

A Spectroscopic Study on Noble Metal Nanoparticle Embedding into a SBA-15 Catalyst System

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SBA-15 is a promising mesoporous catalyst support material [1] because of its large surface area and good thermal stability. A particularly advantageous property of SBA-15 is that its channels are wide enough to allow the entrance of pre-synthesized metallic nanoparticles. Noble metal nanoparticles are widely used in hydrogenation/dehydrogenation reactions and it is anticipated that by controlling the shape of the nanoparticles it should be possible to improve the selectivity of some processes [1]. We are interested in the development and characterization of model catalyst systems based on SBA-15 supported noble metal nanoparticles. In the present contribution we report on the applicability of various spectroscopic methods for monitoring the physico-chemical properties of these materials.

We successfully embedded Pt, Pd, Ru and Rh nanoparticles into the channels of SBA-15. Samples were characterized at various stages of the synthesis using IR and Raman spectroscopy, XRD, TEM, XPS and dielectric spectroscopy (Fig. 1).

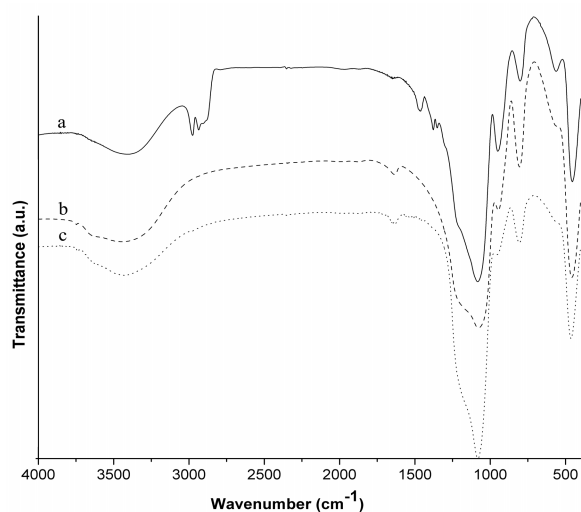


Fig. 1: IR spectra of the pure SBA-15 before calcination (a), after calcination (b) and the 0.1 % Pt/SBA-15 with NIPA capping agent (c)

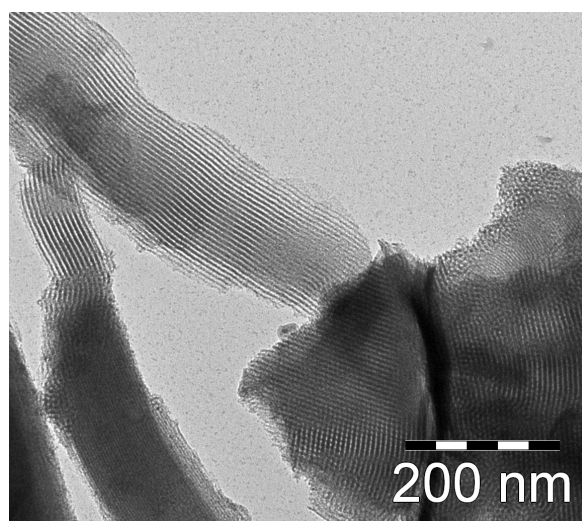


Fig. 2: TEM image of SBA-15 after the calcination

Our results offer insight into the formation mechanism of the working catalyst system, in particular into the interaction of the metal nanoparticle capping agent (NIPA, SPA etc) with the SBA-15 framework. We conclude this report with a comparison between the catalytic performances of the discussed systems in the hydrogenation of cyclohexene.

[1] Éva Molnár, Gyula Tasi, Zoltán Kónya, Imre Kiricsi, *Catalysis Letters* Vol. 101 (2005) 159-167.