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Uptake Co-efficient Studies of HO_2 Radicals with NaCl and $(NH_4)_2SO_4$ Aerosols under Atmospheric Conditions

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The atmospheric oxidising capacity determines the rate of removal of many atmospheric constituents, including pollutants and greenhouse gases such as methane. For most compounds, tropospheric degradation is initiated through reaction with the hydroxyl radical. OH is rapidly interconverted with hydroperoxy radicals HO_2 and organic peroxy radicals (e.g. CH_3O_2, referred to as RO_2 in general) through reaction with volatile organic compounds and nitrogen oxides; consequently loss of peroxy species affects atmospheric oxidising capacity. Model analyses have shown that heterogeneous loss of hydro- and organic peroxy radicals may significantly affect OH levels and hence factors such as pollutant degradation, ozone production and SOA formation - however these processes are poorly understood.

This work aims to increase our understanding of heterogeneous reactions between HO_2 radicals and aerosol; specifically the rate at which HO_2 is lost to aerosols particles. The rate and mechanism of this HO_2 loss process is highly uncertain at present and reducing this uncertainty will allow improved simulation of this process within atmospheric models.

We present new values of the mass accommodation co-efficient, α_{HO2}, and the uptake co-efficient,γ_{HO2}, for NaCl and $(NH_4)_2SO_4$ aqueous aerosols. Sodium chloride is used as a substitute for marine aerosols and ammonium sulphate as a substitute for an urban aerosol. A laboratory flow-tube system, mimicking tropospheric conditions, is used for determination of these values. Hydroperoxy radicals are produced by the photolysis of water vapour and detected using a PEroxy Radical Chemical Amplification (PERCA) technique, while aerosols are generated using a constant output atomiser and detected using a Scanning Mobility Particle Sizer (SMPS). The flow tube system allows variation of the radical aerosol contact distance, and hence time, allowing a rate of uptake, γ, to be determined. Mass accommodation, α, values are determined using aerosols doped with copper, which catalyses the reactions within the bulk of the aerosols, making the uptake of gas molecules into the condensed phase the rate determining step. The atmospheric implications of these results are discussed.