

Mesoporous zeolite as a support for high-performance metal catalysts

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Microporous aluminosilicate zeolites are widely used in petrochemical processes as catalysts by themselves, and as supports for metal catalysts during the past decades. The catalytic applications are due to strong acidity of the aluminosilicate frameworks, and metal-supporting ability of the micropores. The zeolite catalysis is spotlighted again recently due to effects of mesopores on catalytic activity, lifetime and selectivity. Herein, I report that 3d transition metals such as Co, Ni and Cu, can be supported with a high dispersion when a microporous zeolite is imparted with mesopores in a hierarchical manner. Platinum can be supported in zeolite micropores easily due to high atomic polarizability. However, light metals with low polarizability tend to migrate onto external surface of the zeolite, sintering into a large agglomerate. This causes severe loss of the metal dispersion. On the other hand, when a mesopore is present, the 3d transition metal atoms gather into the mesopore to form a moderate-sized nanoparticle. The metal nanoparticle is highly stabilized by confinement in the mesopore. This makes it possible to use 3d metals instead of costly Pt in various reactions.