Instrumentation and Technique

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A trial use of an imaging plate for back-Laue photograph = How quick can an intense spot of white X-ray beam be erased? =

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Introduction

We have performed the X-ray magnetic diffraction (XMD) experiment on the beamline 3C of the Photon Factory. In this experiment we use white X-rays from a bending magnet as an incident beam and also use a single crystal of ferromagnets as a sample. At the initial stage of the experimental setup, a back-Laue photograph is taken for adjusting the sample crystal orientation. So far Polaroid film (#57) has been used for recording Laue spots. The announcement of cease of production of the film has prompted us to adopt an Imaging Plate (IP) instead of the film.

A problem of using an IP as a recording medium of back-Laue photograph is intense white X-ray beam incident on the IP. One way to avoid such intense incident beam is making a small hole on the IP through which the incident beam passes. But the incident beam position recorded on the IP is very useful for precise adjustment of the sample orientation. Here we make a trial use of an IP to the back-Laue photograph in which the incident white beam is irradiated on the IP. The key points of this study are the followings. (1)Dose an IP suffer serious radiation damage from the incident intense white beam or not? (2) Can an IP be used repeatedly in such back-Laue mode? (3) How quick can the intense spot on an IP be erased?

Experiments

IP (Fuji Film: BAS-MS 2025) was irradiated by the direct white beam of the BL3C. The beam size was 0.1mm × 0.1mm, and the exposure time was shorter than 1s. The intensity of the spot recorded on the IP was measured by using the IP reader BAS-2500 (Fuji Film). Erasing of the spot on the IP was made by placing the IP under the fluorescent lamp. We used two types of lamp, a tube type and a ball type, as shown in Fig. 1 (a) and (b), respectively. The tube lamp is 40W × 2, and the ball lamps are 60W and 100W.

The experiment was performed as follows. (1) The IP was irradiated by the incident white beam. (2) The intensity recorded on the IP was measured by the IP reader. (3) The IP was then placed under the fluorescent lamp for erasing for a certain period of time. (4) The procedures (2) and (3) were made repeatedly.

Results and discussion

Fig. 3 shows decay of intensity of the incident spot on the IP. In Fig. 3 the ordinate is the intensity normalized to the initial intensity and the abscissa is the erasing time. The lines (a), (b) and (c) correspond to erasing with a tube lamp (40W×2), a ball lamp (60W) and a ball lamp (100W). The line (d) shows natural decay of the intensity without erasing which was measured by holding the IP in a black plastic envelope to shut out any light. From Fig. 3 we can see that the intense incident spot could be almost erased within 30 min with the ball type fluorescent lamp of 100W. So far we have tried this measurement several tens times and we have seen no damage on the IP.

It is concluded that the IP can be used for back-Laue photograph repeatedly even when the incident white beam is irradiated directly on the IP. The intense direct spot on the IP can be erased within 30min by using a ball type fluorescent lamp of 100W.

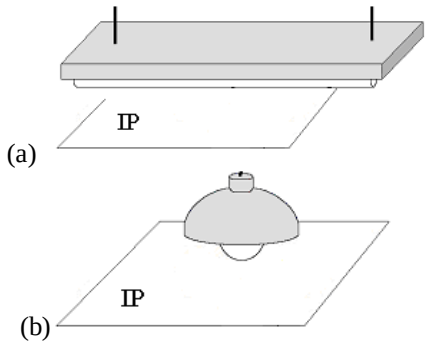

Fig. 1 Schematic diagram of erasing an IP with a fluorescent lamp.

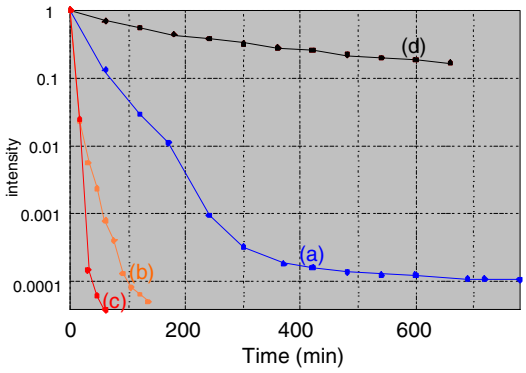

Fig. 2 Intensity of a spot on the IP as a function of erasing time.

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