The adsorption of HO$_2$NO$_2$ on ice

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Nitrogen peroxides, such as peroxynitric acid (HO$_2$NO$_2$) act as reservoir for atmospheric NO$_x$ and HO$_x$ species and thus impact the oxidative capacity of the atmosphere. Mixing ratios of HO$_2$NO$_2$ in the range of 76 pptV have been measured in the upper troposphere. The presence of ice in cirrus clouds there may represent a major sink for HO$_2$NO$_2$, yet little is known about the partitioning to ice particles of this trace gas.

In this study, the partitioning of HO$_2$NO$_2$ between the atmosphere and ice was investigated by coated wall flow tube experiments in the temperature range of -45 °C to -20 °C. The detection was done with a chemical ionization mass spectrometer, using SF$_6$- as ionizing species, allowing for mixing ratios of HO$_2$NO$_2$ of around 2-3 ppbV during the experiments.

The temperature dependence of the equilibrium partitioning constant of HO$_2$NO$_2$ between air and ice was determined. The partitioning of HO$_2$NO$_2$ between air and ice is compared to the IUPAC recommendations for HNO$_3$; the partitioning coefficients of HO$_2$NO$_2$ were found to be orders of magnitude lower than the ones for HNO$_3$. The adsorption of HO$_2$NO$_2$ on ice proved to be fully reversible, as determined by desorption experiments. Further, the atmospheric implications are discussed.