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Heterogeneous Alkane Reactions over Nanoporous Catalysts

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Abstract Pt-USY-712 (Si/Al = 6) and three SBA-15 catalysts (metal-loaded with 1 wt% Pt, 1 wt% Ni or 0.5 wt% Pt and 0.5 wt% Ni) were prepared and characterised using scanning electron microscopy (SEM), X-ray diffraction (XRD), N_2 adsorption porosimetry / BET and transmission electron microscopy (TEM). The catalysts were then tested in the hydroisomerisation and hydrocracking of *n*-heptane using a micro-reactor at atmospheric pressure, and the products were analysed by GC-FID. Reaction temperatures ranged from 250–400 °C while the W/F values of n-C_7 varied from 224.70–550.57 kg mol^{-1}. The coke content of each catalyst was measured using thermo gravimetric analysis (TGA). The catalytic activity was highest on Pt-USY-712 at the lowest reaction temperatures due to (a) the presence of strong Brønsted acids sites on the zeolite and (b) the smaller and more highly dispersed metal clusters on Pt-USY-712, relative to Pt-SBA-15. The activity was higher on the bimetallic Pt/Ni-SBA-15 than on mono-metallic Pt-SBA-15 as the co-impregnation of Ni with Pt enhanced the distribution of the metal clusters on the catalyst and resulted in improved surface area for reaction. The Pt-SBA-15 and Pt/Ni-SBA-15 catalysts both had the lowest and approximately equal coke percentages with 0.116 and 0.119 wt%, respectively.

Keywords *n*-Heptane hydroisomerisation · Zeolites · Mesoporous silica · SBA-15

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