laue case and the Bragg-Bragg-Laue case when the incident beam is regarded as a spherical wave (Hirano *et al.*, [3,4]). The propagating directions of the refracted beams are very sensitive to the crystal distortion. The paths of the refracted beams are of hyperbolic forms in the crystal and the refracted beam $\boldsymbol{S}_1$ intersects the crystal surface at A_2 as shown in Fig. 1 (b), At A_2, a part of the refracted beams come out of the crystal to produce the mirage peak P_m^1 [5]. The rest are reflected and reach the lateral surface. In this paper we report on the measurements of various interference fringes due to the mirage effect by using a cantilever device as shown in Fig.2.

The experiments were carried out by using X-rays from synchrotron radiation at a bending-magnet beam line BL-15C, KEK-PF. The X-rays were σ-polarized and were monochromated by using a Si 111 double crystal monochromator. X-ray energy was 11100 eV. The sample was a Si strip, 40 mm long, 10mm wide and 0.108 mm thick. By using 220 reflection, the fringes were measured as indicated by P_h' in the photographs of Fig. 1(right). Fig. 1 (a) shows the fringes from an unbent crystal and (b) from a bent crystal (D=20 μ m).

Although the fringes in Fig.1 (b) can be seen in the surface side ($y = 0$), those in Fig.1 (a) cannot be seen. In the photograph of Fig. 1 (a), the weak band indicated by P_h^2 just above the fringes is the reflected beams from the back surface. In the photograph of Fig. 1(b) (right), the weak band indicated by P_m^1 is the mirage peak.

In the weakly bent crystal, the mirage peak and the interference fringes modified by the mirage effect are measured. The results will be very useful to estimate the weak stress/strain in a single crystal.

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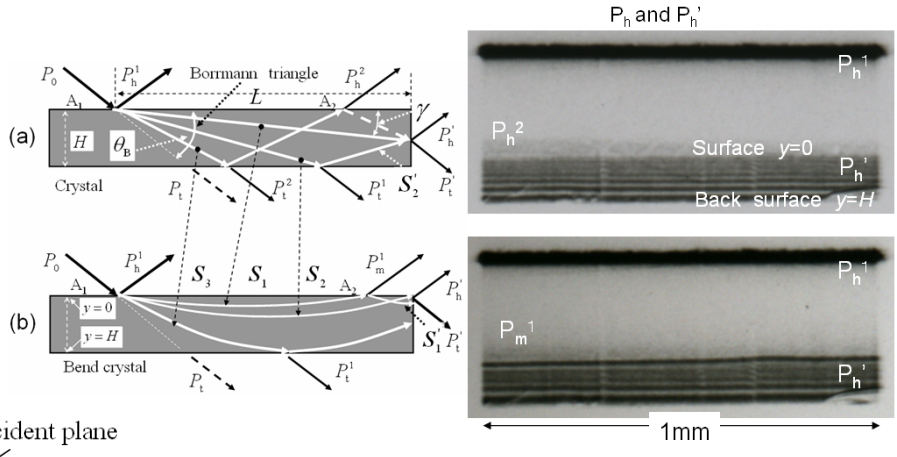

Fig. 1. Schematic diagram of multiple Bragg-Laue case (left) and the observed fringes (right). The upper part (a) shows those from an unbent crystal and the lower part (b) from a bent crystal. L is the distance from the incident point to the edge of the crystal and H the thickness. L=930 μ m and H =108 μ m.

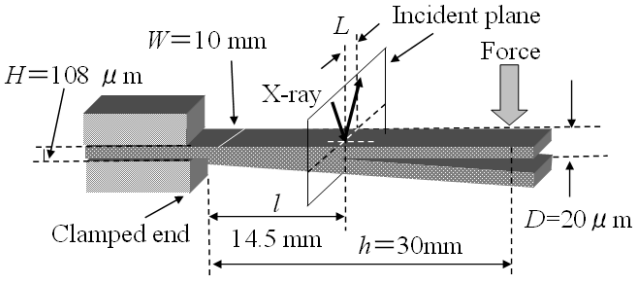

Fig. 2. Sample and bending jig geometries.

References

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