BL35XU
High-Resolution Inelastic X-Ray Scattering

1. Introduction & Overview

During FY 2012 (April of 2012 - March of 2013) the BL35XU scientific staff included S. Tsutsui and H. Uchiyama, and A. Baron, with additional support on specific issues from D. Ishikawa and H. Fukui. Technical support, from SES, was mostly by T. Oguchi with help from M. Hanada.

Scientific work at the beamline continued along similar directions as previously, including both crystalline and disordered materials. Work on systems under high pressure in diamond anvil cells (DACs) continues to expand, including both solids and liquids.

2. Continuing the Extreme

The push toward extreme conditions at BL35XU continues, with, at two groups (Ohtani-lab and Hirose-lab) investigating the elasticity of iron or iron-alloy samples in diamond anvil cells (DACs) with laser and/or resistive heating. The resistive heating allows larger sample sizes to be used, but, unfortunately does not work reliably above ~1200 C (and sometimes even that level is hard) so laser heating is needed for higher temperatures. The two groups are then pursuing slightly different approaches to laser heating, and both have successfully surpassed ~2000 K. The experiments remain difficult, with a lot of effort and beamtime needed to get all components working well at the same time.

3. KB Mirror Setup

The KB setup is used for measuring smaller samples, and, especially, for the laser heating setups with DACs as for this the X-ray beam size must be smaller than the laser spot. Typically, the compound focusing setup at BL35XU gives a ~16 μm beam size (in the FWHM) for both horizontal and vertical beam sizes. However, some time was lost FY 2011 when the setup of the KB failed. Investigation showed this was due, primarily, to incorrect alignment of the bent cylindrical mirror upstream of the KB mirrors, and the instructions for the KB installation were appropriately modified.

4. Toward Higher Resolution

Some experiments at BL35XU would benefit from resolution that is better than the 1.4 meV available with the Si(11 11 11) back reflection in a standard setup. In fact, a resolution of 0.9 meV was demonstrated about 10 years at BL35XU, but the flux was so small that it did not attract much use. Given the replacement of the ID at BL35XU, we tried doing this again during the 2012B run. However, the work in 2012A achieved only ~1.1 meV resolution. Therefore we returned to this in FY 2012 using a combination of in-house and proposal time, changing the offset crystal optics. This successfully showed a resolution of <0.9 meV for one analyzer (see figure 1), and <~1.0 meV on several others. The operating parameters are then as shown in table 1. The flux here continues to be low, but is improved about a factor of 2 over the

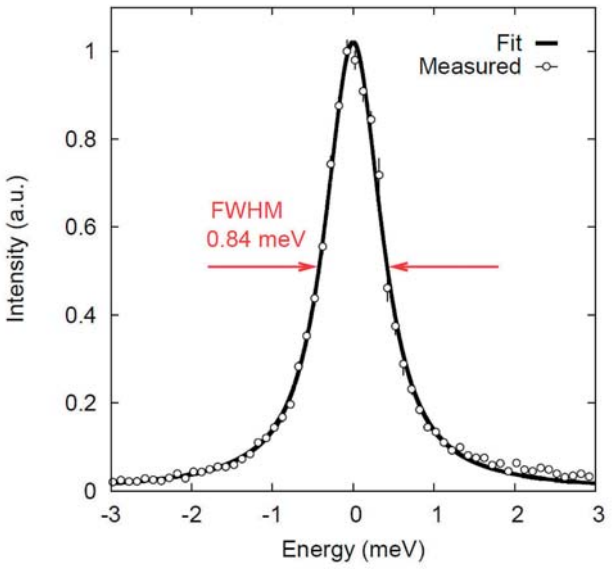

Figure 1. Measured resolution (and pseudovoight fit) using the Si(13 13 13) reflection.

Table 1. Properties of several backscattering setups at BL35XU. Relative intensity refers to photons/s onto the sample, with 1 unit about 10^{10}/s. Ideal resolution is estimated for two flat thick crystals with a perfectly collimated beam.

Refl. (n in Si (nnn))	X-Ray Energy (keV)	Ideal Resol. (meV)	Meas. Resol. (meV)	Rel. Int.
8	15.8	5.9	6	10
9	17.8	2.7	2.8	3
11	21.7	1.17	1.4	1
13	25.6	0.51	0.9	0.2

previous work. The losses are due to reduced source flux (a factor of 2 reduction in source photons/s/meV), and also losses in the other optics. Most notably though, geometric contributions to the resolution have become large (see table). However, for targeted experiments, work can be done.

5. Next Generation Beamline

Effort continued to focus on BL43LXU, especially A. Baron, D. Ishikawa and H. Uchiyama spent large amounts of time commissioning BL43LXU.

6. Other

Other improvements, reports, and changes include:

- For the second year running, the granite base for the spectrometer remained mostly stable and was not re-aligned. This makes one hopeful that the floor is finally stabilizing.
- The computer systems have improved stability, however, there was still one un-explained crash of the system.
- An audio alarm was added to the vacuum gauge for the spectrometer flight path after a case where the power cord for one roughing pump cam out of its socket and the vacuum deteriorated.

Alfred Q. R. BARON
Satoshi TSUTSUI
Hiroshi UCHIYAMA
Daisuke ISHIKAWA
Hiroshi FUKUI