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Observation of X-Ray Beam Condensation by Confinement in a Thin Crystal

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We have observed the X-rays emitted from a side plane of a thin Ge crystal and their condensation by confining a part of the incident X-rays in the crystal[1]. The experiment was carried out at the beam line 15C, Photon Factory, KEK. The schematic diagram of the measuring system is shown in Fig.1. The X-rays from synchrotron radiation were monochromated by a Si 111 double crystal monochromator and a Ge 220 monochromator. In Fig.1, Ph and Pd are the intensities of the reflected and transmitted beams. Ph' and Pd' are the intensities of the emitted beam into the reflected and transmitted directions. The crystal thickness is 38 μm. The X-ray energy was 11102 eV and Ge 220 reflection in the Bragg case was measured. The measured rocking curves of Ph and Pd are shown in Fig. 2. The photographs of Ph, Ph', Pd and Pd' taken on the nuclear plate are shown in Fig. 3. The photographs in Fig. 3 (a) were taken at the angle corresponding to the point A in Fig. 2, where no contrast is seen except for the reflected beam one. The photographs in Fig.3 (b), 3(c) and 3(d) were taken at the angle corresponding to B in Fig. 2, where contrasts of Ph, Ph', Pd' and Pd are observed. In this condition, the beams confined in the crystal are emitted. In the photographs in Fig. 3(b), the interference fringe is also observed. In Figs. 3(c) and 3(d), the emitted intensities increase as the width of the incident beam increases. The density of the emitted beam becomes higher. It may become higher than that of the incident beam when we increase the rate of confinement as well as the incident beam width, which will be our future work.

[1] T. Fukamachi et al., JJAP **43**,L865(2004).

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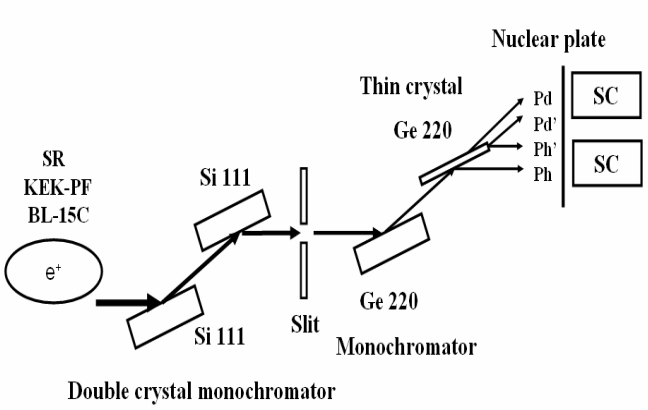

Fig. 1 Schematic diagram of the measuring system.

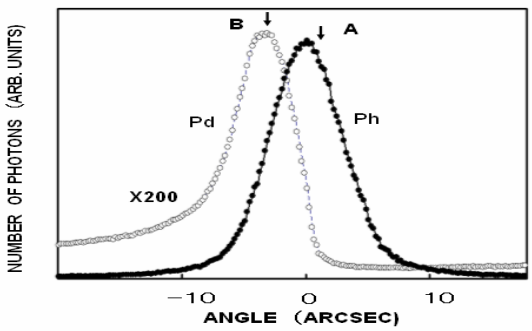

Fig. 2 Measured rocking curves.

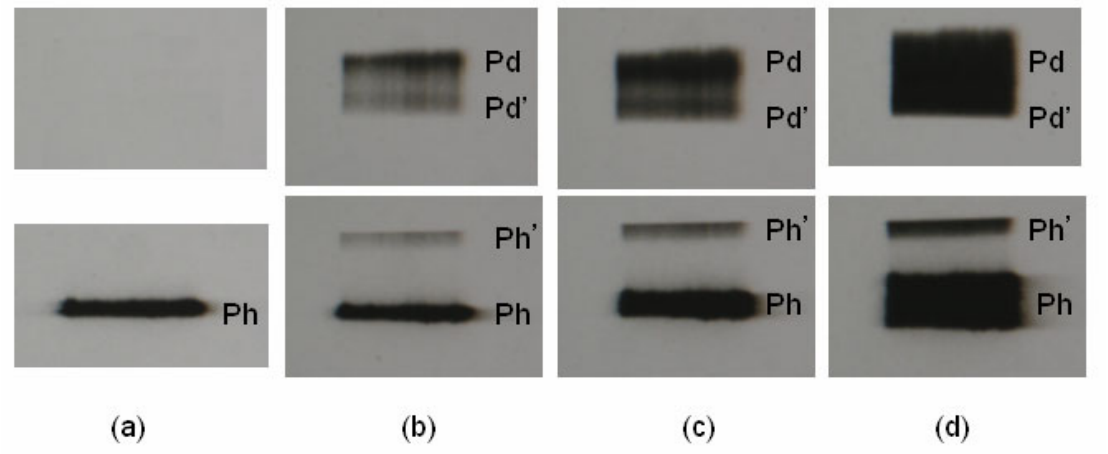

Fig. 3 Photographs of Ph, Ph', Pd' and Pd. The incident beam size is 0.35(W)x0.035(H)mm^2 for (a) and (b), 0.35(W)x0.06(H)mm^2 for (c) and 0.35(W)x0.12(H)mm^2 for (d).