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Jiráťová, Květa
2014

Dostupný z <http://www.nusl.cz/ntk/nusl-177573>

Dílo je chráněno podle autorského zákona č. 121/2000 Sb.

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Datum stažení: 07.05.2024

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ETHANOL OXIDATION OVER TRANSITION METAL MIXED OXIDES
SUPPORTED ON STRUCTURED SUPPORTS

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Abatement of volatile organic compounds in industrial gases can improve life environment, but it is desirable to minimize the cost of the process. We found high catalytic activity of the transition metal mixed oxides [1], calcined Co-Mn-Al LDH-like precursor, in total oxidation of ethanol. However, the concentration of the metals in the catalyst is high, and a considerable part of the pellet volume is not utilized because of internal diffusion in the fast oxidation reaction. In this study, we examined preparation of Co-Mn-Al mixed oxides catalysts over aluminum sieves intended as a main part of metallic monoliths. The layers of active components were deposited over anodized Al sieves by growing of LDH layers under hydrothermal conditions from Co, Mn, Al nitrates. After calcination, properties of the catalysts were compared with those of the catalyst prepared by pelletizing of coprecipitated LDH-like precursor and the catalysts prepared over cordierite monoliths. The catalysts were examined by Saer, H₂-TPR, SEM and catalytic activity in oxidation of ethanol. The catalysts (in the form of simulated monoliths) were tested under unsteady-state conditions from 100 to 400 °C, at rate of 2.27 °C min⁻¹ and GHSV 20 m³ kg⁻¹ h⁻¹. The inlet concentration of ethanol in the air was 1.5 g m⁻³. The temperatures at which 50% conversion of ethanol was observed (T₅₀) was chosen as the measure of catalyst activity.

Table 1 summarizes main data concerning the catalysts prepared. The most active catalyst, even more active than the commercial PPD monolithic catalyst, is pelletized Co-Mn-Al LDH-like precursor. Its deposition on Al sieves decreased catalyst activity by 61-92 °C depending on the amount of active components and aperture of the sieves. Compared to the coprecipitated catalyst, the amount of active components is a half or one tenth. The narrower the aperture, the more active catalyst is. Catalyst activity of the monolithic catalysts prepared by similar methods was about 140 °C lower than that of the pelletized coprecipitated catalyst. The monolithic catalyst prepared by impregnation of monolith with Co,Mn,Al nitrates was only slightly less active than the best Co-Mn-Al catalyst on Al sieve.

Table 1: Organic compounds conversions over various structured catalysts

Catalyst	Support	Co+Mn wt.-%	T ₅₀ °C
Envicat 5022-HC	Monolith	-	118
Coprecipitated	None	67.8	104
LDH growth	Al Sieve ^a	7.89	161
LDH growth	Al Sieve ^b	1.31	192
LDH growth	Monolith	1.71	264
Impregnated	Monolith	3.83	167

^awire 0.1 mm, open area 27%, ^bwire 0.25 mm, open area 37%

References:

- [1] Jiráťová, K.; Míkalová, J.; Klempa, J.; Grygar, T.; Bastl, Z.; Kovanda, F. Appl. Catal. A **2009**, 361, 106-116.

Acknowledgements

The authors thank the Czech Science Foundation for the financial support (project P106/14-13750S).