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Temperature and composition dependence of N_2O_5 uptake coefficients

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Nitrogen oxides play a central role in the chemistry of the atmosphere. Heterogeneous removal of N_2O_5 can be a major loss route for NOx with modelling work by Tie et al (2003) suggesting that, at high latitudes, N_2O_5 hydrolysis can reduce NOx levels by as much as 90 %.

The majority of laboratory studies of the heterogeneous uptake of N_2O_5 by aerosol particles have been performed at room temperature. At present, the role of temperature is the largest source of uncertainty in global loss rates. We are undertaking a series of laboratory measurements of the rate of removal of N_2O_5 by aerosol particles using a new apparatus capable of reaching temperatures relevant to the polar troposphere.

These complement our earlier measurements on sulfates (Hallquist et al., 2003) and sulfates mixed with high molecular weight organics (Badger et al., 2006).

The instrument has been developed in conjunction with Tapcon, Austria, and comprises a temperature-controlled atmospheric pressure aerosol flow tube and differential mobility analyser. The operating range of the instrument is 240-320 K, with control of relative humidity over the range 0-80%.

We present measurements of the uptake coefficient, γ, for loss of N_2O_5 made using the new apparatus, together with an analysis of the data in terms of particle composition, size and other parameters. The development of a kinetic model for uptake, employing explicit treatment of the coupled processes of reaction and diffusion in the aerosol particle will be described.