

Ultraviolet Photoelectron Spectroscopy System at BL-8

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Photoelectron spectroscopy (PES) is a powerful technique to directly investigate electronic structures. Although PES excited by synchrotron radiation (SR) gives us more detailed information, finite SR beamtime limits us to perform SR-PES measurements. In order to perform PES measurements timely, an ultraviolet source (VUV Source HIS 13) has been installed at BL-8 of SR center, Ritsumeikan University. The ultraviolet PES (UPS) measurements are performed at room temperature under ultrahigh vacuum of $\sim 10^{-7}$ Pa, using a hemispherical electron energy analyzer. Typical ultraviolet photon energy is 21.2 eV (He I) or 40.8 eV (He II) by using He gas.

Figure 1 shows typical UPS spectra of Au. The high intensity Au valence bands and clear Fermi cut-off are successfully obtained.

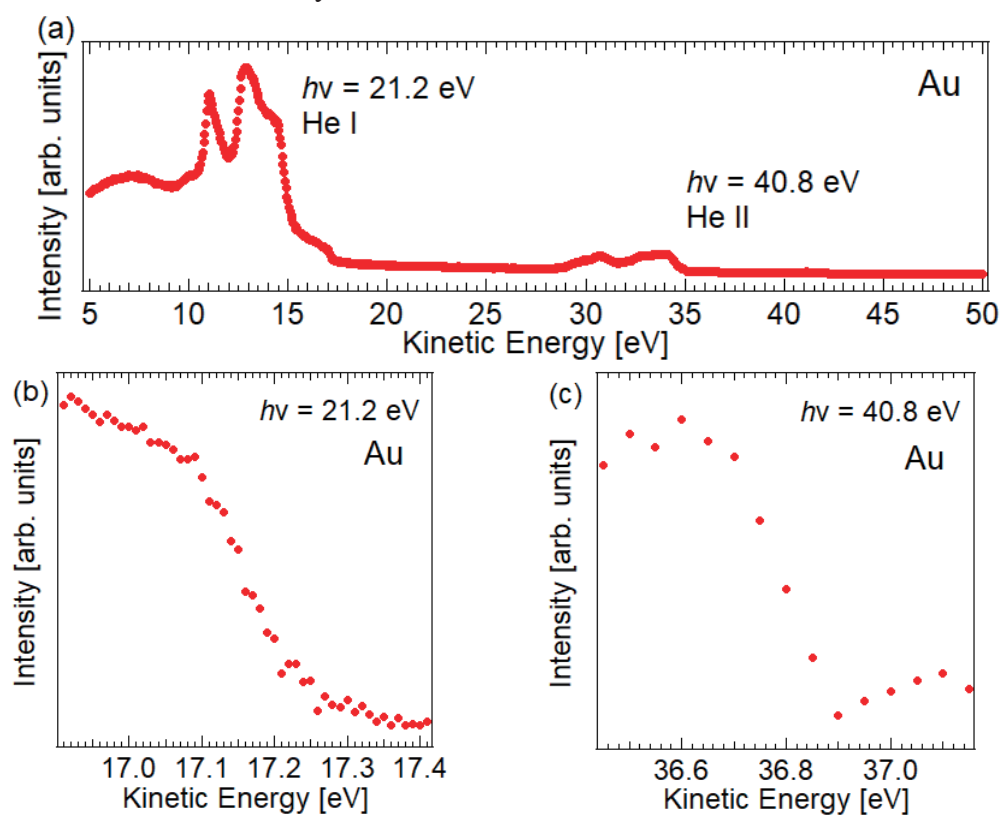


Fig. 1 UPS spectra of Au. (a) Au valence band spectra excited by both He I and He II lines. Au Fermi level spectra taken with $h\nu = 21.2$ eV (He I) (b) and 40.8 eV (He II) (c).

Figure 2 shows some secondary electron spectra [1] which directly measure a work function. Since work function changes are related to surface electronic state modification such as charge transfer [2], it becomes convenient to evaluate work function changes even in maintenance period of SR center.

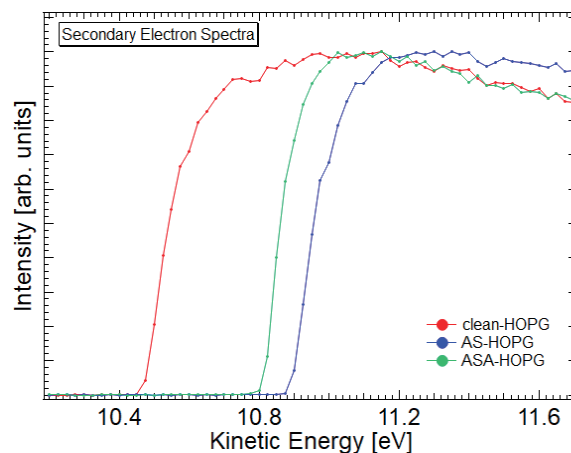


Fig. 2 Secondary electron spectra of HOPG with various surface treatments [1].

With the aid of laser and the view port of the VUV Source HIS 13, it becomes easy to align the sample position to measure UPS (and SR-PES), as shown in the Fig. 3.

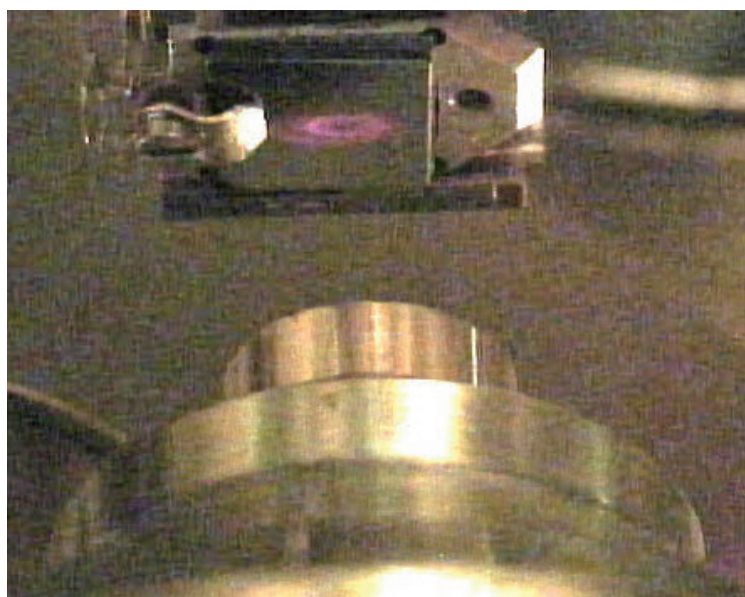


Fig. 3 CCD camera view when aligning the sample with laser.

In summary, UPS system has been successfully installed at BL-8 and electronic structure analysis can be easily performed anytime.

References

- [1] H. Takatani, *Master thesis*, **2022**.
- [2] K. Mitsuhashi, K. Ide, H. Takatani, and M. Takizawa, *J. Electron Spectrosc. Relat. Phenom.*, **2021**, 252, 147123.