



Heterogeneous interaction of SiO₂ with N₂O₅: single particle optical levitation-Raman spectroscopy and aerosol flow tube studies

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The heterogeneous reaction of SiO₂ with N₂O₅ was investigated at room temperature and different relative humidities (RH). The uptake coefficient of N₂O₅ onto airborne sub-micrometre SiO₂ particles, $\gamma(\text{N}_2\text{O}_5)$, was measured using an atmospheric-pressure aerosol flow tube. $\gamma(\text{N}_2\text{O}_5)$ was measured to be $(4.8 \pm 0.4) \times 10^{-3}$ at 7% RH and $(3.5 \pm 0.5) \times 10^{-3}$ at 40%, probably suggesting a slightly negative dependence on RH.

In contrast, Raman spectroscopy measurements of the single particles during the exposure to N₂O₅ show that the amount of nitrate formed on the particles increases with RH, and that nitrate formed on the particles can be entirely removed when the RH is reduced to 0%. The results suggest that nitric acid formed in the heterogeneous hydrolysis of N₂O₅ on the SiO₂ surface can partition in both the gas phase and particulate phase, and the RH determines the partitioning. The atmospheric implications for photochemistry and aerosol aging processes will also be discussed.