

A Study on the relationship between bond distances of Pd deposited on Au(111) and the number of deposited layers by *in-situ* PTRF-XAFS

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1 Introduction

Surface composites of the metal layer deposited on the different metal substrate are widely used in magnetic device and catalytic materials. The catalytic activity of the composites and the structure of the overlayer metal strongly depends on the substrate heterometal structure. In order to observe the influence of the bond distance of the cover layer by the structure of the substrate, and the resulting changes in the catalytic activity of the composites, we deposited two-dimensional Pd films layer by layer by an electrochemical method[1,2] on the surface of single crystal Au(111). We investigated how the bond distance of Pd overlayer changes with the number of Pd layer (1 – 4 monolayer (ML) by *in situ* polarization dependent total reflection XAFS(PTRF-XAFS) which was a suitable technique to observe the bond distance of the metal overlayer.

2 Experiment

Au(111) substrate was obtained by electropolishing and furnace annealing at 900 °C for 36 hours, and the electrochemical properties and morphology of the surfaces was verified by cyclic voltammetry (CV) and AFM. Deposition of the first layer of Pd on Au(111) was achieved by the under potential deposition (UPD) method in a Nitrogen-filled glove box: The double and larger layers of Pd have been realized by the charge control over potential deposition (OPD) method. After deposition, the sample was set on an *in situ* XAFS measurement cell system with 0.1 M HClO₄ filled. PTRF-XAFS measurements were carried out at NW10A beam line of Photon Factory Advanced Ring(PF-AR6.5 GeV) with Si(311) double crystal monochromator. The data were analyzed by using REX 2000.

3 Results and Discussion

We measured Pd L3 edge spectra at reduced condition (+0.55 V vs RHE). Fig.1 shows the comparison of different Pd deposition layers and Pd foil spectrum for s-pol EXAFS data. We found the Pd-Pd bond distance at 2.88 Å in the 1 ML Pd while it decreased to 2.76 Å equal to that of the bulk Pd at 4 ML in average. Fig.2 shows the relationship between the Pd-Pd bond distances and the number of deposited Pd layers in thin Pd films on Au(111). We are now doing the details analysis of the results.

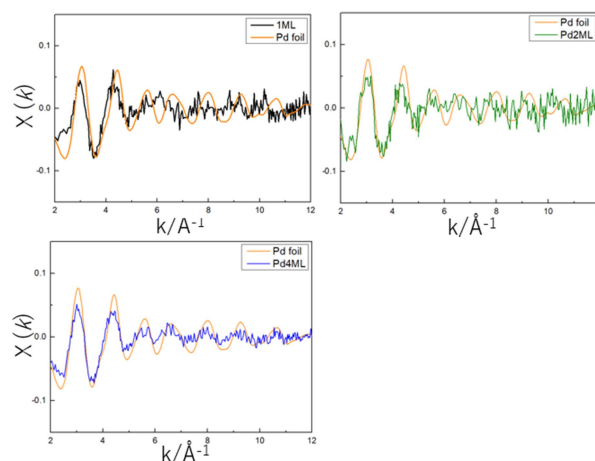


Fig. 1: Comparison of different Pd deposition layers and Pd foil spectrum for s-pol.

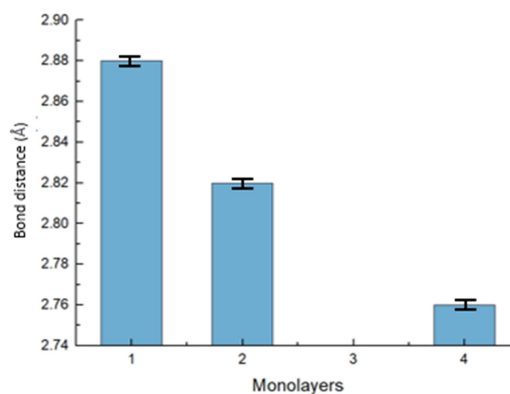


Fig. 2: the relationship between the Pd-Pd bond distance and the number of deposited Pd layer

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References

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