

Pt/Au(111) prepared by Surface limited redox replacement method using X-ray absorption near edge structure spectroscopy with log-spiral bent crystal Laue analyzers

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1 Introduction

We have used a Polarization-dependent total reflection fluorescence extended X-ray absorption fine structure (PTRF-EXAFS) spectroscopy, which is a powerful technique to determine the three-dimensional structures of metal atoms (10^{13-15} cm⁻²) dispersed on atomically flat surfaces [1]. It was applied to the electrode surface in the presence of electrolytes. The significant elastic X-ray scattering from the liquid phase increased the background X-rays, and we had to reduce the liquid layer as thin as possible. Such a thin liquid layer prevented the smooth diffusion of materials. BCLA (Bent Crystal Laue Analyzer) can remove the elastic scattering and only detect a target energy X-ray. We combined BCLA and tried to obtain the fluorescence XAFS in the presence of the liquid phase.

2 Experiment

Pt was deposited on Au (111) surface by Surface limited redox replacement (SLRR) method.[2]

The XAFS measurements were carried at beamline BL-15A1 (Fig. 1). The BCLA was set between the sample and the 7-elements SDD (7-SSD). The position of the BCLA is determined by moving it in the X and Z directions.

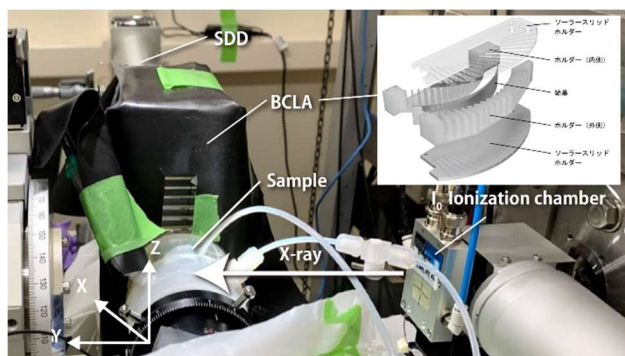


Fig. 1: The experimental setup at BL-15A1.

3 Results and Discussion

Fig. 2 shows the data obtained during Z-positioning. In particular, the position of the BCLA depends strongly on the height of the BCLA (Z-direction), and it is necessary to position the BCLA with an accuracy of 20 μ m in the Z-axis and 500 μ m in the X-axis to receive as much fluorescence X-ray as possible in 7-SDD.

Fig. 3 shows the polarization dependent XANES spectra in s and p-polarization from the Pt on Au(111) with a 1 mm thick liquid phase. It took 30 min to obtain the XANES region. The elastic X-ray scattering could be successfully removed, but the inelastic X-ray finally blocked the high S/B ratio XANES measurements. The detection limit might be 10^{15-16} Pt cm⁻².

The BCLA can remove the elastic scattering from the 1 mm thick liquid layer, but the inelastic scattering determines the detection limit as 10^{15} cm⁻².

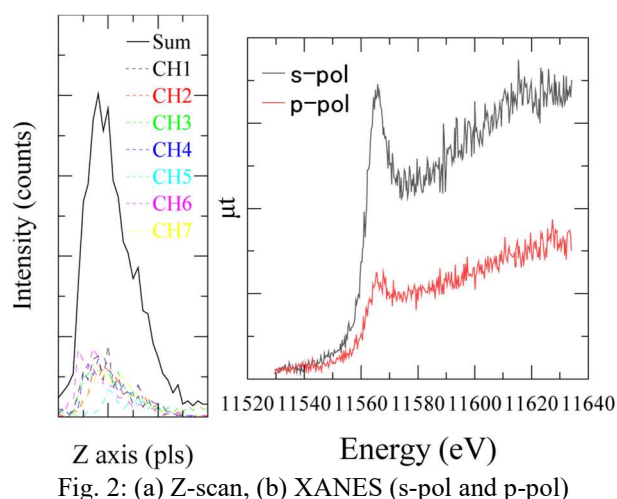


Fig. 2: (a) Z-scan, (b) XANES (s-pol and p-pol)

Acknowledgment

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References

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Research Achievements

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