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The heterogeneous Reactions of NO_2 and SO_2 with Soot in the Temperature Range of 200 K to 700 K

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Soot is produced during the combustion process of aircraft and automobile engines in conjunction with trace gases and water vapour. In the exhaust plume soot particles may act as condensation sites for condensable gases. Heterogeneous sinks of NO_2 and SO_2 on soot particles may alter the physical properties of the particles including their ability to act as condensation nuclei. In addition, by heterogeneous oxidation of these particles with NO_2 particle emissions from automobile engines can be reduced. Therefore, kinetic data of the interaction of trace gases with soot surfaces in an extended temperature range are of great interest.

In this presentation results of a study of the interaction of NO_2 and SO_2 with different types of soot in a temperature range between 200 K and 700 K are reported. The uptake kinetics were determined using a Knudsen flow reactor coupled to a quadrupole mass spectrometer. Condensed phase products have been analysed by means of DRIFT spectroscopy and ion chromatography. In the soot sample have been characterized by various methods including ESEM, TPD, BET.

The major findings can be summarized as follows: SO_2 adsorbs physically on the soot surface. In contrast, NO_2 reacts on the soot surface and forms NO and HONO as gas phase products. The ratio of NO and HONO formed increases with increasing temperature. The uptake coefficient of NO_2 on soot shows a complex temperature dependence which suggests a change in the reaction mechanism.