Present status of VUV angle-resolved photoemission beamline BL7U at UVSOR-II

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BL7U, the VUV angle-resolved photoemission (ARPES) beamline for advanced studies of strongly correlated electron systems, has been constructed in FY2006 and opened for users in FY2007 [1]. To satisfy the needs from users, especially (1) higher photon-flux, (2) reduction of higher-order light and (3) better base pressure of the photoemission chamber, we have improved the beamline in FY2008. As a result, we successfully achieved the sufficient throughput for ARPES experiments.

To improve the photon-flux especially at the bulk-sensitive low photon-energy ($h\nu$ < 15 eV), we updated the lowest photon-energy grating G3 from Au-coating to SiC-coating one. After the update of G3, we realign the beamline to be optimized with the center of the undulator light. As a result, the photon flux as well as the focusing at the sample position has intensively been improved than that in FY2007. Figures 1(a), (b) and (c) show the improved throughput spectra obtained at low (red line)-, medium (red line)-, and high (red, yellow, green, blue lines)-photon energy regions compared with the previous one (black lines), respectively. At each energy region, the spectrum becomes sharper and shifts to the higher energy side in the same condition, indicating successful alignment with the optimum parameter of the undulator light. Clear vibration sub-bands observed higher and lower energy side of the main peak of the throughput spectrum (Fig. 2), which is consistent with a calculation, ensures the correct alignment getting the center of the undulator light.

To reduce the intensity of higher order light at the low photon-energy region, we equipped a VUV filter of MgF_2 just after the exit slit. As a result, we successfully reduced the higher-order light above $h\nu$ = 11 eV (see Fig. 3). Typical loss of efficiency by the filter is less than 10%, which ensures sufficient throughput for VUV ARPES experiments with bulk-sensitive low-photon energies.

Finally, to improve the base pressure at the sample, we added a cryopump (ULVAC Cryogenic Inc., U8H) and an ion pump (ULVAC, PST-200CX2) to the photoemission chamber. As a result, we achieved the base pressure of 5×10^{-9} Pa better than before (2×10^{-8} Pa). For further improvement of base pressure, we plan to equip a thermal radiation shield around the sample in FY2009.

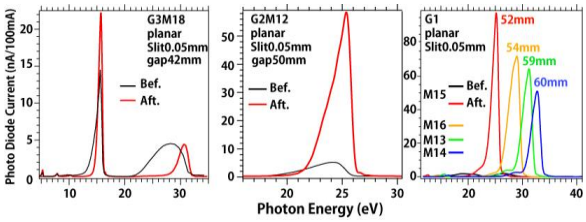

Fig. 1. Improvements of throughput spectra before and after the realignment of optics at BL7U.

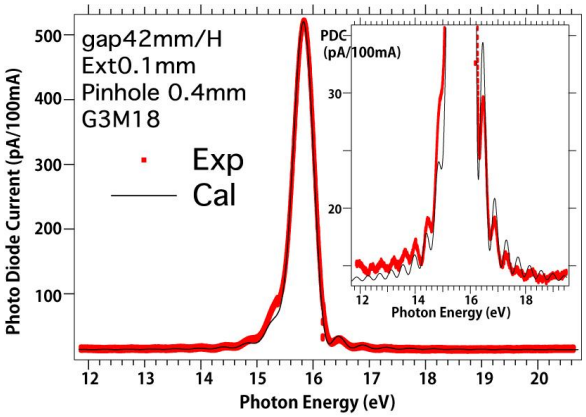

Fig. 2. Throughput spectrum at low photon-energy region in comparison with the calculation.

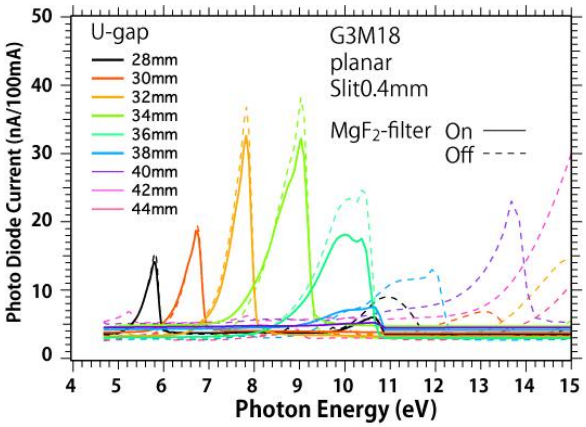

Fig. 3. Throughout spectra with some undulator gap size with and without a VUV filter, MgF_2, in the low photon-energy region.

[1] S. Kimura *et al.*, AIP Conf. Proc. **879** (2007) 527.