Co3O4 Supported on Different Supports for N2O Decomposition.

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2016

Co_3O_4 supported on different supports for N_2O decomposition

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Nitrous oxide (N_2O) is considered as an important pollutant contributing to a greenhouse effect and causing ozone layer depletion. The largest industrial sources of N_2O emissions are waste gases from nitric acid production plants. The low-temperature catalytic decomposition of N_2O (up to 450°C) to nitrogen and oxygen offers an attractive solution for decreasing of N_2O emissions in tail gas from nitric acid production plants. Important question is the choice of suitable catalytic system. Most of the studies mentioned in the literature were performed in laboratory scale in kinetic regime on the catalysts in the grain form. For industrial application, catalyst must be shaped in some way.

In this work Co_3O_4 catalysts supported on different kind of shaped supports (rings, quadrulobes) were prepared by incipient wetness impregnation method. As support materials commercial supports made of MgAl oxides, Al_2O_3 and TiO_2 were used. The catalysts were characterized by AAS, XRD, Raman, FTIR, SEM, H_2-TPR and nitrogen adsorption methods and tested for nitrous oxide decomposition. Influence of geometry and textural parameters on catalytic activity were evaluated by calculation of effectiveness factor. The influence of support composition on the obtained deN_2O catalytic activity is discussed. Samples deposited on support with a high content of Al_2O_3 (Al_2O_3 + 30 wt.% Mg) revealed lower catalytic activity for N_2O decomposition due to the negative influence of Al ions in Co_3O_4 lattice causing formation of hard reducible aluminates. The Co_3O_4 deposited on support with higher content of Mg (Al_2O_3 + 70 wt.% Mg) showed the highest catalytic activity due to favourable dissolution of Mg ions in Co_3O_4 lattice, which probably causes distortion of the spinel structure and thus enable higher oxygen desorption directly influencing N_2O decomposition activity.

This work was supported by the Czech Science Foundation (project no. 14-13750S) and by Ministry of Education, Youth and Sports of the Czech Republic in the National Feasibility Program I, project LO1208 "TEWEP" and by project of specific research SP2015/125.