

STRUCTURED HIERARCHICAL ZEOLITES OVERGROWN ON EXPANDED OBSIDIAN OR PERLITE

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Hierarchical zeolites are materials in which orderly combined two or more types of pore systems, for example zeolitic micropores and transport mesopores. The latter facilitate the transport of molecules to active centers and reduce diffusion limitations, what allow to expect high activity of such materials in different acid-base and redox process including “bulk” (with diameter more than 1 nm) molecules. At the same time, these materials are quite expensive for use in industry. Synthesis of hierarchical zeolites overgrown on obsidian or perlite could significantly reduce the value of such materials.

Structured hierarchical zeolites overgrown on expanded obsidian or perlite were obtained using Gemini-type surfactants as structure directing agents (SDA) and this aluminosilicates as unique Al source. Si/Al ratio change was achieved by preliminary acid treatment of starting perlite and obsidian. Structured hierarchical zeolites with MTW, MFI, MOR or BEA topology (as pure phases) were obtained varying of hydrothermal treatment time, SDA structure, and Si/Al ratio. Obtained materials consist of amorphous aluminosilicate (perlite or obsidian) phase on the surface of which zeolite nanosheets of 2–10 nm thickness are overgrown. Values of external surface were quite high and achieved $200 \text{ m}^2 \cdot \text{g}^{-1}$, while mesopore volume varied in range $0.25\text{--}0.6 \text{ cm}^3 \cdot \text{g}^{-1}$. It was established that degree of perlite or obsidian transformation into zeolite was increased with prolongation of time hydrothermal treatment and decrease of Al content in dealuminated obsidian and perlite.

All synthesized zeolites contain in structure Brønsted (BAS) and Lewis acid sites (LAS), which concentration varied in range $40\text{--}200 \mu\text{mol} \cdot \text{g}^{-1}$. Concentration of BAS and LAS significantly depended on amount of amorphous phase in obtained structured hierarchical zeolites. Such materials will be tested as catalyst for different acid-base process.

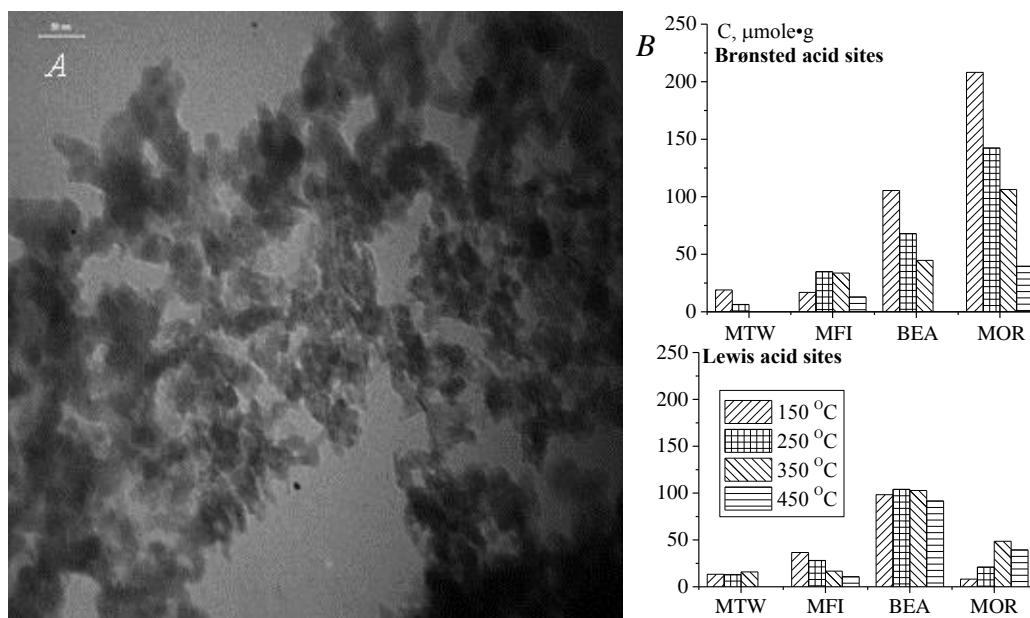


Fig. TEM-image (A) of sample BEA-obsidian, concentration (B) of adsorbed pyridine on Lewis and Brønsted acid sites of obtained composites