

Dragon Beamline at the Taiwan Photon Source (TPS)

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Abstract

Soft x-ray absorption spectroscopy (XAS) is a technique for study the element-specific electronic structure of matter, and provide valance state information. The soft XAS is one of the promising methods to study the strongly correlated electron systems because the photon energy of soft x-ray covers the L-edge absorption of 3d- and 4d- transition metal. Furthermore, the magnetic circular dichroism (MCD) in soft XAS is a powerful tool to study the magnetic properties, and determining the spin and orbital moment of materials to study the fundamental electronic and magnetic physics properties.

On the other hand, vast development of renewable energy materials system become a very important topics due to the current energy crisis. Soft x-ray absorption spectroscopy combinate with the in-suit/operando electrochemistry cell become an important setup to study the physical and chemical properties of energy materials, such as the renewable fuel cell, solar cell.....

TPS Dragon beamline contains two branches and three endstations. The energy range of this beamline covers from 90 eV to 3000 eV, covering the C, N, and O *K*-edge, the $L_{2,3}$ -edge of transition metal, and the $M_{4,5}$ -edge of rare-earth materials. And the energy resolving power is optimized up to 20,000 from 90 to 3000 eV. The key part of this beamline is a novel monochromator system design: the active mirror and plane grating monochromator (AM-PGM). This design let us have a capability to perform the parallel detection in transmission /or reflection XAS & MCD at endstation-I. In conventionally, the soft x-ray absorption spectroscopy took a long time for one spectrum, usually about 5 to 15 minutes for one spectrum, by scanning the angle of grating monochromator. The scope of AM-PGM is that all energy points of absorption spectrum are acquired in parallel. Endstation-II is the high magnetic field MCD (HF-MCD), is a cryo-free superconductor magnet system and magnetic field up to 10 Tesla, combining with fast switching circularly polarized insertion device source, to study the magnetic physics properties. Endstation-III is the in-suit/operando electrochemistry cell with soft s-ray absorption system for studying energy materials.

Dragon beamline at TPS phase-III is expected to provide renewed research opportunities on the subject of magnetic material and energy material, because the high brightness, high performance and parallel detection.

Keywords –XAS, MCD, Parallel detection, Fast switching circular polarization source.