



The heterogeneous reaction of NO_3 on laboratory flame soot.

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Uptake experiments of NO_3 on decane flame soot were carried out under continuous molecular flow conditions at $298 \pm 2\text{K}$ using the thermal decomposition of N_2O_5 as a NO_3 source. Two different types of soot were produced: soot originating from a rich flame at a high fuel/oxygen ratio ('grey' soot) and soot generated from a lean flame at a low fuel/oxygen ratio ('black' soot). In situ laser detection using Resonance Enhanced Multiphoton Ionization (REMPI) was used in addition to mass spectrometry in order to specifically detect NO_2 in the presence of N_2O_5 and NO_3 . At $[\text{NO}_3] = (2.7 \pm 1.0) \times 10^{11} \text{cm}^{-3}$ we found a steady state uptake coefficient γ_{ss} of (0.2 ± 0.02) for both types of soot with γ_{ss} decreasing as $[\text{NO}_3]$ increased. Adsorbed NO_3 led to an enhanced uptake of NO_2 compared to pure NO_2 uptake. For soot originating from a rich flame HONO is released at yields of up to 80 % on large quantities of soot and $[\text{NO}_3] = (2.3 \pm 0.5) \times 10^{12} \text{cm}^{-3}$ whereas no HONO was formed on soot originating from a lean flame. The HONO yield obtained from the source emitting a mixture of NO_2 and NO_3 at small $[\text{NO}_3]$ was smaller by a factor of two than pure NO_2 flow of comparable magnitude. For both grey and black soot we observed production of NO independent of the amount of soot present and of $[\text{NO}_3]$. The disappearance of NO_3 was in part accompanied by the formation of N_2O_5 according to $\text{NO}_3(\text{ads}) + \text{NO}_2(\text{g}) \rightarrow \text{N}_2\text{O}_5(\text{ads})$? $\text{N}_2\text{O}_5(\text{g})$ probably due to the presence of adsorbed NO_3 on the substrate.