

Morino Foundation for Molecular Science (2016)

Prof. Masanari Nagasaka

Pioneering Research on Local Structure Analysis of Intermolecular Interaction Systems by Soft X-ray Absorption Spectroscopy

Dr. Nagasaka has awarded Morino Foundation for Molecular Science (2016) for his pioneering work of soft X-ray absorption spectroscopy (XAS) of liquid samples and application to in operando observations of electrochemical reactions. Morino foundation is established in 1985 by the donation of Prof. Yonezo Morino at the University of Tokyo, and is celebrated young researchers in the field of molecular science.

Dr. Nagasaka has developed a liquid flow cell for XAS of liquid in transmission mode at the soft X-ray undulator beamline BL3U at UVSOR-III Synchrotron. Soft X-ray region below 1 keV has many important absorption edges, such as C, N, and O K-edges, and 3d metal L-edges. However, it is difficult to measure XAS of liquid in transmission mode because soft X-ray is strongly absorbed by solvent water. He has achieved XAS of liquid in transmission mode by controlling the liquid thickness from 20 nm to 2000 nm, in which the liquid layer is sandwiched between two silicon nitride membranes with the thickness of 100 nm. By using the developed liquid cell, local structures of several aqueous solutions are investigated by XAS in C, N, and O K-edges. Furthermore, he has applied XAS of liquid samples to in operando observation of electrochemical reaction by developed a liquid flow cell with built-in electrodes. He also developed a potential modulation method that is able to measure XAS of electrochemical reaction at the same scan rate as in cyclic voltammetry (typically 100 mV/s). The change in valence of Fe ions at different potentials in the Fe redox reaction is successfully investigated by Fe L-edge XAS of aqueous solutions at a scan rate of 100 mV/s. It is a pioneering work about the application of XAS in soft X-ray region to electrochemical reaction.



Awarding ceremony by Morino Foundation at Koshiba Hall, the University of Tokyo.