Polarization Dependent XAFS Studies on Low Coverage of Ni at the Al_2O_3 Surface

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Introduction

Ni supported on Al_2O_3 is an important catalyst for CO and alkene hydrogenation reaction. However, the chemical interaction between Ni and Al_2O_3 is still unknown. In this paper we report our recent results about polarization dependent XAFS investigation on Ni at the Al_2O_3 (0001) single crystal surface.

Experimental

Sample preparation

α-Al_2O_3(0001) (20x20x1mm^3)single crystal was purchased from Earth Jewelry Co. The sample was first treated at 1173 K. Then the sample was put in a UHV chamber and annealed at 873 K. We obtained the (1x1) LEED patterns by this treatment. XPS suggests that little carbon impurity is present. Ni was deposited on α-Al_2O_3 by resistive heating of W wire on which Ni wire is wrapped. The Ni coverage was monitored by XPS using Ni2p peak and O KLL Auger peak. The coverage was estimated to be 0.04 ML.

XAFS measurement

Polarization-dependent XAFS measurements were carried out in a newly-built UHV XAFS chamber for total reflection florescence mode. The base pressure of the chamber is 5 x 10^{-10} Torr. XAFS measurement was carried out in BL9A of Photon Factory in Institute for Material Structure Science, (KEK-IMSS-PF). Synchrotron radiation emitted from 2.5 GeV 400 mA electron storage ring was monochromatized by double crystal monochromator together with focusing mirrors. The X-ray is collimated by a pin-hole slit to avoid needless radiation other than the sample. Fluorescence signal was detected by 19 elements solid state detector (Camberra).

Results

Figure 1 shows polarization dependent XAFS oscillations for the Ni on Al_2O_3 at a coverage of 0.04 ML We carried out curve fitting analysis and found that the Ni-O distances for both directions were 0.203 nm a little shorter than that predicted by the theoretical calculation.[1)] We proceeds detailed analysis to provide the model structure of Ni on Al_2O_3(0001).

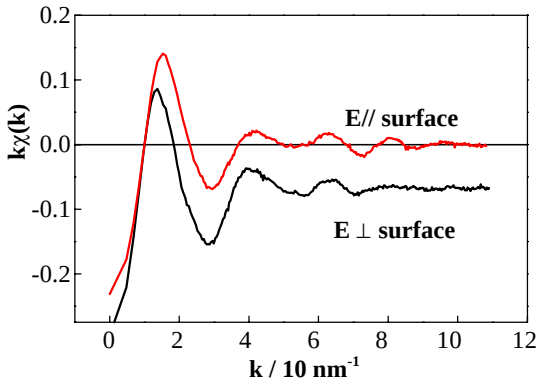

Fig.1 XAFS oscillations of 0.04 ML Ni on Al_2O_3(0001) surface.

References

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