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Interaction of SO_2 with Mineral Dust Model Surfaces

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With a source strength of 2000 - 5000 Tg/year mineral dust represents one of the largest sources for global tropospheric aerosols. It is considered to be a potential sink of atmospheric sulfur compounds through heterogeneous reactions which, as a consequence, may lead to a significant change in the partitioning of atmospheric trace gases as well as an alteration of the physical and chemical properties of the aerosol particles.

In this presentation results of a study of the heterogeneous reaction of SO_2 with Fe_2O_3 as a model compound for atmospheric mineral aerosol are reported. The uptake kinetics were determined in a temperature range from 250 K to 600 K using a Knudsen flow reactor coupled to a quadrupole mass spectrometer. The reaction products in the condensed phase have been analysed by means of DRIFT spectroscopy and ion chromatography.

For the initial uptake coefficient of SO_2 on Fe_2O_3 a mean value of 0.06 has been determined, independent of temperature and sample mass. In the presence of water on the Fe_2O_3-surface a slight increase of uptake coefficient has been observed. At longer reaction times the uptake of SO_2 saturates completely and the amount of SO_2 taken up is determined by the mass of the Fe_2O_3 sample. SO_2 has been found to adsorb irreversibly on the surface forming mainly sulfite and, as a minor reaction product, sulfate. Possible reaction mechanisms will be discussed.