

Summary

Synthetic molecular sieves have attained exceptional importance in second half of twentieth century in many large scale industrial processes such as adsorption, ion-exchange, catalysis and many others. Due to their uniform and ordered porous structures they play an important role in developing the fundamental physico-chemical investigations. All the molecular sieves prepared in laboratories and produced in industry (zeolites, zeolite-like materials, mesoporous materials) in XX century are inorganic compounds, even if in many cases organic reagents (e.g. template agents) are employed for their synthesis. The organic-inorganic materials (MOF, PMO) have been reported only in recent decade. The last representative of the molecular sieves with all organic composition (ordered porous resins) was discovered only some years ago. Only several research groups in the world prepare and study the properties of these materials and my investigation conducted during my Ph.D. program are the first one in Poland.

The main aim of my Ph.D. thesis was synthesis, characterization and potential application in catalysis of ordered porous resins. Preliminary synthesis experiments were based on literature data and they confirmed efficiency of published preparation methods. Generally, the procedure consisted in condensation of phenol-formaldehyde resins in the presence of porogeneous agents and then in removal of the matrix after completing the polymerization. The space occupied before by the template forms the uniform pore system.

The further syntheses involved condensation of formaldehyde with various phenol derivatives (e.g. resorcinol or fluorogucinol, *m*-phenyldiamine) as well as with urea, melamine, sodium 4-hydroxybenzenesulfonate in the presence of triblock copolymers (Pluronic). The condensation was conducted either under reflux or in open vessels allowing evaporation of the solvent (EISA procedure). The porous resins were also prepared with aid of *hard* templates i.e. mesoporous ordered silica (e.g. MCM-41) used for resin condensation inside their pore system (*nanocasting*). The resulted resin replicas of matrices were released by dissolving silica with HF or NaOH. Various components of the condensation mixtures were chosen in order to introduce desired functional groups into resultant resins. The introduced group could play a role of catalytically active sites. For the same reason the Cu cations were linked with the framework of porous products. The obtained materials showed relatively large surface areas and ordered mesoporous structure confirmed by low angle XRD, SEM pictures and nitrogen adsorption isotherms.

Selected samples were examined as catalysts in test reactions (2-propanol decomposition, esterification of ethanol with acetic acid, oxidation of cyclohexene). The samples modified with sulfonic groups indicated remarkable activity in reactions initiated by acid sites, whereas the Cu modified resins were active in oxidation reaction.