XAFS Studies on Pd, Ag Particles Supported on CeO_2

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Ultrafine palladium particles supported on cerium oxide can be prepared by a deposition-precipitation method. The catalytic activity to methanol decomposition at 180°C is generally higher than that produced with the Pd/CeO_2 prepared by an impregnation technique. In the case of 3 wt% Pd/CeO_2, the activity of the former catalyst (DP) is almost double to that of the latter (IMP). Temperature-programmed desorption of carbon monoxide from DP shows that carbon monoxide is adsorbed not only on the surface of palladium particles but on that of cerium oxide while no such phenomenon was observed with IMP. This suggests spill-over of carbon monoxide from the surface of palladium to the support.

Despite the poor S/N ratio caused by the interference of cerium, XANES of DP and IMP (Fig. 1) were similar to that of palladium foil (Fig. 2), suggesting presence of metallic palladium particles both on DP and IMP. However, the chemical properties of the two samples are significantly different. It can be inferred that the surface interaction between palladium particles and cerium oxide is important for activation of palladium, but the interaction appears without a significant change in the structure. Hence, the interaction does not take place in the major part of a palladium particle, and only in the part of junction between the particle and cerium oxide is suggested to be important.

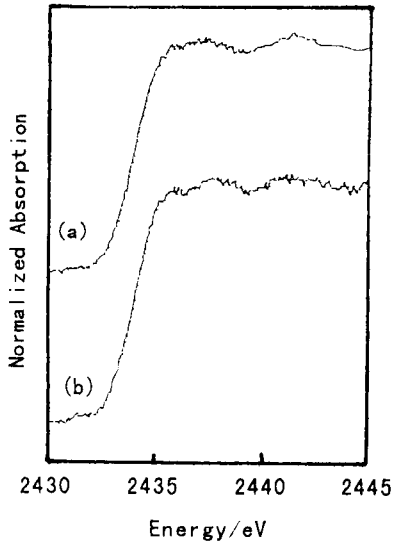

Figure 1. XANES spectra of the Pd/CeO_2 prepared by an impregnation technique (a) and a deposition-precipitation method (b).

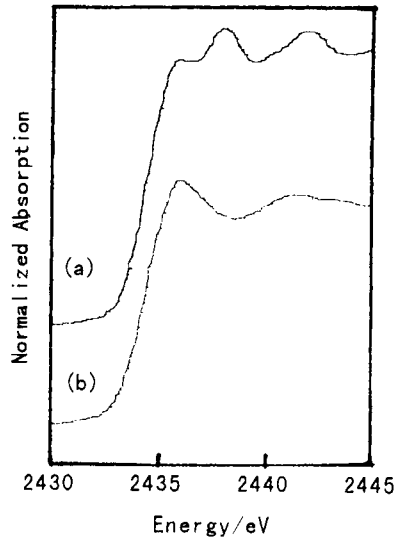

Figure 2. XANES spectra of the Pd foil (a) and PdO (b).