Synthesis and Characterization of Boroaluminates via Non-Hydrolytic Sol-Gel Method

Michal Mlynek[1], Zdeněk Moravec[1], Aleš Stýskalík[2], Petr Machač[2], Tomáš Pokorný[1], Lucie Šimoníková[1], Jiří Pinkas[1*]

[1]*Masaryk University, Department of Chemistry, Kotlarska 2, 611 37 Brno, Czech Republic*

[2]*Masaryk University, CEITEC MU, Kamenice 5, 601 77 Brno, Czech Republic*

e-mail: 460872@mail.muni.cz

Key words: active sites, boroaluminates, catalyst, mixed-oxide, non-hydrolytic sol-gel, porous materials

Abstract

Aluminium oxide is commonly used as a catalyst or catalyst support in many processes, such as oxidation, dehydrogenation, or isomerization. Al_2O_3 has an amphoteric character, which is undesirable in specific catalytic applications. However, the acidity of aluminium oxide can be promoted by binding with other metal oxides, such as B_2O_3. Different coordination of aluminium and boron atoms creates different Lewis and Brønsted acid sites. Overall acidity of material is highly depending on homogeneity and uniformity of the system, and oxides ratio, respectively. Resulting material can possibly possess interesting acidic active sites, suitable for catalysis.[1–3]

Non-hydrolytic sol-gel method (NHSG) could be very promising for this purpose, preserving hydrothermal stability and potentially leading to higher porosity, acidity, and, thus, catalytic activity. Another advantage, that sol-gel approach brings, are mild reaction conditions, possibly more homogeneous distribution, and higher control over amount of oxygen atoms in precursors, than in hydrolytic sol-gel.

In our work we prepared mixed oxide of alumina and boria via alkylhalide NHSG synthesis with a boron/aluminium precursor ratio 1:1. We characterized our material using MAS NMR, SEM microscopy, N_2 porosimetry, and thermogravimetry combined with ICP-OES and XPS elemental analysis. We also tried its practical application in catalytical reaction converting ethanol to ethylene and diethyl ether respectively.

References

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