

Effect of He Gas Purity on UPS Spectra

Minami Kondo and Masaru Takizawa

Department of Physical Sciences, Faculty of Science and Engineering, Ritsumeikan University, 1-1-1 Noji-Higashi, Kusatsu 525-8577, Japan

Ultraviolet photoelectron spectroscopy (UPS) is an effective means of observing the electronic state of a sample surface. A He discharge tube is used to extract the UV light, and the purity of the He gas can affect the UPS spectrum. However, high purity He gas is currently not available due to a shortage of He gas supply. If low purity He gas is used, impurities (H_2O gas) may affect the UPS spectrum. Therefore, a liquid nitrogen trap was installed in the He gas line, and changes in the amount of residual gas before and after discharge and before and after installation of the liquid nitrogen trap were investigated using Q-mass. We also investigated the time variation of the UPS spectra of Au and TiO_2 before and after the installation.

The experiments were performed at BL-8 of SR Center, Ritsumeikan University. In the UPS measurement, He I with an incident energy of 21.22 eV was used as the light source. The energy resolution is ~ 100 meV. The vacuum in the chamber of the apparatus is approximately 10^{-8} Pa. Samples were cleaned Au and pre-cleaned TiO_2 .

Figure 1 shows the typical Q-mass spectrum during UPS measurements after the liquid nitrogen trap was installed. Some gases are seen; strong He (4 amu), H_2 (2 amu), and small H_2O (18 amu) and CO (28 amu). Even using the low purity of He gas with 99.99%, Q-mass spectra did not show significant change in the amount of H_2O gas (18 amu) with and without liquid nitrogen trap (not shown).

Figure 2 shows typical UPS valence band spectra of Au after the installation of the liquid nitrogen trap. It was found that both intensity and peak position did not change significantly over time with and without liquid nitrogen trap (not shown). Figure 3 shows typical UPS valence band spectra of TiO_2 after the installation of the liquid nitrogen trap. It was found that both intensity and peak position did not change significantly over time. Note that slight change was observed maybe due to the surface contamination on TiO_2 . The experimental results show that He gas of 99.99% purity does not affect the UPS spectrum significantly.

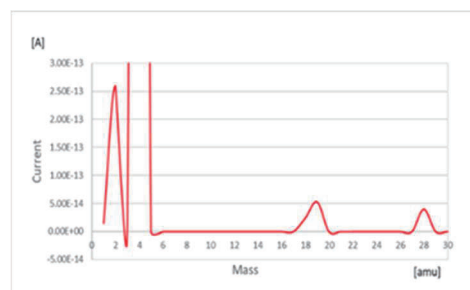


Fig. 1 Q-mass spectrum during UPS measurements.

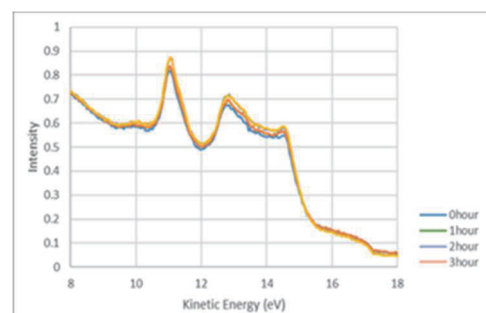


Fig. 2 UPS valence band spectra of Au.

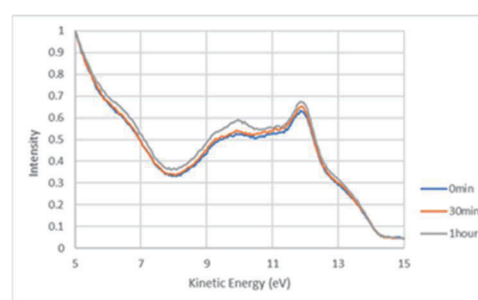


Fig. 3 UPS valence band spectra of TiO_2 .