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Solid-liquid interface of water/SAE304 probed by TREXS (Total REflection X-ray Spectroscopy)

H. Abe[1,2,3]*, Y. Niwa[1,2] and M. Kimura[1,2]

[1]*Institute of Materials Structure Science, High Energy Accelerator Research Organization (KEK), 1-1 Oho, Tsukuba, Ibaraki, 305-0801 Japan*

[2]*Graduate University for Advanced Studies (SOKENDAI), 1-1 Oho, Tsukuba, Ibaraki, 305-0801 Japan*

[3]*Graduate School of Science and Engineering, Ibaraki University, 2-1-1 Bunkyo, Mito, Ibaraki, 310-8512 Japan*

*e-mail: hitoshi.abe@kek.jp

Surfaces and interfaces are the places where important chemical reactions occur. Water splitting, for example, a key reaction of artificial photosynthesis, proceeds at solid-liquid interfaces. Solid-liquid interfaces have been studied for more than 30 years, and STM in liquids revealed real images of the topmost layer at interfaces[1]. Spectroscopies have been also applied[2,3]. However, kinetics and behaviours at interfaces are still unclear. It is required to observe chemical states and local structures with a reasonable interface sensitivity and enough temporal resolution.

We have developed Total REflection X-ray Spectroscopy (TREXS) with the surface sensitivity of ~2-3 nm[4,5], which gives information on chemical states and local structures, based on X-ray Absorption Fine Structure (XAFS) method. Near edge regions of TREXS spectra are useful to reveal chemical states and to track kinetics of surface reactions, while extended regions of the spectra can be analysed to obtain local structures. Similar methods are reported, and film growth processes have been discussed, for example[6].

Solid-liquid interface TREXS has been developed based on the surface sensitive TREXS to study various solid-liquid interface phenomena and reactions. We have carried out solid-liquid TREXS measurements to observe a solid-liquid interface of stainless steel, SAE304, under water, which was covered by a polyimide film. A bare SAE304 surface was also observed for comparison. Here, wide energy range TREXS spectra including both Fe and Ni *K*-edges were clearly obtained in one scan. These spectral features will be discussed at the conference. We are trying to develop this solid-liquid interface TREXS method further to perform real time observation.

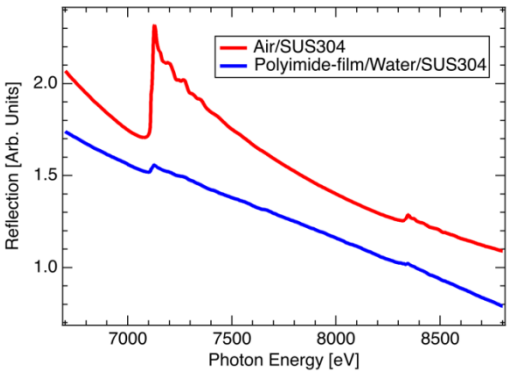

Figure 1. Obtained TREXS spectra covering both Fe and Ni *K*-edges by one scan: (red) bare SAE304 and (blue) water/SAE304.

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