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# MONOLITHIC Co-Mn-Al OXIDE CATALYSTS IN TOTAL OXIDATION OF ETHANOL

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Abatement of volatile organic compounds in industrial gases is necessary in order to improve life environment, but it is desirable to minimize the cost of the process. In our previous study<sup>1</sup>, we found high catalytic activity of the calcined Co-Mn-Al LDH-like precursor in total oxidation of ethanol. However, the concentration of the metals in such catalyst is high, and a considerable part of the pellet volume is not utilized because of internal diffusion in the fast oxidation reaction. Therefore, we studied preparation of mixed oxide Co-Mn-Al catalysts over cordierite monoliths and examined their properties in comparison with properties of other catalysts prepared by impregnation or pelletizing. The calcined catalysts were examined by adsorption/desorption of N<sub>2</sub>, H<sub>2</sub>-TPR, NH<sub>3</sub>-TPD, scanning electron microscope and catalytic activity in oxidation of ethanol. The results are summarized in Table 1.

Table 1 Properties and catalytic activity in total oxidation of ethanol of the Co-Mn-Al catalysts prepared over preformed supports

| Catalyst name | Support                          | Method           | Co+Mn+Al wt. %     | T <sub>50</sub> °C | T <sub>90</sub> °C |
|---------------|----------------------------------|------------------|--------------------|--------------------|--------------------|
| 1             | Monolith                         | W+I <sup>c</sup> | 8.45               | 210                | 231                |
| 2             | Monolith                         | W+I <sup>c</sup> | 6.61               | 211                | 254                |
| 3             | Monolith                         | W+I <sup>c</sup> | 5.56               | 214                | 242                |
| 4             | Monolith                         | W+I <sup>c</sup> | 6.61               | 218                | 268                |
| 5             | Monolith                         | W+I <sup>c</sup> | 6.31               | 217                | 270                |
| KL110317D     | θ-Al <sub>2</sub> O <sub>3</sub> | I <sup>b</sup>   | 6.39 <sup>d</sup>  | 199                | 295                |
| KL110317C     | γ-Al <sub>2</sub> O <sub>3</sub> | I <sup>b</sup>   | 8.25 <sup>d</sup>  | 225                | 333                |
| 110824        | γ-Al <sub>2</sub> O <sub>3</sub> | D <sup>c</sup>   | 7.03 <sup>d</sup>  | ndtd               | 220                |
| 110815        | γ-Al <sub>2</sub> O <sub>3</sub> | D <sup>c</sup>   | 6.03 <sup>d</sup>  | 201                | 270                |
| 110808.2B     | γ-Al <sub>2</sub> O <sub>3</sub> | D <sup>c</sup>   | 4.32 <sup>d</sup>  | 174                | 217                |
| 110216        | -                                | P <sup>a</sup>   | 70.38 <sup>d</sup> | ndtd               | 210                |

(<sup>a</sup>pelleting of dried precipitate, <sup>b</sup>impregnation by nitrates solution, <sup>c</sup>deposition of the precursor over support spheres, <sup>d</sup>sum of Co and Mn, <sup>e</sup>washcoating and impregnation by nitrates solutions, T<sub>50</sub>, T<sub>90</sub> – the temperatures at which 50 and 90 % conversion of all organic compounds was observed at 20 000 ml g<sup>-1</sup> h<sup>-1</sup>)

The Co-Mn-Al mixed oxide catalysts prepared over washcoated monoliths show comparable activity in ethanol oxidation, but slightly lower than the pelletized Co-Mn-Al LDH-like precursor (110216). However, the amount of active components is nearly 10 times lower. Deposition of the precursor in a thin layer over the alumina spheres leads to similarly active catalysts as the monolithic ones. Impregnation of the Al<sub>2</sub>O<sub>3</sub> spheres with nitrates solution does not provide sufficiently active catalysts.

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## References:

- <sup>1</sup> Jiráťová, K.; Mikulová, J.; Klempa, J.; Grygar, T.; Bastl, Z.; Kovanda, F.: Appl. Catal. A 2009, 361, 106-116.

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Table 1 Proper and their catal

| Catalyst  |   |
|-----------|---|
| 110214 ZZ | c |
| 100621 K  | c |
| KL111019C | 1 |
| KL111019A | 1 |
| KL111020  | 1 |
| KL111019B | 1 |

<sup>c</sup>coprecipitation, <sup>e</sup>ca T<sub>90</sub> – the temperatur observed under ree helium, 0.5 % meth

prepared mec and the T<sub>90</sub> te and T<sub>90</sub> > 21 similar activi prepared by c

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## References:

- <sup>1</sup> Jiráťová, K.; A 2009, 361,