J. Heyrovský Institute of Physical Chemistry

New catalysts from old structures; Design of active sites in zeolites at the atomic level

Edyta Tabor

Department of Structure and Dynamics in Catalysis
J. Heyrovský Institute of Physical Chemistry of the CAS v. v. i.
Dolejškova 2155/3, Prague, 182 23, Czech Republic

Zeolites represent the widest and most important group of heterogeneous catalysts applied in chemical industry. Theirs catalytic properties are directly linked with unique combination of their structure and composition. The well-defined crystalline structure of zeolites with regular 3D channel/cavity system can be regarded as a system of nanoreactors while isomorphous substitution of Si(IV) atoms by Al(III) in the silicate framework allows stabilization of extra-framework cationic species (protons, metal (oxo)ions) acting as Brønsted and Lewis acids, redox and base active sites. The organization of Al atoms in the zeolite framework controls concentration, speciation and location of active sites in zeolite catalysts thus represents, beside the zeolite topology, the most important parameter for tuning zeolite catalysts properties.

The significant effect of Al organization in zeolites and impact of the distance of active sites on acid catalysed reaction will be demonstrated over propane oligomerization and ethanol dehydration.

The influence of Al organization on the nature of redox active sites (Fe, Mn, Ni or Co metal ions) embedded in various zeolite matrices will be discussed for the abatement of greenhouse N_2O and for splitting of O_2 or N_2O with subsequent selective oxidation of methane to valuable products.