Bent Crystal Laue Analyser Combined with Polarization-dependence Total Reflection Fluorescence X-ray Absorption Fine Structure (BCLA-TRFXAIFS) and its Application to Electrode Surface

K. Asakura¹, K.Dong¹, T.Wada², D. Kido¹, S. Takakusagi¹

1 Institute for Catalysis, Hokkaido University, Kita 21-10, Kita-ku Sapporo 001-21, Japan.
2 Tokyo Medical and Dental University, Yushima, Bunkyo-ku, Tokyo 113-8549, Japan.

askr@cat.hokudai.ac.jp

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Ultra low emittance X-ray source will expand the possibilities for the polarization dependent total reflection fluorescence XAFS (PTRF-XAFS) [1,2] which requires a large flat surface (several cm order) owing to grazing incidence. When the PTRF-XAFS is applied to the electrode surface under the working conditions, the coexisting electrolyte over the electrode surface creates the undesirable scattering to decrease the signal to background ratio. In this work we have investigated the feasibility of the bent crystal Laue analyser (BCLA), for the PTRF-XAFS spectroscopy to separate the fluorescence X-ray emission of a target atom from the elastic scattering X-rays and other fluorescence emission lines [3,4]. The BCLA is an X-ray energy analyser with a medium energy resolution (about 10 eV) and has a focal line parallel to the BCLA surface. We have adjusted BCLA focal line to the X-ray footprint on the substrate surface as shown in Figure 1. We have measured the PTRF-XAFS of the 1 monolayer(1 ML) Pt on the 30 nm thick Au film in the absence and presence of electrolyte. BCLA can successfully remove the elastic X-ray and Au fluorescence as shown in Figure 2. We find the small glitch at the Au L₃ edge which is caused by the sudden change of complex refraction index of the Au substrate at the Au edge. This abnormal spectrum feature can be removed by correction of reflectivity using Au foil absorption data as shown in the green curve of Figure 2 [3]. The BCLA combined with PTRF-XAFS spectroscopy (BCLA + PTRF-XAFS) is a new technique for the in situ surface analysis of highly dispersed systems even in the presence of a liquid overlayer.

Figure 1 Setup for BCLA+PTRF-XAFS[3]

Figure 2. Pt L3 BCLA+PTRF-EXAFS of 1 ML Pt on Au thin film.(a) Without BCLA, (b) with BCLA (Black) and after the correction of the reflectivity (Green). Inset is the magnified image[3].