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Possibility of BCLA+PTRF-EXAFS

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A bent crystal Laue analyser combined with polarization-dependent total reflection fluorescence X-ray absorption Fine Structure (PTRF-XAFS) is a promising technique for *in situ* surface analysis of highly dispersed systems even in the presence of solution.

1 Introduction

Polarisation-dependent total reflection fluorescence extended X-ray absorption fine structure (PTRF-EXAFS) spectroscopy is a powerful technique to determine the three-dimensional structures of metal atoms (10^{13-15} cm^{-2}) dispersed on atomically flat surfaces[1]. When it is applied to the electrode surface which is covered with solutions, the elastic X-ray scattering of the liquid overlayer becomes large and seriously increases the background X-rays. We used BCLAn(Bent Crystal Laue Analyzer) to remove the elastic scattering from the solution and to allow the PTRF-XAFS measurements under the solutions.

2 Experimental

A thin Pt layer was deposited on a 60-nm-thick polycrystalline Au thin film evaporated on a 10-mm × 20-mm Si(100) wafer by self-terminating electrodeposition[3]. Pt was electrochemically deposited on a Au polycrystal from 3 mmol K_2PtCl_4–NaCl at pH = 4 with an applied voltage of −0.7 V vs. Ag/AgCl. The deposition time was 20 s. Hereafter, the sample is called Pt/Au/Si. The EXAFS measurements were carried out under the total reflection conditions at beamline BL-15A1. The BCLA was set between the sample and the detector.

3 Results and Discussion

Figure 1 shows the χ(k) of L_3-edge EXAFS of Pt/Au/Si under the total reflection conditions (s-polarization) in a fluorescence mode with and without the BCLA, respectively. In the EXAFS spectrum without the BCLA, strong Au L_a X-ray fluorescence appeared above 11900 eV (the Au L_3 edge). Even under the total reflection conditions, X-rays could penetrate the bulk and excite the Au edge [2]. The BCLA reduced the PtL_α fluorescence X-ray signal to 1/160 of that without the BCLA, i.e., 0.0024 and 0.38 at 11800 eV with and without the BCLA, respectively. However, S/B ratio was tremendously improved to 11000(with BCLA) from 140 (without BCLA) . The S/N ratio of χ(k) was 1.5 times better with than without the BCLA. This work suggests that, we can measure an EXAFS of the thick solution covered surface.

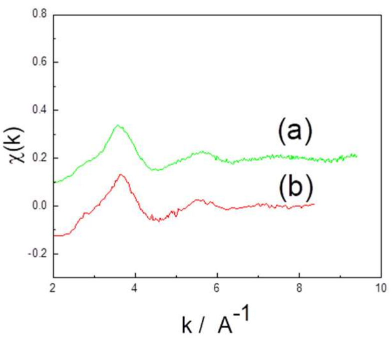

Figure 1 EXAFS oscillations (χ(k)) for Pt Lα of Pt on Au (a) with and (b) without the BCLA.

References
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