Development and Application of HAXPES at TPS

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We have established a new Hard X-ray Photoelectron Spectroscopy (HAXPES) experimental end station at the Taiwan Photon Source (TPS) 47A beamline. This end station leverages the superior synchrotron radiation produced by the high-brightness TPS source and a high-energy-resolution monochromator (HRM) specifically designed for the 47A beamline. The TPS 47A beamline delivers outstanding performance, featuring an energy resolution below 100 meV and a photon flux exceeding 1×10^{11} photons/second. The beam spot size in our setup is approximately 6×6 microns.

Our HAXPES end station incorporates a modular chamber design that allows seamless switching between near-ambient pressure (NAP) and ultra-high vacuum (UHV) modes, enabling flexibility to accommodate various experimental needs. The high penetration depth of hard X-rays provides significant advantages for investigating semiconductor devices and multilayer systems, particularly when probing buried interfaces and inner layers.

A primary research objective of this end station is to study interfacial properties in semiconductor devices, with the aim of enhancing their efficiency and operational stability. HAXPES enables the detection of elemental distributions and chemical shifts at interfaces, providing insights into factors that influence device performance. These data are crucial for identifying degradation mechanisms and guiding device optimization. Furthermore, the development of in situ and operando measurement capabilities will be a key focus of ongoing research efforts at the HAXPES end station.