



## **Chemical environment of Ag atoms contained in NPG (nanoporous gold) and the generation of the catalytic activity for CO oxidation**

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The catalytic activity for CO oxidation and the chemical environment of Ag of NPG were examined and compared with those investigated on 5 samples of Ag-contaminated Au powder (mainly Ag/Au-b) in order to get insight into the nature of active sites and the genesis of the catalytic activity for CO oxidation. The NPG was prepared by the selective etching of Ag from AgAu alloy plate in concentrated nitric acid under applied potential. Although the etching was continued for 90 min, the small amount of Ag remained. The residual Ag was estimated to be enriched near to the top surface layers of NPG. The NPG exhibits high catalytic activity for CO oxidation near at room temperature with quite low apparent activation energy. These features were almost the same with those observed on Ag/Au-b. Therefore, the rate constants of CO oxidation per unit metallic surface area of the NPG, i.e.,  $k_{\text{CO}_2}$ , were calculated and compared with those measured on Ag/Au-b. Although the NPG and Ag/Au-b are entirely different in the morphology and in the method of preparation, the Arrhenius plots of  $k_{\text{CO}_2}$  of both catalysts show almost the same slope. However, the values of  $k_{\text{CO}_2}$  of the NPG are nearly one order of magnitude smaller compared to those of Ag/Au-b.

Therefore, the chemical environment of residual Ag atoms was investigated by measuring the Ag K-edge EXAFS to compare with those measured on Ag/Au-b. Similar to the case of Ag/Au-b, Ag atoms are surrounded by Ag and Au atoms and the CN of Ag-Au is larger than that of Ag-Ag.

However, the ratio of CN of Ag-Au to that of Ag-Ag in the NPG is smaller than that observed on Ag/Au-b, indicating that the extent of the dispersion of Ag atoms in the surface layers of NPG is worse than those of Ag/Au-b. It seems that Ag atoms have to be highly dispersed in order to work highly active sites for the catalysis of the CO oxidation.

**Keywords:** Nanoporous gold; Residual Ag; CO oxidation; Ag K-edge EXAFS