

Ambient/ Ultra-High Vacuum X-ray Photoelectron Spectroscopy at TPS BL43A

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Abstract

Conventional X-ray photoelectron spectroscopy (XPS) is one of the powerful surface analysis tools and can be applied to study the chemical state and elemental composition of surface layers in solid samples. In contrast to high vacuum requirement of conventional XPS, ambient pressure XPS (APXPS) is able to carry out the real-time investigation of gas-solid, liquid-solid, and liquid-gas heterogeneous reactions at the pressure up to mbar range. The experimental stations related to conventional XPS and APXPS have been planned to install at TPS BL 43A, and this construction plan has been included in the phase III projects of TPS as well. In this presentation, we will introduce the preliminary beamline specifications, optics layout and the design of end stations shown in Figure 1. The X-ray source of this beamline is from an elliptically polarizing undulator (EPU 56 mm) provides the photon flux higher than 10^{12} photons per second with the beam size smaller than $50 (H) \times 20 (V) \mu\text{m}^2$ in the photon energy range from 200 to 3000 eV. Three experimental end stations are planning to install at this beamline by tandem like structure. The Ultra-high vacuum (UHV) XPS end station is dedicated to performing the conventional surface science research topics including the surface physics, surface chemical reaction, and materials science. An APXPS end station has been constructed and opened to users at Taiwan light source (TLS) beamline 24 A in 2017. This APXPS end station will be upgraded and relocated to be APXPS end station I at TPS 43A to carry out the vapor-solid reactions at the high-pressure region. A new APXPS end station II will be designed to carry out the liquid-solid reaction, especially in electrochemistry applications. The more detailed design concept of this beamline and end stations will be addressed in this presentation.

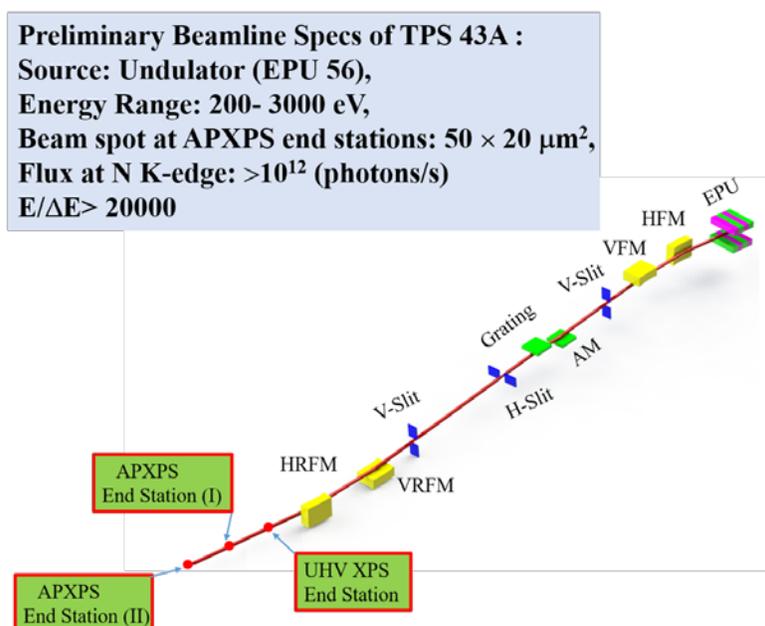


Figure 1. Preliminary beamline specifications, optics and end stations layout for TPS BL43A.

Keywords – XPS, Ambient pressure, APXPS, surface science, catalysis.