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Mesoporous silica of KIT-5 type modified with functional groups – synthesis, characterization and catalytic application

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During our studies two different synthetic procedures were applied in order to obtain mesoporous materials of KIT-5 type, containing functional groups with sulfur. Both procedures led to silicas with 3D interconnected cage-like mesoporous structures, what was confirmed on the basis of low-angle XRD and TEM measurements. The resulting XRD patterns revealed reflexes typical for KIT-5 structure. However, diffractograms of materials modified by the co-condensation procedure are characterized by slightly less evolved signals when compared to diffractograms of their counterparts with surface modified by grafting. According to new IUPAC recommendations, the nitrogen adsorption-desorption isotherms obtained for mesoporous KIT-5 silicas may be ascribed to a type IV(a) with a quite sharp capillary condensation step at higher p/p_0 values. A broad H2(a) hysteresis loops were also visible, indicating large uniformity of cage-like pores. Results of elemental analysis clearly point out that synthesis methods employed for obtaining modified KIT-5 materials allow to incorporate organic groups containing sulfur. Moreover, according to these results, co-condensation to some extent seems to be more effective than the grafting technique. Synthesized materials were applied as acid catalysts in the Friedel-Crafts alkylation of anisole with benzyl alcohol. The results obtained after 6h of reaction in 100°C (conversion of anisole around 20%) seem to be quite satisfactory. However, some further tests are recommended in order to improve the catalytic performance. Similar observations can be made for the reaction of fatty acids esterification with methanol.

Biography

Izabela Nowak is a Professor at the Faculty of Chemistry, Adam Mickiewicz University in Poznan (AMU). She wrote her MSc thesis at the University of Reading (UK), where she was granted a scientific fellowship within TEMPUS. She received a DSc degree from AMU, whereas Postdoctoral training at the University of Liverpool (industrial grant). She stayed at the Kent State University (OH, USA) as a Fulbright Senior Fellow (2003) and Kościuszko Foundation Grantee (2007). The American Chemical Society recognized her in 2011 as "Distinguished Women in Chemistry/Chemical Engineering". The total number of her publications in peer-reviewed journals is more than 70.

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