**CO OXIDATION IN THE PRESENCE OF WATER AND METHANOL VAPOR OVER FexCo1-x MIXED OXIDE CATALYSTS**

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**ABSTRACT**

The majority of catalysts employed in CO elimination from industrial emissions are based on supported noble metals, mainly Pt and Pd. The advantages of noble metal catalysts include high catalytic activity, infrequent regeneration and tolerance under moisture, but their main drawback is the cost because of their scarcity. Development of efficient catalysts based on transition metal oxides can provide a sustainable alternative to noble metals. Co3O4 is among the most active transition metal oxides in CO oxidation, although its activity decreases significantly in the presence of water vapour in the feed, which is the typical case encountered in practice. Baidya et al. reported on the superior catalytic performance of Fe-doped Co3O4 catalysts in CO oxidation reaction with a dry gas feed [1].

In the present work, FexCo1-x mixed oxide catalysts have been synthesized with various Fe/(Fe+Co) molar ratios, spanning the whole composition range, by employment of the citrate complexation method. The catalysts have been evaluated in the CO oxidation reaction in the absence and presence of 3% H2O vapor. The optimal Fe/(Fe+Co) molar ratio has been determined in each case and the best-performing catalysts were also evaluated in the oxidation of a CO-CH3OH mixture in the presence of water. N2 physisorption, XRD, Raman, XPS, H2-TPR and CO-TPR were employed for the physicochemical characterization of the examined catalysts. In CO oxidation, Fe-containing catalysts up to molar ratio 0.50 (in the absence of H2O) and 0.25 (under moist conditions) achieved higher specific rates than pure Co3O4, while Fe0.10Co0.90 demonstrated the optimal H2O tolerance. The addition of CH3OH (0.2 vol%) in the reaction mixture led to a dramatic inhibition of CO oxidation over mixed oxide catalysts shifting the required temperature for total CO removal to a higher temperature by 100oC. CO-TPD, CH3OH-TPD and CH3OH-TPSR were employed to investigate the inhibiting effect of methanol in the CO oxidation reaction over the Fe-Co catalytic system. It was concluded that CO and CH3OH compete for the same active sites on the catalyst surface while the adsorption capacity of the examined samples is higher for methanol than CO. As CH3OH oxidizes at higher temperatures, it blocks CO adsorption until its oxidation is completed.

**KEYWORDS:** carbon monoxide, methanol, oxidation, cobalt oxide, iron oxide

**REFERENCES**

[1] T. Baidya, T. Murayama, P. Bera, O.V. Safonova, P. Steiger, N.K. Katiyar, K. Biswas, M. Haruta. (2017). *J. Phys. Chem. C.* 121:15256–15265. https://doi.org/10.1021/acs.jpcc.7b04348.

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