Scientific Opportunities of Soft X-ray Tomography in Bio-Science

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Abstract

Soft X-ray tomography (SXT) beamline is one of the phase II constructed beamline located at port 24A Taiwan Photon Source (TPS 24A). This is a newly developed transmission full-field microscopy to image 3D frozen-hydrated biological sample [1]. SXT has an unique property of water window which is between K-edge absorption of carbon (284 eV) and oxygen (543 eV). Therefore, due to the organic composition of biological samples, SXT can produce highly natural contrast image of biological sample from the water environment in the energies of water window without the need of staining. In addition, the penetration depth of soft X-ray in water window is about 10 μm, indicating the sample with the thickness of 10μm can be imaged by SXT without the need of sectioning. The spatial resolution of SXT in 2D image is about 15~30 nm, and in 3D image is about 50 nm. Therefore, the technique of SXT can be complementary with fluorescence microscopy and electron microscopy in biomedical study.

Currently, SXT is available at many synchrotron beamlines in the worldwide, such as XM2 at ALS in USA, U41-TXM at BESSY II in Germany, Mistral at ALBA in Spain, and B24 at DIAMOND in UK. In this meeting, I would introduce some scientific opportunities of SXT in bio-science, including phenotypic switching to antifungal peptoids in *C. albicans* [2], restructure of endoplasmic reticulum and mitochondria by HCV infection [3], degranulation in mast cells [4], cholesterol crystal formation in macrophages [5], intracellular nanoparticles distribution [6], and calcium concentrates in algae [7].

Keywords – Soft X-ray tomography, water window, 3D image, cells.

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