BL05XU
R&D-ID I

1. Introduction

The BL05XU undulator beamline has two optical hutches, OH1 and OH2, and an experimental hutch (EH). In OH1, a double multilayer monochromator (DMM) and basic optical components such as diamond beam monitors have been installed and tested under high-heat-load conditions. In OH2, an atmospheric section called a high-energy test bench has been positioned upstream of a double-crystal monochromator (DCM) for conducting pilot experiments with a high-energy, high-flux beam from DMM. In EH, small-angle scattering (SAXS) and wide-angle diffraction (WAXD) measurements have been performed with monochromatic X-rays from DCM. In EH, the structures of polymers and soft materials were evaluated using SAXS and WAXD measurement methods. It is useful to use a microbeam to evaluate the local structures of small samples such as fibers and bonded interfaces. In FY2023, we created a microbeam using compound refractive lenses (CRLs).

2. Recent activities

For the SAXS and WAXD measurements in EH, an X-ray beam is focused to optimize the angular resolution and beam size using vertical and horizontal mirrors. The focusing position is 2 m downstream from the sample in EH. The focusing conditions are not changed when the camera distance is from 0.2 to 4 m. The beam size at the sample position is 250 μm (H) × 120 μm (V).

The CRLs are used as a complementary focusing device. Figure 1 shows a photograph of the CRLs and switchable pinholes with diameters of 2 and 0.2 mm installed in the vacuum chamber. When the microbeam is not used, the beam is guided downstream through the 2 mm pinhole, and the CRLs are removed from the optical axis. When the microbeam is used, the 0.2 mm pinhole limits the beam size to the aperture size of the CRLs.

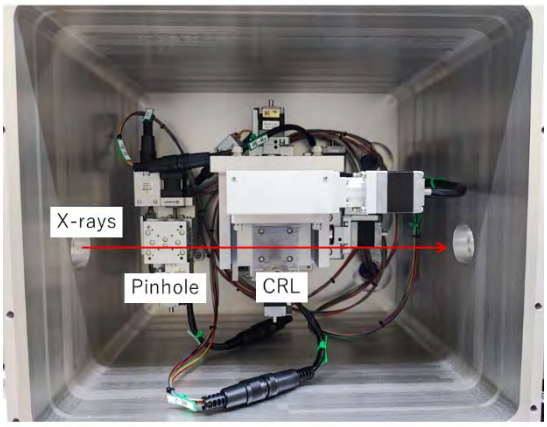

Fig. 1. Photograph of the inside of the vacuum chamber where the CRLs and pinhole are installed.

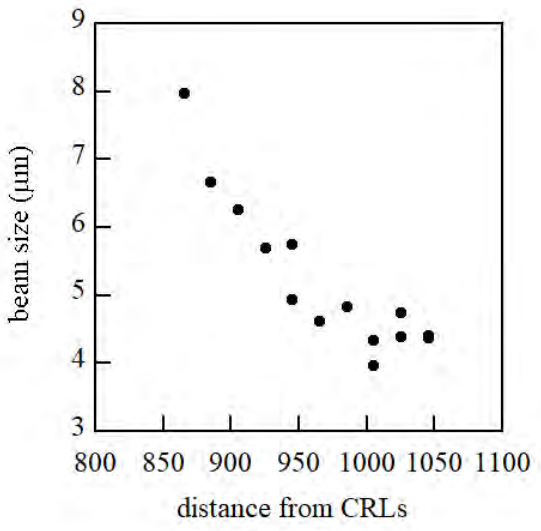

Fig. 2. Vertical beam size versus distance from the CRLs. The beam size is the full width at half-maximum.

Figure 2 shows the vertical beam size versus the distance from the CRLs. The best focus of 4 μm was achieved at 1050 mm downstream from the CRLs.

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