Article

Magnetic Fe_3O_4@SiO_2–Pt and Fe_3O_4@SiO_2–Pt@SiO_2 Structures for HDN of Indole

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Abstract: The effect of a second porous SiO_2 shell in the activity and selectivity of the Fe_3O_4@SiO_2–Pt catalyst in the hydrodenitrogenation of indole is reported. The double Fe_3O_4@SiO_2–Pt@SiO_2 structure was prepared by coating Fe_3O_4 nanoparticles with tetraethyl orthosilicate (TEOS) with a further impregnation of 1.0 wt.% of Pt on the (3-aminopropyl)triethoxysilane functionalized Fe_3O_4@SiO_2 structures. The second porous SiO_2 shell, obtained by using a hexadecyltrimethylammonium bromide (CTAB) template, covered the Fe_3O_4@SiO_2–Pt catalyst with a well-defined and narrow pore-sized distribution. The full characterization by TEM, inductively coupled plasma-optical emission spectroscopy (ICP-OES), XRD, and N_2 adsorption isotherm at 77 K and vibrating sample magnetometry (VSM) of the catalysts indicates homogeneous core@shell structures with a controlled nano-size of metallic Pt. A significant effect of the double SiO_2 shell in the catalytic performance was demonstrated by both a higher activity to eliminate the nitrogen atom of the indole molecule present in model liquid fuel and the improvement of the catalytic stability reaching four consecutive reaction cycles with only a slight conversion level decrease.

Keywords: core@shell; platinum; mesoporous materials; indole HDN

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