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COMPARISON OF VARIOUS STRUCTURED SUPPORTS OF THE CATALYSTS FOR VOC OXIDATION OVER TRANSITION METAL OXIDES

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Volatile organic compounds (VOCs) in industrial gases represent a serious environmental problem, which can be solved using total catalytic oxidation. Oxides of transition metals are a cheaper alternative to the noble metal catalysts. Low pressure drop of the catalytic layer is very important especially for the process when high gas phase throughputs are applied. Thus, in this contribution, catalysts based on cobalt are prepared over monoliths made of cordierite or Al foils, and over both stainless steel and Al sieves.

Total oxidation of ethanol including the reaction intermediates is interesting and worth studying as ethanol is often used as a fuel for buses and cars (e.g., in Scandinavian countries and especially in South America). For that reason, preparation of oxide catalysts over the structured supports is studied.

Monoliths made of cordierite or corrugated Al foils were impregnated either by a solution of Co or Co-Mn-Al nitrates, or by deposition of a layered double hydroxide-like compounds of Co or Co-Mn-Al under hydrothermal conditions, or by deposition of Co electrochemically, or using a Co sol prepared according to Lin et al.¹ After calcination, the catalysts were characterized by SEM, XRD, porous structure, and TPR. Ethanol oxidation was carried out with 10 ml volume of a catalyst from 80 to 400 °C, the temperature ramp of 2 °C min⁻¹, at GHSV of 2-90 m³ l⁻¹ h⁻¹, and the inlet ethanol concentration in air 1.2 g m⁻³ (equaled to 750 ppm). Temperatures T_{50EtOH} and T_{50VOC} (the temperatures, at which 50% of ethanol and 50% of all organic compounds conversion were achieved) were chosen as a measure of the catalyst activity. Selectivity in ethanol conversion was evaluated as the amount of formed acetaldehyde (ppm) in the examined temperature range.

Catalytic activity of the monolithic catalysts (T_{50EtOH}) varied in the range 140 – 214 °C for the GHSV=2 m³ l⁻¹ h⁻¹. The highest activity showed the catalyst made of dense Al sieves covered with the highest amount of Co-Mn-Al active components, followed by Al monoliths with Co₃O₄. Equal activity showed the thin Al sieves containing less Co-Mn-Al oxides than that mentioned previously. The lowest activity was found with the stainless steel sieves covered electrochemically with CoCO₃.

References:

¹ Lin, Ch.; J.A. Ritter, J.A.; Popov, B.N. J. Electrochem. Soc. **1998**, 4097-4103.

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