REMOVAL OF NITROGEN OXIDES WITH OZONE AND METAL OXIDES

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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 to remove NO_2 by further oxidation to N_2O_5 [1]. The latter process can be improved by the presence of metal oxides, which can act as both adsorbents and catalysts. 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.

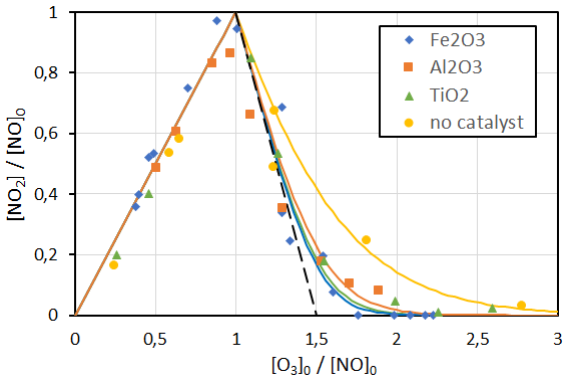

Fig.1. Normalized outlet concentration of NO_2 as a function of the inlet concentration of ozone.

200-800 ppm of NO in a mixture of N_2 and O_2 was directed through a reaction chamber at flow rate 1 L/min. The reaction chamber contained the catalyst powder and was heated to 60-140°C. Ozone was produced in a dielectric barrier discharge reactor and was directed through the reaction chamber. The concentrations of gas-phase reaction products were measured at the outlet of the reaction chamber by UV absorption spectroscopy.

TiO_2, Fe_2O_3 and Al_2O_3 exhibited similar tendencies in catalytic activity and adsorption, implying similar surface processes. All studied materials improved the oxidation of NO to N_2O_5, yielding comparable results in increasing the overall effective rate constant of oxidation. Investigation of adsorption of NO_x on the surface revealed a significant increase of adsorption capacity when NO_2 was oxidized to N_2O_5. The adsorption capacities of TiO_2 and Al_2O_3 were comparable while Fe_2O_3 had somewhat smaller adsorption.

References

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

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