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# AP-XPS Study of surface potential variation during X-ray resonance

## Content

The surface potential of semiconductor surfaces has been widely investigated with X-ray photoelectron spectroscopy (XPS). [1] The semiconductor surface potential is closely related to the band bending of semiconductor surfaces. For instance, with UV/Visible illumination, the semiconductor surface potential can be modulated through light-induced band bending reduction, resulting from the accumulation of photocarriers, i.e. surface photovoltage (SPV). [2]

To probe the light-induced modulation of surface potential at the X-ray regime, a tunable X-ray at synchrotron radiation and ambient-pressure XPS (AP-XPS) are applied to modulate the number of photocarriers of the system, Ar gas/MnO(001). As the photon energies are tuned to the near Mn 2p absorption resonance edge, the presence/variation of surface potential is moni-tored via the positions of Ar 2p gas phase peak near the surface as well as O 1s spectra of the MnO(001) surface.

In Fig. 1, our results show that the magnitude of the surface potential has a linear correla-tion with the X-ray absorption strength of the MnO(001). O 1s and Ar 2p photoelectron kinetic energies shift in the same magnitude. The observed linear correlation between X-ray absorption and photoelectron kinetic energy shift cannot be understood as a normal band banding reduction. Instead, the linear behavior can be related to the change of photoionization cross-section during the resonance. The effects of a) the X-ray-induced photocarriers and b) the resonant Auger emis-sion in surface potential variation will be discussed together.

- References [1] Zhen Zhang and John T. Yates, Jr., Chemical reviews, 112, 5520 (2012) [2] Peter Schindler et al., ACS Energy Letter, 4, 2436 (2019)

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