Catalytic reduction of NO with CO on Ce-Added Alumina Supported Cu-Co Catalysts

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NOx removal from exhaust gases still remains one of major challenges in the area of environmental catalysis. The most common approach is the reaction with residual reductants (unburned or partially burned hydrocarbons and CO) in the exhaust. Various catalysts have been extensively studied containing noble metals, ion-exchanged zeolites, and metal oxides. The metal-supported alumina catalysts have received one of the most attentions due to its high activity and stability. The mixing of two different oxides offers an opportunity not only to improve the performance of the involved metal oxide, but also to form new stable compounds that may lead to totally different physicochemical properties and catalytic behavior from the individual components. Doping of ceria by divalent or trivalent ions can increase the concentration of oxygen vacancies or improve its thermal stability

In the present work we investigate the effect of cerium addition to alumina supported copper, cobalt and copper-cobalt oxides with low loadings on the catalysts efficiency in NO reduction with CO. We suggest that the combination of the supported metal oxides will lead to formation of active phases with physicochemical properties suitable for the studied reaction. The attention is also focused to varying the impregnation procedure in the ternary supported catalysts in order to determine the best catalyst as well as the reasons for the enhanced catalytic activity.

Ternary Co-Cu-Ce and binary Co-Ce, Cu-Ce and Cu-Co supported alumina were prepared and characterized by ICP, XRD, adsorption studies, XPS, H_2-TPR and catalytic investigations.

The ceria promoted alumina supported copper and cobalt catalysts with metal loadings up to 4 wt. % total metal are effective in reduction of NO with CO. The ternary supported samples are more active than the binary ones, where the catalyst prepared by simultaneous impregnation with the three active metals is the most active in the temperature range. The addition of cerium in the binary systems affects the activity at temperatures over 130^{o}C, whereas the activity of the ternary supported catalysts is enhanced even at room temperature. The higher activity of the ternary and the binary catalysts is determined by the favorable influence of the added cerium on the dispersion of the copper and cobalt active phases. The presence of ceria contributes the formation of appropriate active phases, resulting in catalytic sites on the surface of the samples that promote the reduction of NO with CO.