METAL OXIDES AS CATALYSTS AND ADSORBENTS IN OZONE OXIDATION OF NITROGEN OXIDES

Kalev Erme, Indrek Jõgi

Institute of Physics, University of Tartu, W.Ostwaldi 1, 50411 Tartu, Estonia
e-mail: kalev.erme@ut.ee

NO_x (NO and NO_2) is an important group of pollutants emitted in fossil fuel burning and is a precursor for acid rain and smog. Most of the NO_x is emitted as NO, which is difficult to remove by purely absorption- or adsorption-based methods. A possible solution is to apply ozone injection to first oxidize NO to NO_2 and then further to N_2O_5 [1]. The latter process can be improved by the presence of metal oxides, which can act as both catalysts and adsorbents. The aim of the present study was to investigate the adsorption of NO_x on TiO_2, Fe_2O_3 and Al_2O_3 and to compare the catalytic properties of the materials.

NO in a mixture of N_2 and O_2, along with ozone produced in a dielectric barrier discharge reactor, was directed through a reaction chamber which contained the catalyst powder and was heated to 60-140 °C. The concentrations of gas-phase reaction products were measured by UV absorption and reactions on the catalyst surface were monitored by DRIFTS spectroscopy.

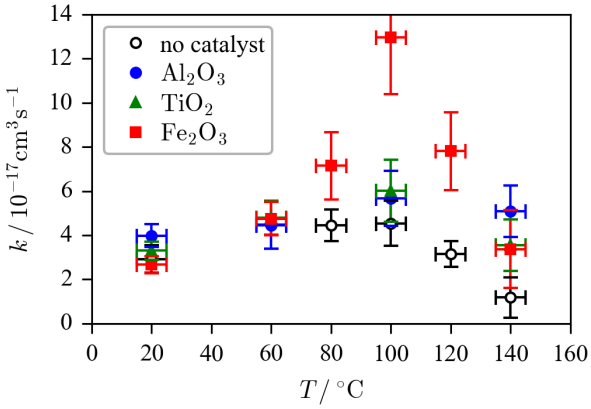

Fig.1. Dependence of the global rate coefficient of NO_x oxidation on temperature.

The addition of metal oxides improved the oxidation of NO_2 to N_2O_5. To compare the influence of different materials, the effective rate coefficient was calculated, which characterizes both gas-phase and surface processes. Fe_2O_3 had the largest effect, resulting in a nearly three-fold increase in the rate coefficient at 100 °C (Fig. 1). At the same time Fe_2O_3 had the lowest NO_x adsorption capacity. In case of all metal oxides, oxidation of NO to N_2O_5 caused an abrupt increase in adsorption of NO_x.

References

1. K. Skalska, J.S. Miller, S. Ledakowicz, 2010, *Science of the Total Environment*, 408, 3976–3989.

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