

Studies on the Structure of Pd Supported on Zeolite by XAFS

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Palladium has been known to be active for combustion of hydrocarbons. Zeolite is effective support to stabilize the high dispersion state of Pd. The activity strongly depends on the composition as well as the structure of zeolite used as support. It was expected that valuable information, such as particle size of Pd, could be directly obtained by the X-ray absorption fine structure (XAFS) analysis, which was difficult to evaluate with other method.

Pd K-edge XAFS spectra were measured at room temperature in a transmission mode at the beam line BL01B1 of SPring-8. Pd/zeolite was prepared by ion-exchange method from $(\text{NH}_4)_2\text{PdCl}_2$ solution. Pd loading was 0.2-0.3 wt%. The samples calcined at 673 K under N_2 atmosphere were transferred to aluminum cells with two Kapton windows connected to a closed circulating system. For the measurement of Pd K-edge spectra two ion chambers filled with Ar and Kr were used as detectors of I_0 and I , respectively. Pd-Pd coordination number was determined by the usual curve fitting analysis, using the spectrum of Pd foil as a reference.

Figure 1 shows the relationship between Pd-Pd coordination number and $\text{Al}_2\text{O}_3/\text{SiO}_2$ ratio of the zeolite used as support. Maximum coordination number was attained at $\text{Al}_2\text{O}_3/\text{SiO}_2$ ratio of 0.04 and it was

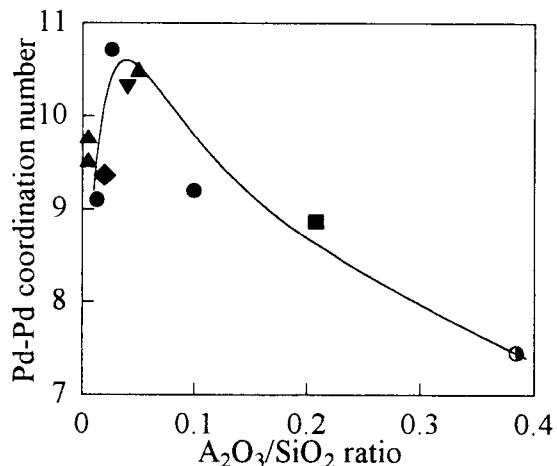


Fig. 1. Pd-Pd coordination number of Pd loaded on various kinds of H-form zeolite.
●:ZSM-5, ▲:Mordenite, ■: Y, ▽: β ,
■: Ferrierite, ○:X.

relatively small at high and extremely low Al concentration. The fact suggests that small Pd particles are stabilized on zeolite with high and extremely low Al concentration. The observed tendency agreed well with the change in the catalytic activity. For instance, the combustion activity of methane on Pd/ZSM-5 increased with decrease in $\text{Al}_2\text{O}_3/\text{SiO}_2$ ratio of ZSM-5 from 0.05 to 0.005.