BL35XU
(High-Resolution Inelastic Scattering)

1. Overview

BL35XU investigates dynamics in materials using inelastic X-ray scattering. The beam time is devoted to non-resonant high-resolution inelastic X-ray scattering (IXS) measurements, where a Si backscattering monochromator is utilized in accordance with the high-order reflection. The operated energy resolution is mainly around 1.5 meV (hν=21.747 keV, using the Si(11 11 11) reflection) and 3 meV (hν=17.794 keV, using the Si(9 9 9) reflection).

Versatile measurements are conducted for both crystalline and disordered materials. The cylindrical mirror provides a beam size of < 100 μm × 100 μm (FWHM), which greatly benefits measurements for small samples with a size of < 1 mm^3. Furthermore, due to the additional focusing system using the KB mirror, a smaller beam size of < 20 μm × 20 μm (FWHM) is available, which allows measurements in extreme conditions such as high temperature with high pressure (in a diamond anvil cell).

2. Stabilization of the analyzer temperature readings

The analyzer temperature should be precisely estimated since the energy shift in IXS measurements is determined by the temperature difference between the backscattering monochromator and analyzers. BL35XU has 12 analyzers for IXS measurements, and the temperature is monitored using two thermistors at each analyzer. These thermistors are read out using a four-wire method.

We replaced the temperature reading system with a new one, which consists of a new channel box and digital multimeter (Fig. 1). This box and multimeter measure the temperature of all the thermistors around the analyzers (a total of thirty thermistors, including six thermistors for the cooling water paths).

Fig. 1. New reading system for the analyzer temperature.

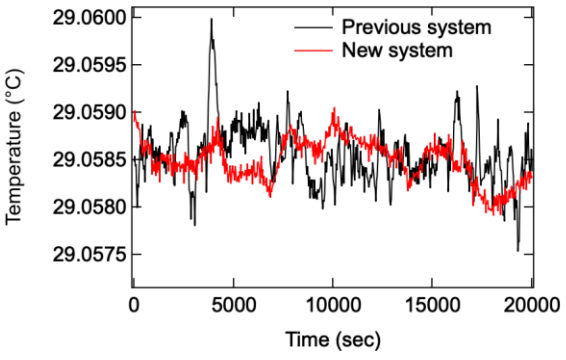

Fig. 2. Results of the analyzer temperature measurements. Red line indicates the result obtained by the new reading system, while the black indicates the result by the previous system.

After the optimization, the obtained temperature in the new system was stabilized (Fig. 2, red line). In particular, spike noises, which were observed in the previous system (Fig. 2, black line), almost disappears.

3. Development of a compact heating system

We developed a new heating system with a compact size of ϕ35 mm (Fig. 3). The sample is heated by two ceramic heaters through radiation, and the system is operated in nitrogen or air. The maximum sample size is ~ 0.5 mm × 0.5 mm × 0.5 mm, and the maximum temperature is 500 °C (773 K). The temperature is monitored using a K-type thermocouple located near the sample position. The windows are made of Kapton (a transparent polyimide film), and the sample can be observed easily even while heating.

Fig. 3. New compact heating system.

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