Momentum/Real-space Photoemission Station at UVSOR-III

Resonating Photoelectrons and Auger Electrons

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Photoemission and X-ray absorption processes have been well studied. Angle-resolved photoelectron spectroscopy and X-ray absorption spectroscopy are powerful methods to study the electronic structure of a crystal surface. However, by combining the two methods, one can explore many exotic phenomena that are worth investigating [1]. Recently we found the "band dispersion" embedded in the Auger electron angular distributions.

The wide-acceptance-type ARPES analyzer was installed at the BL6U of the UVSOR-III Synchrotron [2,3]. This spectrometer consists of a hemispherical electron analyzer equipped with a mechanical deflector and a mesh electrostatic lens close to the sample to make the size of acceptance cone tunable up to ±3.0 $Å^{-1}$. The beamline covers the photon energy range of 45 to 700 eV. The optics were cleaned and carbon contamination was reduced for measuring the resonant photoelectron at C K-edge region.

Figure 1 shows a comparison of band dispersion by angle-resolved photoelectron spectroscopy from single crystal graphite sample with excitation photon energies below and above the C K absorption threshold. The measurements were done at BL6U, UVSOR. When excited by the photon energy of the π* peak, it was confirmed that the π band resonated clearly. In addition, a new feature with maximum energy at the Γ and K reciprocal points was found in the Auger electron angular distribution. When excited C 1s core electrons are trapped in Dirac cones near the Fermi level, the change in wavenumber is limited. Our preliminary understanding is that momentum conservation occurs between the two electrons involved in the spectator resonant Auger electron emission process.

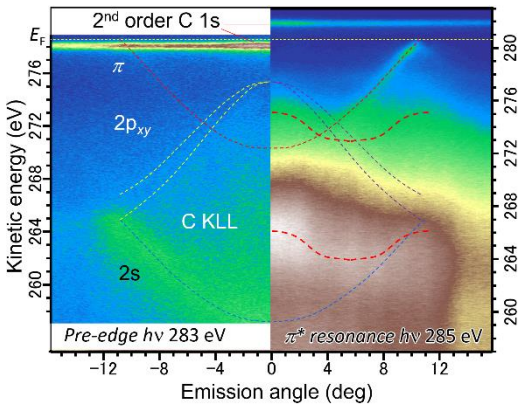

Fig.1 Angle-resolved photoelectron spectra from graphite below and above the C K-edge absorption threshold.

References

[1] F. Matsui *et al.* Phys. Rev. B **97**, 035424 (2018).

[2] H. Yamane *et al.* Rev. Sci. Instrum **90**, 093102 (2019).

[3] F. Matsui *et al.* J. Phys. Soc. Jpn. B **88**, 114704 (2019)