第273回触媒化学研究センター談話会

演 題：The oxidation of formaldehyde at room temperature over noble metal catalysts supported by TiO_2

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要旨：

The effect of indoor air quality on health has received increasing concern in recent years. Formaldehyde (HCHO), which is known to cause the inflammation of eyes and respiratory tract, headache, and even cancer, is one of dominating pollutants in indoor environment. In this talk, I will introduce our recent study on the catalytic oxidation of indoor HCHO.

Since the catalytic oxidation with oxygen at room temperature is desirable for indoor air purification, the noble metal (Au, Rh, Pd and Pt) catalysts supported by TiO_2 were first evaluated at room temperature for the catalytic oxidation of HCHO. The catalytic activity observed was in a sequence of Pt/TiO_2 >> Rh/TiO_2 > Pd/TiO_2 > Au/TiO_2 >> TiO_2. Formaldehyde could be completely oxidized into CO_2 and H_2O over Pt/TiO_2 in a gas hourly space velocity of 50,000 h^{-1} at room temperature. The XRD patterns and HRTEM images showed that Pt particles on TiO_2 were well dispersed into the size smaller than 1 nm. Pt particle size is a key factor to enhance the TOF of Pt active site for HCHO oxidation.

The activities of different noble metals for HCHO oxidation were studied with respect to the behavior of adsorbed species on the catalyst surfaces at room temperature using in situ DRIFTS. The results showed that the activities of the TiO_2 supported Pt, Rh, Pd and Au catalysts for HCHO oxidation were closely related to their capacities for the formation of formate species and then the formate decomposition into CO species. On the basis of in situ DRIFTS studies, a simplified reaction scheme of HCHO oxidation was also proposed.

Pt/TiO_2 catalyst is proved to be an ideal material for indoor HCHO elimination, and has been commercialized in China. This work has contributed to the 2008 Olympic Games in Beijing, and it will also benefit many people in the future.

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