Supporting Information

Synthesis and Applications of Magnetic Nanocomposite Catalysts

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Figure SII. XRD patterns of $\text{SiO}_2/\text{Fe}_2\text{O}_3$ support.

Figure SI2. TEM micrograph of Pd/SiO₂/Fe₂O₃ synthesized without affinity ligands.

Detailed Experimental Procedures

General

Igepal CO-520, tetraethylorthosilicate (TEOS), Pd(OAc)₂, and Pd/C (10%) were purchased from Aldrich, and used without further purification. Discover® Labmate™ from CEM was used for microwave synthesis. For TEM analysis on Tecnai™ (Philips, 200 kV), samples were dispersed in ethanol and placed on carbon grids. Elemental analysis of Pd was performed by EDX interfaced with TEM, and by ICP-MS (HP 4500). Powder XRD patterns were obtained with Xpert™ (Panalytical).

Synthesis of Pd/SiO₂/Fe₂O₃

SiO₂/Fe₂O₃ with 20 nm-thick silica shell was synthesized by reverse microemulsion. Polyoxyethylene(5)nonylphenyl ether (35 g, 0.084 mol, Igepal CO-520) was dispersed in cyclohexane (440 ml, ACS grade) by sonication. Next, 40 ml of γ-Fe₂O₃ nanoparticles dispersed in cyclohexane (0.4 mg/ml) were added. The resulting mixture was vortexed until it became transparent. Ammonium hydroxide (29.4%, 3.5 ml) was then added to form a transparent, brown reverse microemulsion. Lastly, TEOS (2 ml) was added. The mixture was gently vortexed, and the reaction was continued for 2 days at room temperature. The resulting SiO₂/Fe₂O₃ nanocomposite particles were precipitated by adding methanol, and collected by centrifuging at 7000 rpm. The collected SiO₂/Fe₂O₃ nanoparticles were redispersed in ethanol, and purified by sonication and centrifugation. The ethanol washes and centrifugation were repeated three times. The nanoparticles obtained were dried *in vacuo*.

225 mg of SiO₂/Fe₂O₃ were functionalized with 0.045 mmol of MPS and AAPS by refluxing in toluene for 30 h to give HS-SiO₂/Fe₂O₃ and H₂N-SiO₂/Fe₂O₃, respectively. The functionalized SiO₂/Fe₂O₃ supports were then treated with Pd(OAc)₂ under microwave (300 W) for 15 min. The resulting black colloidal particles were collected by a magnet, washed with toluene 3 times, and dried *in vacuo*. Microwave was used to form palladium particles rapidly (i.e. within a few minutes), and to produce a uniform distribution of finer palladium particles with well-defined crystallinity. Thermal decomposition of palladium acetate in organic solvents could also be used to derive slightly larger palladium nanoparticles over a longer reaction period.

Hydrogenation of Nitrobenzene

For the recycling studies, 2 mmol of nitrobenzene were reacted in 6.5 ml of 2-propanol over 2.2 mg of Pd/H₂N-SiO₂/Fe₂O₃ (2 mmol Pd) under room temperature and 1 atm of H₂ for 90 min. The turnover number was set at 1000 for 100% conversion in each run. The product was

filtered with 200 nm-pore filter, and analyzed by GC. Pd/SiO₂/Fe₂O₃ catalysts were collected by a magnet, and washed with 2-propanol before its reuse in the next run.