# Tender X-ray Spectroscopy Beamline (32A) at the Taiwan Photon Source (TPS)

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## Abstract

Tender X-ray spectroscopy beamline located at the bending magnet port #32 of the Taiwan Photon Source (TPS) has been designed under the Phase-III project of the National Synchrotron Radiation Research Center (NSRRC), Taiwan. This beamline covers a unique energy range (1.7-10 keV), allowing the collection of the spectra at K-edges for the elements from Si (1839eV) to Zn (9659eV) and L-edges for the second-row transition metals. Even the M-edges of some rare-earth and 5*d* elements can be measured. As the energy range of tender X-ray is not easily accessible by a grating monochromator, two double-crystal monochromators (DCM), either with a pair of Si(111) or InSb(111), will be installed in this brand new beamline. In addition to the expanded spectral range, the beamline will provide X-ray spectroscopic techniques such as X-ray absorption spectroscopy (XAS) and hard X-ray photoelectron spectroscopy (HAXPES), along with the microprobe imaging capability. Compared to the existing TLS 16A beamline and similar facilities abroad, our preliminary design offers improved performance in terms of photon flux, brilliance, high-order harmonics rejection, and energy resolution. The design goal is to deliver a photon flux ~$10^{12}$ @ 5 keV (ph/sec) and a resolving power (E/ΔE) up to 7,000. TPS 32A beamline will be suitable for application to various scientific and industrial fields including physics, chemistry, materials science, chemical engineering, geology, earth, and environmental sciences, as well as biology. XAS technique will be routinely employed to probe the electronic and/or atomic structures of specific elements in the sample. The detection limit of the multi-sensor fluorescence silicon drift detector (SDD) may reach around monolayer (a few ppm) levels. On the other hand, HAXPES with a high-quality electron energy analyzer can probe properties in deeper layers of the samples and access core level electrons. Various furnaces, cryostats, and in-situ cells for different sample environments will be available on request. All the efforts are to provide a diversified and user-friendly experimental conditions and environments to maximize the scientific output.

***Keywords – Tender X-ray, XAS, HXPES.***