

Photoelectron Related Image and Nano-Spectroscopy (PRINS) End-station at TPS 27A2: Capabilities and Opportunities

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Abstract

The Photoelectron Related Image and Nano-Spectroscopy (PRINS) end-station at TPS 27A2 will host a photoelectron microscope that aims to work on photoelectron-related images and nano-spectra through the combination of an imaging-type electron column integrated with a hemispherical electron energy analyzer and an imaging spin filter. The microscope is able to conduct full-field imaging by collecting photoelectrons in either real-space or momentum-space with spin contrast.

Taking advantage of the elliptically polarized undulator photon source, i.e. the energy and polarization of the X-rays are both tunable, and powering by an in-house designed active-mirror plane grating monochromator, which delivers 90-3000 eV soft X-rays, the PRINS microscope has multiple capabilities, such as (1) X-ray absorption spectroscopy (XAS)-based and X-ray magnetic circular dichroism (XMCD)-based real-space imaging to obtain element-resolved mapping or spin-texture information, (2) X-ray photoelectron spectroscopy (XPS)-based real- and k-space imaging to obtain spatially-resolved chemical state mapping and band-structure imaging, (3) spin-resolved band structure measurement when the imaging spin filter is introduced, and (4) micro-area spectroscopy (XAS, XPS, and angle-resolved photoelectron spectroscopy) extracted from a series of images measured at different kinetic energies of the electrons.

The photoelectron microscope system including a hexapod sample manipulator, imaging spin filter, and UV light sources (mercury and helium) is expected to arrive at NSRRC before June 2021. A sample preparation chamber with standard surface science characterization capabilities, including the ion sputtering, low energy electron diffraction, Auger electron spectroscopy, and electron-assisted thin-film deposition, will be connected to the main photoelectron microscope system to enable the *in-situ* experiments. It will firstly be initiated and tested at the end of 2020.

Technical capabilities and scientific opportunities of the end-station will be demonstrated and discussed in the talk, and the current status will also be reported.

Keywords – XPEEM, Momentum Microscopy, imaging spin filter, soft X-rays, XPS.