X-ray Absorption Spectroscopy Beamline (38A) at the Taiwan Photon Source (TPS)

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Abstract

There are currently four X-ray absorption spectroscopy (XAS) beamlines (01C1, 07A1, 16A1, and 17C1) at TLS and one QEXAFS beamline (44A) at TPS in operation. Under the TPS Phase-III beamline construction plan, we propose to build a new XAS beamline using the bending magnet port #38. The TPS-38A beamline is designed to cover a wide energy range (4.5-34 keV) to meet the demand of users from various disciplines. This new beamline will be equipped with several important optics, including a three-stripe (bare Si, Rh- and Pt-coated) collimating mirror (CM), a Si(111) channel-cut quick-scanning monochromator (Q-Mono), a bi-layer coating (12.5 nm Al_2O_3/50 nm Pt) toroidal focusing mirror (TFM) and a double-bounce two-stripe (Si, Rh) high harmonics rejection mirror (HHRM) system. With an incidence angle of 4.5 mrad for HHRM, a ratio of 1 $x10^{-4}$ for high harmonics relative to the fundamental photons can be achieved while a flux higher than 1 x 10^{11} photons/s in the energy range between 5 and 10 keV. Under optimized conditions, the calculated spot size is 49 μm x 148 μm (H x V) (FWHM) at the sample position located at 45 m from source. The quick scanning capability of the monochromator allows time-resolved XAS investigation on the structural transformation of various samples under operando conditions. In addition to XAS, we plan to implement the capability of powder diffraction using a 2D area detector. These two complementary techniques can be used together or separately to probe different characteristics of the sample. We also consider the possibility of conducting *in-situ* XES measurement using a spectrometer based on the *Von Hamos* geometry. Hence, the operation of TPS-38A beamline in the future is expected to largely benefit the scientific research in material science, chemistry, physics, energy and environmental sciences, and biology, as well as industrial applications.

Keywords: In-situ* and *operando XAS, Quick XAS