DESILICATION OF ZSM-5, ZSM-12 AND MCM-22 TYPE ZEOLITES AND THEIR PERFORMANCE IN ISOMERIZATION OF α-PINENE

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We wish to report on the title reaction proceeding over ZSM-5, ZSM-12 and MCM-22 type zeolites, parent and modified by the sodium hydroxide treatment, because available information on the isomerization of α-pinene proceeding over zeolites and desilicated materials is scarce [1]. Accordingly, the NaOH solutions of various concentrations (0.05-1 M) were used as a desilicating agent. Such treatments were applied both under atmospheric pressure and hydrothermal conditions (1 h each). The samples were characterized by XRD, sorption, 29Si and 27Al NMR, and SEM techniques.

First, it was shown that both ZSM-5 and ZSM-12 were more resistant towards the basic solutions treatment, and their structure was retained in a whole concentration range studied. Contrary to ZSM-5 and ZSM-12, MCM-22 [2,3] was less resistant to such a modification, and its structure was largely damaged upon using more concentrated NaOH solutions. Second, NMR spectra of the parent and desilicated materials showed that during the NaOH treatment not only silica was removed from crystals, but aluminium was depleted as well. Nitrogen sorption revealed strong influence of the desilication process on the pore structure of the materials studied – a system of mesopores was clearly formed upon treatment applied.

Finally, catalytic studies were carried out using parent ZSM-5, ZSM-12 and MCM-22 samples. It was shown that MCM-22 was much more active than the other ones. The catalytic properties of investigated zeolites were dramatically affected by the NaOH treatment. In particular, desilication of ZSM-5 with highly basic solutions led to the materials very active in the isomerization of α-pinene in tests carried out at 90°C. Sample modified with 1.0M NaOH solution at 100°C exhibited 66.1mol% conversion level with selectivites to camphene and limonene of 38.8 mol% and 36.8 mol% respectively [3].

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References:
3. Łukasz Mokrzycki, Bogdan Sulikowski, Zbigniew Olejniczak, „Properties of desilicated ZSM-5, ZSM-12, MCM-22 and ZSM-12/MCM-41 derivatives in isomerization of α-pinene”, Catalysis Letters, accepted