

ALUMINUM SIEVES SUPPORTING COBALT-MANGANESE MIXED OXIDES AS CATALYSTS FOR DEEP ETHANOL OXIDATION

Květa Jiráťová¹, František Kovanda², Jana Balabánová¹

¹*Institute of Chemical Process Fundamentals CAS v.v.i., Rozvojová 135, 165 02 Prague, Czech Republic*

²*Department of Solid State Chemistry, University of Chemistry and Technology, Prague, Technická 5, 166 28 Prague, Czech Republic*

Volatile organic compounds (VOC) emissions in industrial gases can be reduced applying the catalytic total oxidation. We found high catalytic activity of the Co-Mn-Al mixed oxides, obtained from layered double hydroxide (LDH) precursors, in ethanol total oxidation¹. Recently we reported analogous catalysts deposited on anodized aluminum foils². Now we have prepared the Co-Mn-Al mixed oxides and Co oxides over Al sieves covered by thin layers of alumina.

Two kinds of Al sieves, thick and thin (diameter of wires 0.1 and 0.25 mm, open area 27 and 37 %, respectively) were anodized in 2.8 M H₂SO₄ at current density of 20 or 30 mA cm⁻² and then hydrothermally treated in the solutions of Co and Mn nitrates to form precursors of Co-Mn catalysts. For comparison, Co oxides over the oxidized Al sieves were prepared by deposition of Co oxides sols according to Liu et al³. The catalytic performance of the obtained structured catalysts (diameter of a piece of sieve was 26 mm) was examined in the total oxidation of ethanol (750 ppm in air), which was chosen as a model VOC. Various number of sieves were placed into the thin metal cylinder to simulate monolithic catalysts (diameter of 26 mm, height of 20 mm).

It was found out that T₅₀ temperature (the temperature at which 50 % conversion of ethanol was achieved) observed at 10 l h⁻¹ sieve⁻¹ varied from 156 to 225 °C. As content of active phase in the catalysts varied from 6.3 to 31.5 wt. %, specific activity related to weight of deposited active oxide was evaluated. The highest specific activity at the same space velocity was observed with the Co oxide catalysts (0.5 mmol EtOH g_{Co}⁻¹ h⁻¹) prepared over thin Al sieve, while the catalysts containing Co-Mn mixed oxides were less active. Their specific activities varied from 0.32 to 0.19 mmol EtOH g_{Co+Mn}⁻¹ h⁻¹ in dependence on the thickness of the sieves; higher specific activity was observed over catalyst deposited on the sieves anodized at 30 mA cm⁻².

It can be concluded that conditions of sieves pretreatment substantially affect properties of the deposited oxides, and consequently, the catalytic activity of the prepared catalysts.

Acknowledgements:

Authors acknowledge financial support of the Czech Science Foundation (17-08389S).

References:

- ¹ Jiráťová, K.; Mikulová, J.; Klempa, J.; Grygar, T.; Bastl, Z.; Kovanda, F. *Appl. Catal. A*, **2009**, 361, 106-116.
- ² Kovanda, F.; Jiráťová, K.; Ludvíková, J.; Raabová, H. *Appl. Catal. A*, **2013**, 464-465, 181-190.
- ³ Liu, Ch.; J. A. Ritter, J. A.; Popov, B. N. *J. Electrochem. Soc.* **1998**, 4097-4103.