BL08W
High Energy Inelastic Scattering

1. Introduction

BL08W is the beamline that can deliver the highest energy X-rays, the range of which is from 100 to 300 keV, emitted by the only wiggler source at SPring-8 [1]. This beamline is used in several research fields, including Compton scattering, high-energy X-ray diffraction [2], and high-energy X-ray fluorescence analysis [3]. Three methods of Compton scattering can be performed in this beamline. The first method is magnetic Compton scattering (MCP) for studying magnetic states [4]. The second method is high-resolution Compton scattering (HCP) with a high momentum resolution of 0.1 a.u. for studying electronic states and fermiology [5]. The third method is Compton scattering imaging (CSI) using a CdTe two-dimensional detector (HEXITEC) having energy dispersive capability in each pixel [6]. Moreover, structural studies of disordered materials by pair distribution function analysis using high-energy X-ray diffraction and studies of cultural properties by high-energy X-ray fluorescence analysis (XRF) can also be performed.

2. Experimental optimization by update of experimental hutch of BL08W

Experimental hutches at BL08W are separated into EH1 and EH2. For some time after the construction of SPring-8, MCP and XRF measurements were performed at EH1, while HCP measurements were performed at EH2 where the monochromators are in single-crystal arrangements. The reflected beam moves when the energy is required to be changed and the energy ranges of the monochromators are

Fig. 1. Before and after the removal of the inclined stage in EH2.

limited geometrically. A large inclined stage was installed at EH2 because the monochromator for EH2 was designed to reflect the X-rays in the vertical direction. However, because the inclined stage is very difficult to use, HCP measurement has also been performed at EH1 since about 15 years ago. Recently, the use of high-energy X-ray diffraction has increased, so the experimental setup at EH1 has been changed frequently. Because of the limited experimental space at EH1, there were no permanently installed experimental devices, so all the devices had to be moved in and out of the hutch, requiring a lot of time and effort to change the experimental setup. Therefore, we removed the inclined stage of EH2 and upgraded the experimental hutch to a tandem beamline to optimize the use of the beamline. Figure 1 shows the condition of EH2 before and after the removal of the inclined stage.

Figure 2 shows the beam position before and after the upgrade of the experimental hutches. The beam position moves when the energy changes because the monochromators are in single-crystal arrangements. Two monochromators, Si (400) and Si (620), are used for different X-ray energy ranges. The X-ray ranges available for EH1 are from 110 to

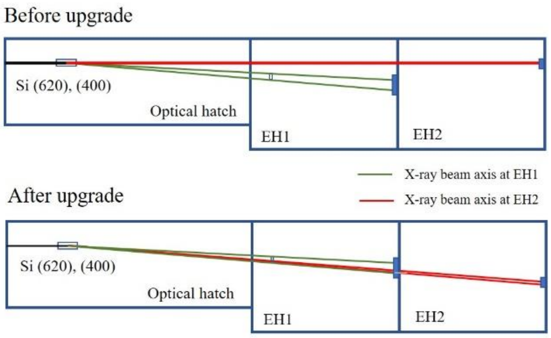

Fig. 2. Beam position before and after upgrading the experimental hutches.

171 keV for Si (400) and from 174 to 271 keV for Si (620). To cover the wide X-ray range, a wide end stopper, which is about 1000 mm wide, is installed behind EH1. We use only two energies, 115 and 182 keV, at EH2. Therefore, we can make the hole between EH1 and EH2 small, that is, 70 mm in diameter. Furthermore, the new end stopper at EH1 was changed to a movable type so that we can access EH2 even when X-rays are being delivered to EH1. The new end stopper and the auxiliary shielding were installed at EH2 because the beam position was changed. As the beamline was

Fig. 3. End stoppers at EH1 and EH2, the hole, and the auxiliary shielding.

upgraded to a tandem beamline, the interlock system was modified. Figure 3 shows the hole between EH1 and EH2, the end stoppers at EH1 and EH2, and the auxiliary shielding.

Fig. 4. Experimental hutches after the upgrade.

After the upgrade of the experimental hutches, HCP, CSI, and XRF measurements are performed at EH1, and MCP and high-energy X-ray diffraction are performed at EH2. Figure 4 shows the experimental hutches after the upgrade. The stage for high-energy XRD is currently not ready. However, the stage will be prepared and permanently installed at EH2.

In the past, we expended a lot of time to change the experimental setup. After the upgrade, we succeeded in reducing the setup time significantly. Table 1 shows the experimental setup times. In particular, the setup time for HCP is significantly reduced. The upgrade of the experimental hutches not only reduced the setup time but also improved the reproducibility of the HCP experimental data. The HCP experiment requires a low background environment to obtain good high-resolution Compton profiles because of the weak intensity of Compton scattering X-rays, which is analyzed using a Ge single crystal analyzer. Since we can permanently install the devices for HCP measurement, a Ge single-crystal analyzer, a slit for Compton scattered X-rays, and vacuum pipes for the analyzed high-resolution Compton scattering X-rays, we can obtain the highly reproducible Compton profiles.

Since we can change the setup quickly and easily and can obtain highly reproducible Compton profiles, it is expected that experimental advancement will be promoted.

Table 1. Setup time.

METHOD	Before	After
HCP	24	1
MCP	5	3
CSI	5	2
HIGH-ENERGY XRD	5	4

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