Shape-Selective Mesoporous Silicalite-Encapsulated Palladium Catalyst

Significance: Palladium nanoparticles encapsulated in mesoporous silicalite-1 (Pd@S1; pore size 5.3 x 5.6 Å, 1.7 wt% Pd) were prepared for use as a shape-selective catalyst. Reduction of nitrobenzene (1a) by NaBH4, oxidation of benzyl alcohol (3a) under O2, and the Suzuki–Miyaura coupling of iodobenzene (5a) with 4-methoxyphenylboronic acid proceeded in the presence of Pd@S1 to give the corresponding products 2a, 4a, and 6a in 93–94% yield. Under similar conditions, the reactions of substrates with larger molecular size (1b, 3b, and 5b) gave the corresponding products in less than 4% yield.

Comment: The selectivity of the catalysis was evaluated by using Pd/C as catalyst as a control instead of Pd@S1 under similar conditions. Reduction of 1a, 3a, and 5a by NaBH4, the oxidation of 3a, and the Suzuki–Miyaura coupling of 5a with 4-methoxyphenylboronic acid proceeded in the presence of Pd@S1 to give the corresponding products 2a, 4a, and 6a in 93–99% yield. In the coupling reaction of 5a with 4-methoxyphenylboronic acid, Pd@S1 was reused fourteen times without significant loss of its catalytic activity.