

Review of the Doctoral Thesis of MSc. Qiudi Yue

The title of the Ph.D dissertation: Labile elementosilicates as intermediates for design of novel materials

Supervisor: Dr. Maksym Opanasenko

Advisor: Prof. Ing. Jiří Čejka, DrSc

The main goal of the dissertation was the design of a series of elementosilicate zeolites with tunable properties by controlling the crystallization mechanism and by changing zeolite structure and chemical composition. The ambitious goal has been fully achieved.

Importance of the thesis and results:

The literature (234 references) in the thesis indicates the highly vital areas of current catalytic research. The scientific results of the thesis are undoubtedly presented in scientific journals. Reversed crystal growth mechanism described in the dissertation is for the first time demonstrated in zeolite synthesis. Two new zeolites (IPC-17 and IPC-18) were prepared using the ADOR (assembly- disassembly-organization-reassembly) approach. The thesis is full of results, tables and mostly figures. All figures are carefully prepared, and the results clearly presented. Many techniques for characterization of the prepared materials have been used, and their results well interpreted. This part of the thesis is well written and indicates the interest of the candidate for the synthesis and detailed characterization of solid materials.

Importance for practice

Developed synthesis of isomorphously substituted M-CHA (M = B, Al, Ga, and Ti) zeolites free of metal cations at ion-exchange positions should be applied for preparation of materials for separation of CO₂/CH₄ mixtures, e. g. from biogas-stations.

Questions and comments:

1. Real gaseous mixtures of CO₂/CH₄ always contain also water vapour. What should be the effect of water on separation or the influence on material properties?
2. Using described preparation procedure (for the M-CHA materials) are changed their hydrothermal properties?
3. At high concentration of structure-directing agent (F⁻) in the reaction mixture, crystal growth switches to the reversed mechanism. After synthesis is it possible to remove quantitatively this agent not to influence acid properties?

Final evaluation

The dissertation describes new methods for the synthesis of new materials with well defined structures. The topic of dissertation is modern and important for science and for possible practical application. Obtained results provides a very good background for understanding the mechanism of synthesis of highly sophisticated materials. On the bases of presented results my opinion is that the reviewed thesis fulfils all requirements needed for obtaining PhD degree.

I fully recommend the thesis of MSc. Qiudi Yue to be defended orally and awarded by the PhD degree.

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Prof. Ing.Milan Hronec,DrSc
Slovak University of Technology,
Bratislava