**Green Synthesis of MTT Type Zeolite as a Key Component in Middle Distillate Upgrading Catalysts**

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Upgrading the properties of diesel fuel represents a pivotal undertaking within the realm of the petrochemical industry. To tackle this imperative, the application of hydroisomerization technology is employed with the aim of enhancing the chemical composition of the fuel, thereby ensuring its compliance with rigorous quality standards [1]. Hydroisomerization catalysts are typically classified as bifunctional catalysts, comprising a metallic component responsible for dehydrogenation/hydrogenation reactions and an acidic support facilitating isomerization processes. A central obstacle in the progression of hydroisomerization technology pertains to the imperative for exceptionally efficient and selective bifunctional catalysts capable of minimizing the generation of byproducts arising from hydrocracking [2].

The objective of this study is to synthesize ZSM-23 (MTT) zeolite type as a component for a catalyst employed in the upgrading of diesel fuels via a seed-assisted method. The investigation deals into scrutinizing the influence of synthesis parameters, specifically gel composition and crystallization duration, on the crystalline structure, textural and morphological properties, along with acidity of the resultant samples.

Table 1. Synthesized ZSM-23 samples

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sample | Si/Al, mol. | Crystallization time, h | Seeds/SiO2, wt. % | Framework topology (crystallinity, %) | SBET, m2/g | Total acidity, mmol/g |
| Z-23-1 | 50 | 72 | 4.45 | ZSM-23 (55.81 %) | 109 | 0.482 |
| Z-23-2 | 50 | 24 | 3.86 | ZSM-23 (40.74 %) | 98 | 0.537 |
| Z-23-3 | 50 | 48 | 3.86 | ZSM-23 (48.58 %) | 200 | 0.591 |
| Z-23-4 | 50 | 72 | 2.00 | ZSM-23 (62.51 %) | 181 | 0.580 |
| Z-23-5 | 40 | 72 | 2.00 | ZSM-5 (100 %) | - | - |
| Z-23-6 | 30 | 72 | 2.00 | ZSM-5 (100 %) | - | - |

The XRD results show that when Si/Al < 50, ZSM-5 is formed instead of ZSM-23. Increasing the crystallization time from 24 h to 48 h doubles the surface area SBET and reduces the pore volume Vpore by a small amount; after 48 h SBET decreases to 181 m2/g. As for the synthesis without NaOH, Z-23-1 showed an acceptable surface area (SBET = 109 m2/g) and the largest pore volume among the obtained samples Vpore = 0.29 m3/g. As for the pore diameter, in all cases they met the requirement of mesoporosity. The best total acidity of 0.591 mmol/g is achieved upon crystallization for 2 days. The resulting materials have almost the same characteristic morphology of ZSM-23, which looks like a dense cluster of mesostructures consisting of numerous crystals in the form of thin needles, as in Z-23-(2,3,4), whereas in the case of Z-23-1 crystals tend to be plate-shaped.

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**References**

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