

## Preliminary Experiments of Surface and Interface in BL09XU

Shinichiro NAKATANI (3300), Wataru YASHIRO (3297), Shuji KUSANO (3548),  
Toshio TAKAHASHI (3133)\*, Takayoshi SHIMURA (1281)<sup>1</sup>, Akira SAITO (3282)<sup>1</sup>,  
Yasuharu KASHIHARA (0051)<sup>2</sup>, Makina YABASHI (0387)<sup>2</sup>,  
Nobuo KASHIWAGURA (3153)<sup>3</sup>, Yoshikazu FUJII (3188)<sup>4</sup>, Masatoki ITO (3402)<sup>5</sup>,  
Munehiro SUGIYAMA (3280)<sup>6</sup>, Masamitsu TAKAHASHI (1168)<sup>7</sup>  
and Yoshitaka YODA (1245)<sup>8</sup>

Institute for Solid State Physics, University of Tokyo

<sup>1</sup>School of Engineering, Osaka University

<sup>2</sup>Japan Synchrotron Radiation Research Institute

<sup>3</sup>Faculty of Engineering, Gifu University

<sup>4</sup>Faculty of Engineering, Kobe University

<sup>5</sup>Faculty of Science and Technology, Keio University

<sup>6</sup>Device Physics Research Laboratory, NTT Basic Research Laboratories

<sup>7</sup>Spring-8, Japan Atomic Energy Research Institute

<sup>8</sup>School of Engineering, University of Tokyo

Our activity in Spring-8 since March 1998 consists of two parts: preparation of the multi-axis diffractometer at BL-09XU and preliminary tests of experiments proposed by members of our group.

Following the installation and the basic test of the diffractometer in FY 1997<sup>1)</sup>, we examined it in detail. All imperfections pointed out in the examination have already been removed by replacement of parts or adding new attachments. Now its performance has reached the specification in the blueprint.

In parallel with the above examination we performed preliminary tests of themes in the following.

1. Characterization of surfaces and interfaces of crystals by X-ray crystal truncation rod (CTR) scattering.
2. Observation of superstructures on metal surfaces by X-ray diffraction.
3. Evaluation of the thickness of a thin film on a steel surface by total X-ray reflectometry.
4. Location of atomic sites in composite crystals by X-ray standing waves.
5. Measurement of the effect of multiwave diffraction in CTR scattering.
6. Fluorescent X-ray holography.

Since space is not enough we report only on the first theme briefly. The samples are a Si/Ge/Si(001) crystal and a Si/SiO<sub>2</sub>/Si(001)

crystal. The CTR scattering profiles were measured near the 004 Bragg point of the Si/Ge/Si(001) crystal and the 111 Bragg point of the Si/SiO<sub>2</sub>/Si(001) crystal. The same measurement had already been performed at Photon Factory (PF). In both measurements we observed characteristic oscillations caused by interference between the substrate crystals and the layers grown on them. From a comparison between the data of Spring-8 and PF we reached the conclusion that the beam intensity of Spring-8 is 10 ~ 100 times stronger than that of PF. Although the intensity is much smaller than expected, this result seems reasonable because all data of Spring-8 were taken when the ring current was less than 20mA and the beam selected by the double-crystal monochromator was very divergent. The much stronger beam may be available under a perfect operation mode.

In the process of those tests our measurements were sometimes disturbed by the contamination of higher harmonics. Thus we hope an effective optical device against the harmonics such as a total reflection mirror.

### Reference

- 1) T. Takahashi *et al.*, SPring-8 Annual Report (1997) 299.