Instrumentation and Technique

14C1/2002S-001

60 × 40-mm X-ray interference pattern generated by two-crystal X-ray interferometer

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Introduction

A Skew-symmetric two-crystal X-ray interferometer (STXI, Fig. 1) is the most well-suited device for phase-contrast X-ray biomedical imaging based on X-ray interferometry. The field of view can be doubled compared with that of monolithic X-ray interferometers, and thermal disturbance caused by heat from a sample can be suppressed by separating the distance between the crystal wafer and the sample.

To date, various biological samples such as rat livers have been observed[1] by our 3rd imaging system using STXI[2]. *In vivo* observation of cancer implanted in a nude mouse was also carried out, and the inner structure of the cancer, such as blood vessels, were revealed without the use of a contrast agent[3].

Last autumn, the height of the incident X-ray beam at BL-14C1 was expanded from 30 mm to more than 60 mm by rebuilding the transport channel of BL-14 (see the chapter of experimental facilities in this volume Part 1). To use this wide X-ray beam for the imaging, we first tried to generate a large-area X-ray interference pattern by using our 3rd imaging system.

Results and discussion

Figure 2 shows an interference pattern obtained using 17.7-keV X-rays. The pattern size was 60-mm wide and 40-mm high, which was determined by the crystal wafer of STXI. The view area of the imaging detector was too small to obtain the entire pattern in one exposure; therefore the pattern was observed with four exposures (3 sec each).

Visibility was in the range from 40 to 60%, with an average of 50%, which is sufficient for use in phase-contrast imaging. Since no object was placed in the beam path, the interference fringes observed in the figure were due to the lattice strain and/or deformation of STXI.

Our next step will be to observe large biological samples such as rabbit livers using this wide beam. We also plan to carry out *in vivo* observation of the growth process of a cancer over a few days. To do this, we are developing a new imaging detector, which will enables us to detect interference patterns five times faster than the current imaging detector. This method of observation will allow the *in vivo* evaluation of the effects of drugs in the near future.

References

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[3] T. Takeda et al., Jpn. J. Appl. Phys. 43, L1144-L1146 (2004)

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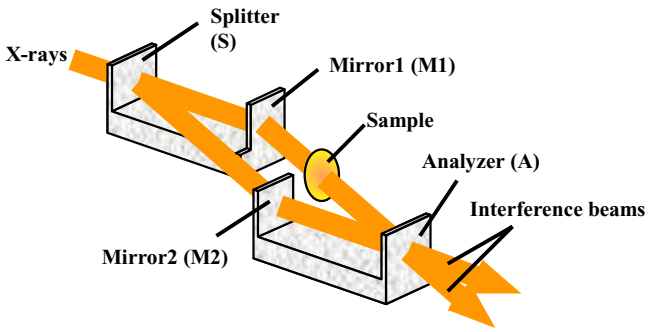

Fig. 1. Skew-symmetric two-crystal X-ray interferometer

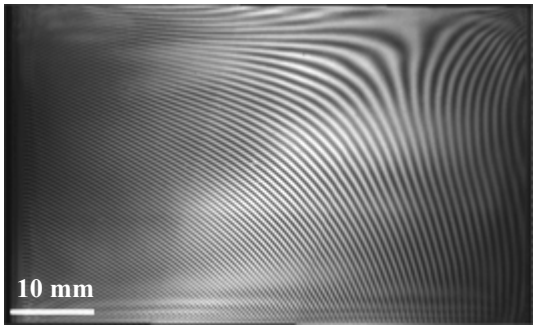

Fig. 2. A 60 × 40-mm interference pattern obtained using 17.7 keV-X-ray.