

How many Pd Layers are necessary to retain the original bond length in Pd ultra-thin films deposited on Au(111) ?- *in situ* PTRF-XAFS investigation.

(¹Graduate School of Engineering, Hokkaido University, ²Graduate School of Graduate School of Medical and Dental Sciences, ³NIMS) ○Chenghao YANG,¹ Daiki KIDO,¹ Bing HU,¹ Kaiyue DONG,¹ Soichi TOMIDOKORO,¹ Takahiro WADA,² Takuya MASUDA,³ Satoru TAKAKUSAGI,¹ and Kiyotaka ASAKURA^{1*}

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The structure (bond distance) of metal ultra-thin film depends on the substrate surface structure. 1 ML Pd on Au (111) has an elongated Pd-Pd bond distance. [1-3] We are interested in how many Pd layers are necessary to retain its original Pd-Pd bond distance. We carried out *in situ* polarization dependent total reflection fluorescence XAFS (PTRF-XAFS) to determine the Pd-Pd bond distances.

The Pd was electrochemically deposited on Au(111). The amount of the deposited Pd was controlled by the applied potential and holding time, and was estimated by the total current and the XPS intensity analysis. The flat morphology of surfaces was confirmed by atomic force microscopy (AFM). Pd K-edge PTRF-XAFS measurements were carried out at NW10A beamline of Photon Factory Advanced Ring (PF-AR 6.5 GeV) with a Si(311) double crystal monochromator. The XAFS data were analyzed using REX2000 and FEFF.

Figure 1 shows the relationship between the Pd-Pd bond distance and the number of the Pd layers. As reported[3], we found the Pd-Pd bond distance at 2.88 Å in the 1 ML Pd while it decreased to 2.77 Å equal to that of the bulk Pd at 3 ML. These result suggested that the substrate effect did not reach 2 or more layers.

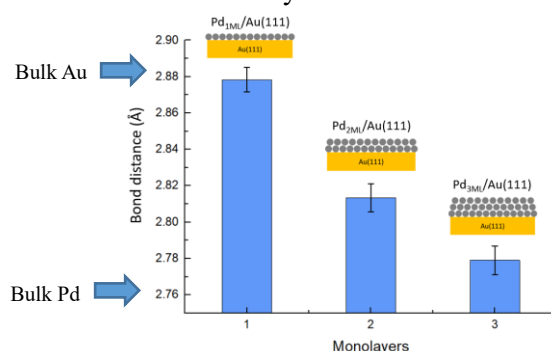


Figure 1 Relationship between the Pd-Pd bond distance and the number of deposited Pd layer in thin Pd films on Au(111).

- 1) Kibler, L. A., et al. "Initial stages of Pd deposition on Au (hkl) Part I: Pd on Au (111)." *Surface Science* **443** (1999): 19-30.
- 2) Tang, J., et al. "Pd deposition onto Au(111) electrodes from sulphuric acid solution." *Electrochimica Acta* **51** (2005):125-132.
- 3) Takuya Masuda *et al* "In Situ Structural Determination of Underpotentially Deposited Pd Monolayer on Au(111) Surface" 2018 Meet. Abstr. MA2018-02 1778