

# Crystal Structure Analysis (BL02B1)

BL02B1 is designed for the study of crystal structure analysis and phase transition phenomena in solid state physics. The apparatus with a 6+1-circle diffractometer, a vacuum oscillation IP camera, Weissenberg camera and a powder diffraction system are equipped. These items are being utilized with the combination of the bending magnet and synchrotron light source. The facility specification is the same as that stated in the previous annual report of SPring-8 1998.

## 1. X-ray Source

The X-ray source for BL02B1 is the SPring-8 standard bending magnet. The critical energy of the light source is 28.9 keV. The source size is  $\sigma_x=0.182$  mm,  $\sigma_y=0.058$  mm and  $\sigma_y'=0.065$  mrad at 10 keV. The Horizontal beam divergence is 1.5 mrad. The incident X-ray is monochromatized by SPring-8 standard double monochromator. Two Pt coated X-ray mirrors are equipped in a position 28.7 m and 38.3 m from the bending magnet, respectively. The double crystal monochromator is set in the 31.7 m position. We can choose the diffraction plane as (111), (311) and (511) of the Si monochromator crystal.

The available energy range is from 5 to 90 keV. In a typical case, the energy resolution  $\Delta E/E$  and the photon flux is  $= 10^{-4}$  and  $10^9 \sim 10^{10}$  photons/sec, respectively. The beam size at the sample position is about 2mm in height and 10mm in width without focusing. In Autumn 2000, we are planning to add horizontal X-ray focusing system with sagittal bending of the second monochromator crystal. The actual photon numbers at the sample position in the square region with a height of 0.1mm and a width of 1mm are estimated as  $10^{10}$  photons/sec at 30keV with a vertical focused X-ray beam.

## 2. Experimental System

### 2.1 Diffractometer

The diffractometer equipped is a HUBER 5020 6+1-circle diffractometer system. It has a short  $2\theta$  arm and a long  $2\theta$  arm. The short  $2\theta$  arm is mainly utilized for Bragg points collection like a conventional 4-circle diffractometer with the automatic software. The long  $2\theta$  arm which has an angle resolution of 0.0001 deg is utilized for the mapping scan in a reciprocal space, diffuse scattering observation or high resolution powder pattern observation with a scintillation counter.

### 2.2 Oscillation IP Camera

An automatic vacuum IP camera system is installed for small crystal structure analysis. The processes of X-ray exposure and the reading out are managed automatically by computer. The whole process is performed in a vacuum to obtain a high S/N ratio measurement. The sample is set on a rotating refrigerator to utilize the oscillation camera motion. The available temperature range of this camera is from room temperature to 25K.

### 2.3 Powder Diffraction

The powder diffraction experiment is performed with long  $2\theta$  arm with analyzer crystal and scintillation counter. The FWHM of the powder pattern profile with this method has achieved a 0.008 degree.

### 2.4 Weissenberg Camera

The apparatus is equipped with a Weissenberg camera system for scanning in reciprocal space. The camera motion is realized by a combination of the translation of the IP sheet and the  $\omega$  rotation of the sample.

Table 1. Experimental Setup Summary

	Low Temperature Experiment with Large Refrigerator (T > 8K)	Low Temperature Experiment with Small Refrigerator (T > 10K)	Room Temperature	High Temperature Experiment with Vacuum Furnace (T < 1000K)
Bragg Points Collection	6+1-circle diffractometer with long 2θ arm and MXC software (DAC available)	6+1-circle diffractometer with short 2θ arm and MXC software  Automatic Vacuum Oscillation Camera (T > 25K)	6+1-circle diffractometer with short 2θ arm and MXC software  Automatic Vacuum Oscillation Camera	6+1-circle diffractometer with short 2θ arm and MXC software
Bragg Points Observation	Weissenberg Camera	Weissenberg Camera	Weissenberg Camera	Weissenberg Camera
Diffuse Scattering and Mapping Measurement	6+1-circle diffractometer with long 2θ arm and 4-circle commands software (DAC available)	6+1-circle diffractometer with long 2θ arm and 4-circle commands software	6+1-circle diffractometer with long 2θ arm and 4-circle commands software (DAC available)	6+1-circle diffractometer with long 2θ arm and 4-circle commands software
Powder Diffraction	6+1-circle diffractometer with long 2θ arm and analyzer  Curved IP Sheet		6+1-circle diffractometer with long 2θ arm and analyzer  Curved IP Sheet	6+1-circle diffractometer with long 2θ arm and analyzer  Curved IP Sheet