Simple Synthesis of Ru Nanoparticles Confined in Channels of Ordered Mesoporous Aluminosilicate as Fischer-Tropsch Catalysts for Production of Liquid Fuels

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Metal/ordered mesoporous aluminosilicates (OMAS) have received great attention as bifunctional Fischer-Tropsch (FT) catalysts that directly convert syngas into liquid fuels. However, both synthesis of OMAS with large pores and efficient pore confinement of metal nanoparticles still remain challenges. Here we report a simple method to synthesize Ru nanoparticles confined in the nanochannels of OMAS (Ru@OMAS). We prepare three types of Ru@OMAS with different Si/Al mole ratio (denoted as Si/Al-x, x = 10, 30, 50) having the same large pore size (~30 nm) and Ru NP loading (3 wt. %). Changing Si/Al ratio strongly affects the number/strength of acid sites and the metal-support interaction, thereby mediating the catalytic acitivity and product selectivity. With increasing Al content, support's acidity and metal-support interaction increase, whereas reducibility of Ru decreases significantly. As a consequence, among the Si/Al-x catalysts, the Si/Al-50 shows the highest selectivity (63.6%) for liquid fuels (C5-C20) and excellent FT activity (CO conversion of 47.8%) due to its mild acidity and relatively good reducibility.