15:00-, 24-AUG-2018
G201, KPSI, Kyoto, JAPAN
The 42nd KPSI Seminar, KPSI-QST

Soft-X-ray emission spectroscopy with electron microscopy and its applications for materials characterization

Prof. Masami Terauchi
Institute of Multidisciplinary Research for Advanced Materials, Tohoku University

X-ray emissions originate form electronic transitions from valence bands (bonding electron states) to inner-shell electron levels inform us energy states of bonding electrons. Those X-rays range in ultrasoft or soft X-ray region form a few tens to a few thousands eV. Since K-emissions of light elements and L-emissions of 3d transition elements are in this energy region, soft X-ray emission spectroscopy (SXES) based on electron microscopy can be a sensitive tool for elemental and chemical identifications. We have been developing and testing SXES instruments by attaching to TEM [1], EPMA, and SEM [2]. The spectrometer was commercialized as an attachment for EPMA/SEM with an energy resolution of 0.2 eV for Al-L emission, which is about two order better than that of solid state X-ray analyzer for electron microscope. This SXES spectrometer informs us energy states of bonding electrons from specified specimen areas by electron microscopy, which is hardly obtained by EELS and EDS.

Figure 1(a) shows a photo of a SEM attached with a SXES spectrometer for 50-4000 eV. Spectrum intensity is acquired by a micro-channel plate (MCP) optically coupled with a CMOS camera. Fig.1(b) shows Ti-Lα,β emissions obtained from bulk specimens of TiO_2 (rutile), and TiO as well as metal-Ti. It is clearly seen that each spectrum shows different intensity profiles reflecting the different bonding states due to different crystal structure in each material.

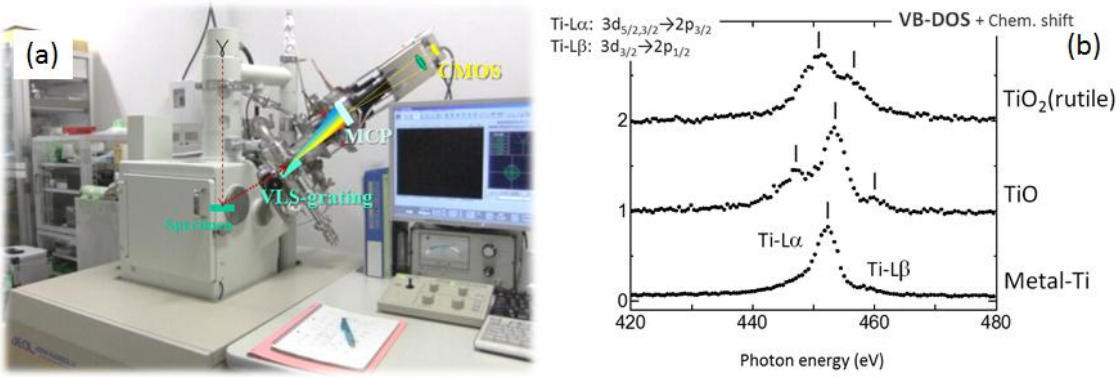

Fig.1 (a): Photo of the SEM attached a SXES spectrometer for 50-4000 eV. (b): *Ti*-Lα,β emission spectra obtained from bulk specimens of TiO_2 (rutile), and TiO as well as metal-Ti.

References

[1] M.Terauchi in "Transmission Electron Microscopy Characterization of Nanomaterials", ed. CSSR Kumar, (Springer-Verlag Berlin Heidelberg 2014) 284.
[2] M.Terauchi, *et al.*, Microscopy and Microanalysis 20 (2014), 629.