Introduction of a special optics and application to structural determination of interfaces.

1. Abstract

Beamline BL13XU is dedicated for surface/interface structural studies using diffraction and scattering techniques such as crystal-truncation-rod scattering, reflectivity, and standing waves. We do not only offer users measurement tools but also improve diffraction techniques and methods for structural determination of interfaces.

The aim of this training course is to introduce such technical improvements that we are initiating.

For example, the users often request us to make an incident beam smaller and smaller since their samples become smaller. Such request will be fulfilled by utilizing a focusing optics or by limiting the beam. Of course, they would not like to smear the angular resolution or lose the intensity either.

1) Plan of the first day:

To arrange an optics to overcome such difficulties and to evaluate a beam size and an angular divergence.

2) Plan of the second day:

To apply the optics to dynamical diffraction measurements and standing wave measurements.

2. Schedule

1) Introduction

1-1) Introduction of beam line BL13XU . (30 min)

Quick tour from the optics hutch to experimental hutch 3 to watch the Lq. N2 cooled monochromator, mirrors for rejecting higher harmonics, and typical facilities like diffractometers for in-air or in-solution measurements and for ultra-high vacuum measurements.

1-2) Brief review on surface x-ray diffraction (30 min)

Presentation on what surface x-ray diffraction is and what kind of information we achieved.

2) Outline of today's training (60 min)

We plan to make an x-ray optics proposed for dynamical diffraction measurements of a non-ideal crystal. The optics is composed of a pair of channel-cut Si (004) crystals and a one-dimensional focusing lens system. We measure a rocking curve of a substrate Bragg peak having a several arc-sec width. In addition, we carry out standing wave measurements of recording a fluorescence emission of a thin film.

3-1) Arrangement of an optics for the first day.

a) To find the Si (004) Bragg peak from the first channel-cut Si (004) crystal located upstream and measure a rocking curve.

b) To find the Si (004) Bragg peak from the second channel-cut Si (004) crystal located downstream and measure a rocking curve.

c) To adjust a lens system.

d) To evaluate beam properties of a horizontal beam dimension and a vertical angular divergence if there is time.

3-2) Sample alignment and measurements for the second day.

a) To make a quick alignment of the optics.

b) To evaluate beam properties of a horizontal beam dimension and a vertical angular divergence.

c) To put sample and detect a Bragg peak from an oxide substrate.

d) To record a rocking curve of the substrate and a fluorescence emission of a thin film.

[1] O. Sakata, T. Kudo, H. Yamanaka, and Y. Imai, *Trans. MRS-J* **34**, 601 (2009).