

Nanocomposites and Nanomaterials

Hierarchical Ti-, Sn- and Zr-containing zeolites as potential catalyst for oxidation-reduction reactions

M.M. Kurmach, P.S. Yaremov, V.V. Tsyryna, O.V. Shvets

*Department of Porous Substances and Materials
L.V. Pisarzhevskiy Institute of Physical Chemistry of the NAS of Ukraine,
31 Nauky Ave., Kyiv 03028, Ukraine. E-mail: mazinator3710@ukr.net*

High efficiency of Ti-containing zeolites in epoxidation of olefins [1], of Sn-containing in Bayer-Villiger oxidation process [2] and of Zr-containing in Meerwein-Ponndorf-Verley-Oppenauer reaction [3] motivates scientists to more detailed investigation of these materials. Although conventional zeolites give high conversion in processes involving small molecules (up to 0.75 nm) their activity significantly decreases in reactions involving bigger molecules (more than 0.8 nm).

To solve this problem the most promising method is to obtain hierarchical zeolites with high external surface using Gemini-type surfactants. Gemini-type surfactants are organic salts containing hydrophobic alkyl chains (C_{16} – C_{22}) and hydrophilic part formed by 2-8 ammonia groups linking with alkyl chains (C_3 – C_6).

Hierarchical Ti-, Sn-, Zr-containing zeolite materials with MTW-topology were obtained using different Gemini-type surfactants as structure-directing agents (SDA). Nanoparticles or nanoneedles of zeolites could be obtained depending on structure of SDA. Ti, Sn, Zr-containing zeolites are characterized by external surface area up to 200 m²/g and mesopore volume up to 0.4 cm³/g. Such materials contain two different types of Lewis acid centres with overall concentration up to 90 mmol/g. HF addition into reaction mixture let obtain zeolite materials with increased thermal stability, acidity and porosity.

1. Přeč, J., Eliášová, P., Aldhayan, D., & Kubů, M. Epoxidation of bulky organic molecules over pillared titanasilicates.// Catalysis Today. – 2015. – **243**. – P. 134-140.
2. Kang, Z., Zhang, X., Liu, H., Qiu, J., & Yeung, K. L. A rapid synthesis route for Sn-Beta zeolites by steam-assisted conversion and their catalytic performance in Baeyer–Villiger oxidation.// Chemical Engineering Journal. – 2013. – **218**. – P. 425-432.
3. Zhu, Y., Chuah, G., & Jaenicke, S. Chemo- and regioselective Meerwein–Ponndorf–Verley and Oppenauer reactions catalyzed by Al-free Zr-zeolite beta// Journal of Catalysis. – 2004. – **227(1)**. – P. 1-10.