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TITANIA SUPPORTED Co-Mn-Al CATALYSTS IN TOTAL OXIDATION OF ETHANOL

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In pelletized mixed oxide catalyst prepared by calcination of coprecipitated precursors, a considerable part of the pellets is not utilized in case of very fast catalytic reaction, due to the effect of internal and external diffusion. Therefore, deposition of thin active layer on a supporting material is advantageous. In this contribution, the effect of the support (titania grains and extrudates) on properties and catalytic activity in VOC oxidation of both catalyst geometric forms were examined.

Titania (Eurosupport Litvinov, Czech Republic) in the form of extrudates (diameter 3 mm) was crushed to grains (0.16-0.315 mm) and both forms of the support were impregnated by a water solution of Co, Mn and Al nitrates (molar ratio of metal ions Co:Mn:Al=4:1:1) to obtain catalysts with nominal amount of 5 – 25 wt. % of metal oxides. After the impregnation, the catalysts were dried at 130 °C and calcined at 500 °C for 4 h in air. The changes in porous structure, reducibility, and activity in ethanol oxidation ($1.4 \text{ gm}^3 \text{ in air, space velocity } 20 \text{ l/g/h}$) of the catalysts were examined.

It was found out that the surface area of the titania support ($200 \text{ m}^2/\text{g}$) decreased up to $70 \text{ m}^2/\text{g}$ with increasing amount of impregnated active components. Similarly, volume of mesopores decreased to a half and the mean pore radii as well. Temperature program reduction revealed two main reduction peaks,^{1,2} the first one being around 425 °C (reduction of Co_2O_3 to CoO and Mn_2O_3 to Mn_2O) and the second one within the limits 520 – 580 °C (reduction of Co_2O_3 , Mn_2O_3 and CoAl spinels). The amount of easily reducible particles increased with increasing amount of active components in the catalysts. Oxidation activity of the grain catalysts was proportional to the amount of easily reducible components present in the catalysts. The most active grained catalyst, containing 12.8 wt. % of active components, oxidized 50 % of ethanol at 130 °C. When the same active components were supported over titania extrudates, the same catalytic activity was observed with lower amount of active components (by 4 wt. %). In case of the same concentration of the active components in the extrudates as in the grains, the temperature necessary for achieving 50 % conversion decreased by 40 °C.

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