Current situation concerning the element strategy for diffraction experiments at the SPring-8 NIMS beam line

Osami Sakata, Yoshio Katsuya, Masahiko Tanaka: NIMS, Kohei Yoshimatsu, Akira Ohtomo, Takao Shimizu, Hiroshi Funakubo: Tokyo Tech, MCES

We are going to introduce maintenance from the beginning of the elemental strategy project: 1) high throughput measurement of powder X-ray diffractometer, and 2) microbeam focusing optics. For item 1), in order to investigate the solid phase reaction of oxynitride perovskite, its phase transition behavior, and thermal history, the measurement efficiency of powder X-ray diffraction improved by mounting multiple units of one-dimensional semiconductor X-ray detectors. We developed a small radius six-multiple mode in which detectors are arranged asymmetrically so that it is possible to collect a 72 °diffraction



Fig. 1 Small-radius six-multiple mode

angle data without 2 θ scanning [1]. The another is a large radius (955 mm) quadruple-mode system capable of collecting high-angular resolution diffraction data. For item 2), in order to clarify the correlation between the electric polarization function and the structure of novel ferroelectric thin films, a focusing optical system for the thin film diffractometer was introduced upstream of the sample position. Two lens systems were introduced for incident X-ray energies of 12.4 and 30 keV and had a structure in which microlens elements for alternately focusing the vertical direction and the horizontal direction were arranged alternately. The focused beam size at the specimen position was evaluated by knife edge scan. The FWHM beam sizes evaluated were 1.5 μ m in the vertical direction and 1.7 μ m in the horizontal direction.

The following three research examples are also included in our poster presentation. As an example of published research results, A) for a novel double perovskite transition metal oxide crystal structure, we evaluated the degree of film crystallinity order and revealed that the magnitude of magnetization strongly depends on the degree of order [2, 3]. In addition, research examples under preparation for publication are as follows. B) Combining a focusing optical system, a flat plate powder sample, and a large area detector allowed us to determine the distribution of Zn - Ga ions in IGZO related crystals using anomalous dispersion diffraction measurements at the Zn K absorption edge. C) Film thickness dependency of crystal structure at room temperature was investigated for epitaxial HfO₂-based ferroelectric films. In addition, film thickness dependency of phase change temperature as a temperature (corresponding to Curie temperature) was also revealed.

Bibliography

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