

DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

One of the consequences of development of civilization is degradation of the environment. Toxic substances with a long biodegradation time, such as certain heavy metals and inorganic anions, pose a major threat. They adversely affect both human body and the environment, and their constantly increasing levels have become an increasingly significant issue. Volatiles organic compounds (VOCs), which constitute ca. 60% of all substances that pollute the atmosphere, are an additional problem, especially given the fact that 73% them have been classified as carcinogenic compounds. These substances include products of combustion such as aliphatic and aromatic hydrocarbons, among others. Environmental protection has therefore become very important. Due to the fact that technologies applied in environmental protection require solutions that are both effective and environment-friendly, widely available, inexpensive and natural mineral materials are sought after. As excellent adsorbents of heavy metals, crystalline materials that belong to the group of zeolite materials fulfill these requirements to large degree. Some of their most essential characteristics include primarily a well-developed surface and their ability to exchange foreign ions and retain them within their structure. It would thus seem that the applications of zeolites in environmental protection are limitless. However, despite their numerous advantages, access to active centers is an issue; in addition, their microporous nature presents a severe limitation in the context of processes involving large particles. This problem has led researchers to search for solutions that would allow the diffusion-related limitations to be overcome, thereby increasing the sorption capacity of these materials and enabling their application in environmental protection. The concept of the so-called hierarchical zeolites – systems that feature both micro- and mesopores – appears to be an appropriate solution. In present proposal design of an effective way of modifying selected zeolite structures intended for application in sorption processes is planned. Modification of zeolite structure will result in improved sorption and ion-exchange properties, which will be utilized in the sorption of selected transition metal cations, inorganic anions, and organic molecules with a larger size. The project will focus especially on the application of structural examination methods (including IR spectroscopy and Raman spectroscopy in particular) for a description of the structure of the zeolite skeleton that takes into consideration the method and extent of their modification and their sorption properties.