Palladium Nanoparticles Supported on Alumina Nanofibers as Dual Catalyst for the Hydrogenation of Alkenes and the Aerobic Oxidation of Alcohols

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Palladium catalysts have been proved to be attractive catalysts in many useful organic transformations. Homogeneous palladium catalysts are often used, but the difficulty in separation and reuse hinders large-scale applications. We prepared new palladium nanoparticles supported on alumina nanofibers (Pd/ANF) as heterogeneous catalysts and the activity of Pd/ANF was compared with those of commercial palladium catalysts (Pd/C, Pd/Al_2O_3) in the solvent-free hydrogenation of alkenes and the aerobic oxidation of alcohols. Pd/ANF was synthesized through the hydrothermal treatment of the mixture of an aluminum precursor (aluminum tri-sec-butoxide), a cationic surfactant ($CH_3(CH_2)_{15}N(CH_3)_3Br$), a Palladium precursor ($PdCl_3$), and a stoichiometric amount of water (H_2O/Al=2). After calcination and reduction, palladium nanoparticles of 9.6 nm on a distinct fibrous morphology were obtained and the specific surface area of Pd/ANF was determined to be 360m^2/g. The Pd/ANF catalyst showed much higher activities relative to commercial catalysts in both the hydrogenation of alkenes and the aerobic oxidation of alcohols. Moreover reused Pd/ANF maintained the original catalytic activity.