Figure S1: Correlation plot of $C_{10}H_{16}O_2$ and $C_{20}H_{32}N_2O_8$. (inset) R^2 values for the comparison between $C_{10}H_{16}O_2$ and the series of $C_{20}H_{32}N_2O_x$ (x = 8 – 12).
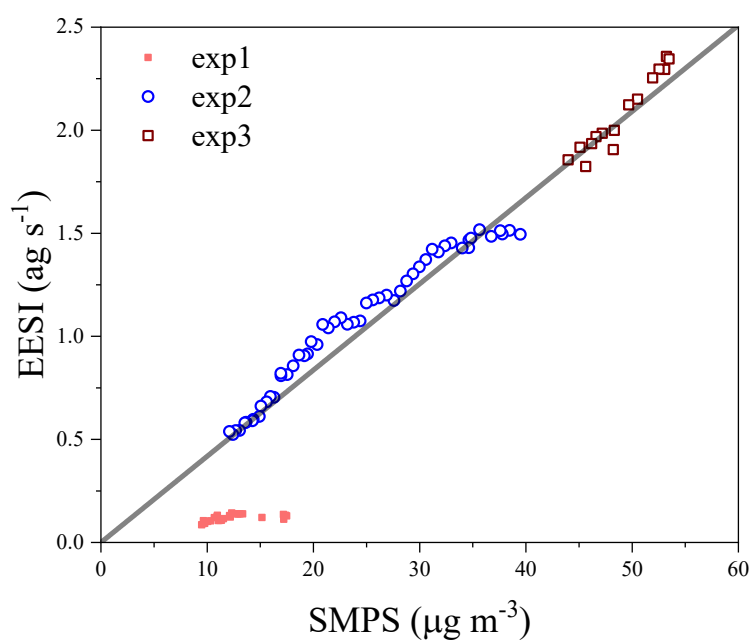
Figure S2: EESI mass flux compared to the measured SMPS mass for experiments 1 – 3, when the EESI was present. The total mass flux measured by the EESI is the ion signal (s⁻¹) converted to measured mass per second by scaling each molecular formula according to its mass.
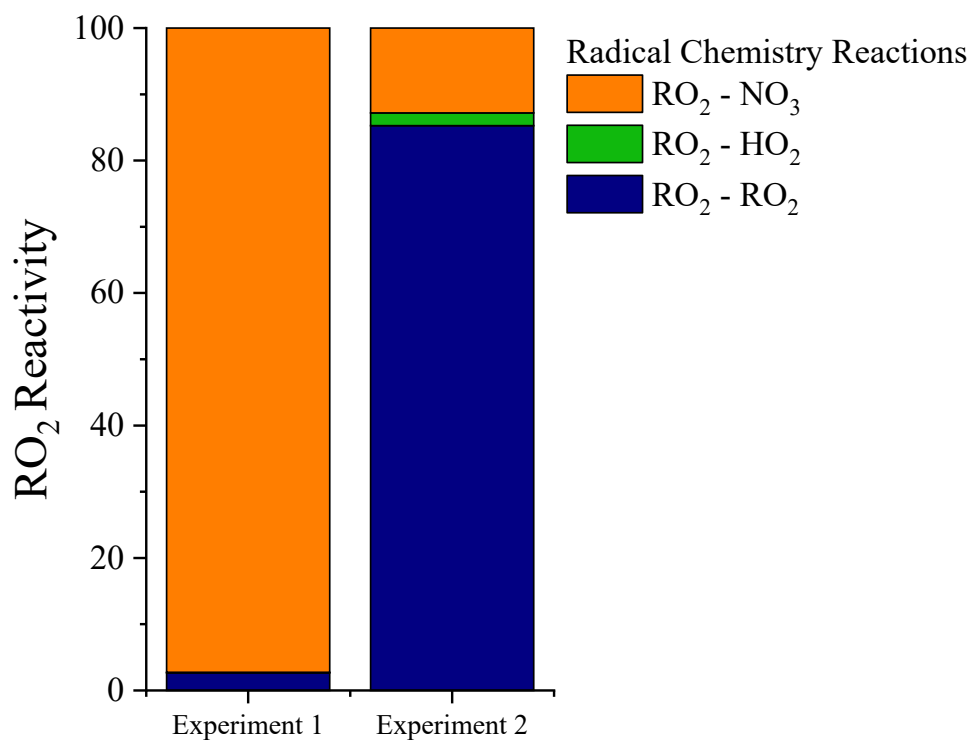
Figure S3: Integrated radical reactivity of RO_2 radicals in experiment 1 and experiment 2 modeled with the Master Chemical Mechanism (MCM) (Jenkin et al., 2003; Saunders et al., 2003). The absolute values will differ depending on the reaction rates of $RO_2 – RO_2$, but this provides insight into the reactions controlling the initial composition of the particle phase.
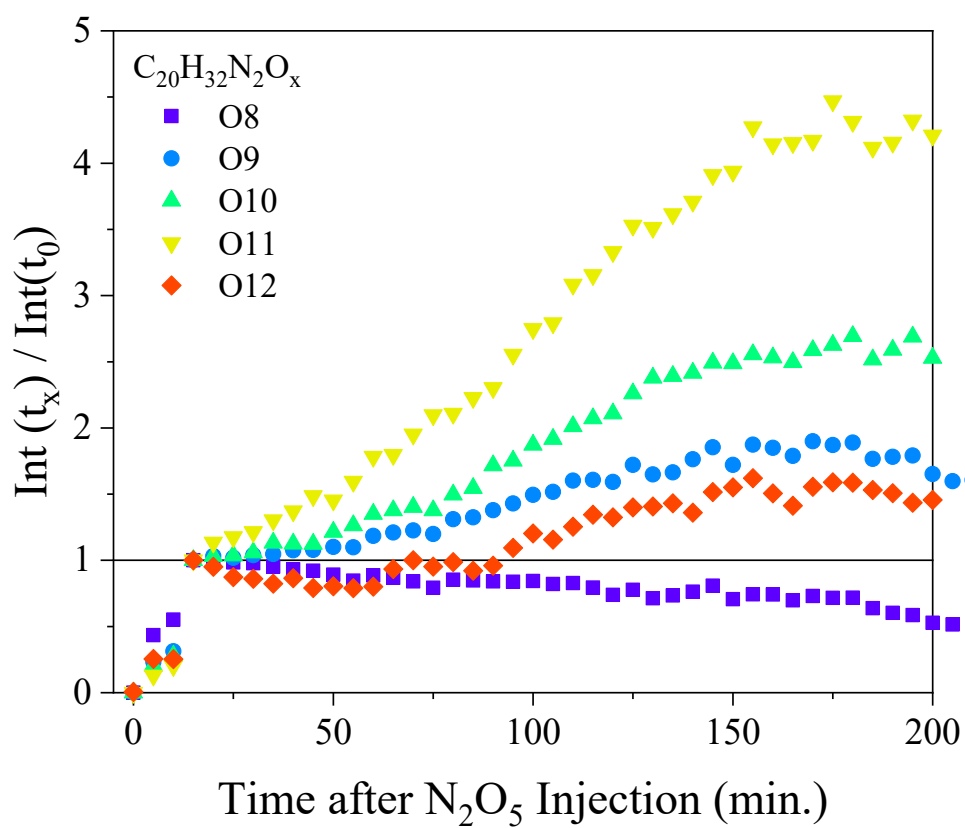
Figure S4: Normallized $C_{20}H_{32}N_2O_x$ dinitrate signals relative to t = 15 min mass from experiment 3. t = 15 min represents the maximum in particle mass, which is why this time was chosen.
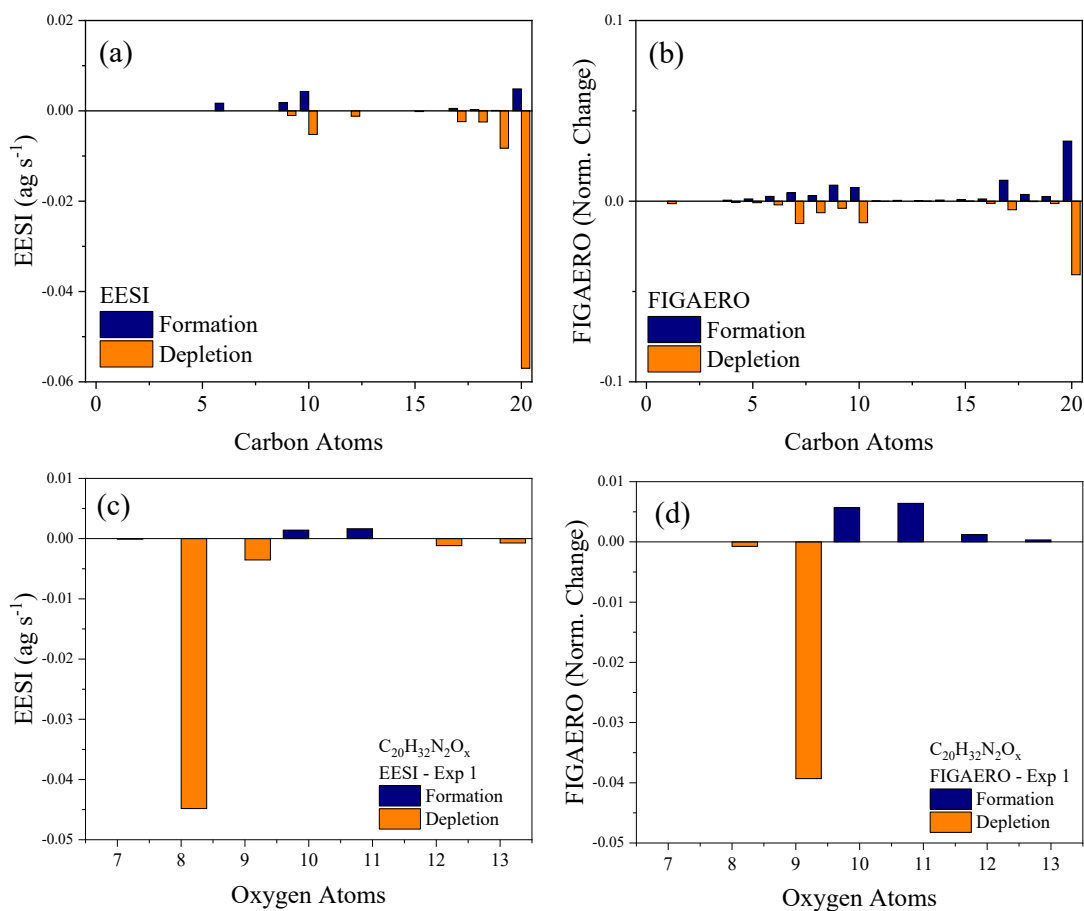
Figure S5: (a) and (b) Carbon distribution of the molecules formed (blue) and depleted (orange) in the particle phase during aging for both the EESI **(a)** and FIGAERO-CIMS **(b)**, respectively for exp 1. **(c & d)** The change in the oxygen distribution for the $C_{20}H_{32}N_2O_{8-13}$ molecules during dark aging for the EESI-ToF **(c)** and FIGAERO-CIMS **(d)**, respectively.
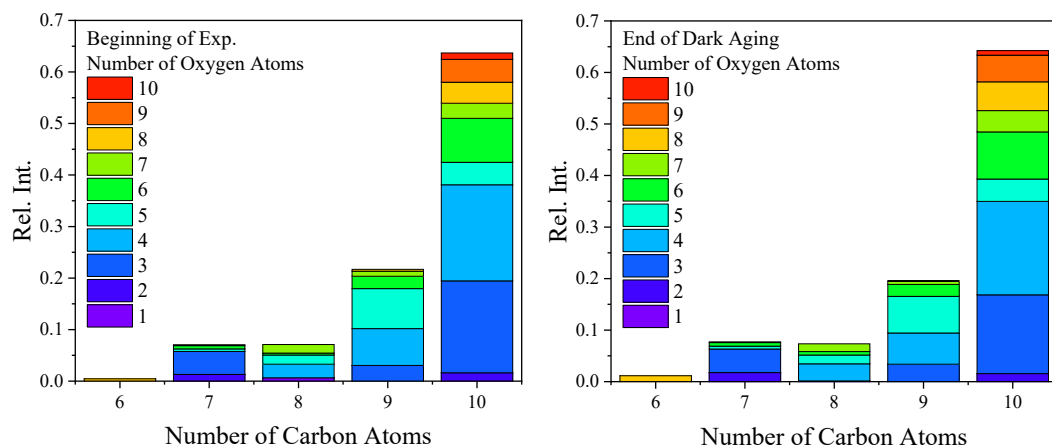
Figure S6: Monomer carbon and oxygen atom distribution for the beginning of the experiment t_{early} = 10 min and end of dark aging t = 240 min for exp 2.
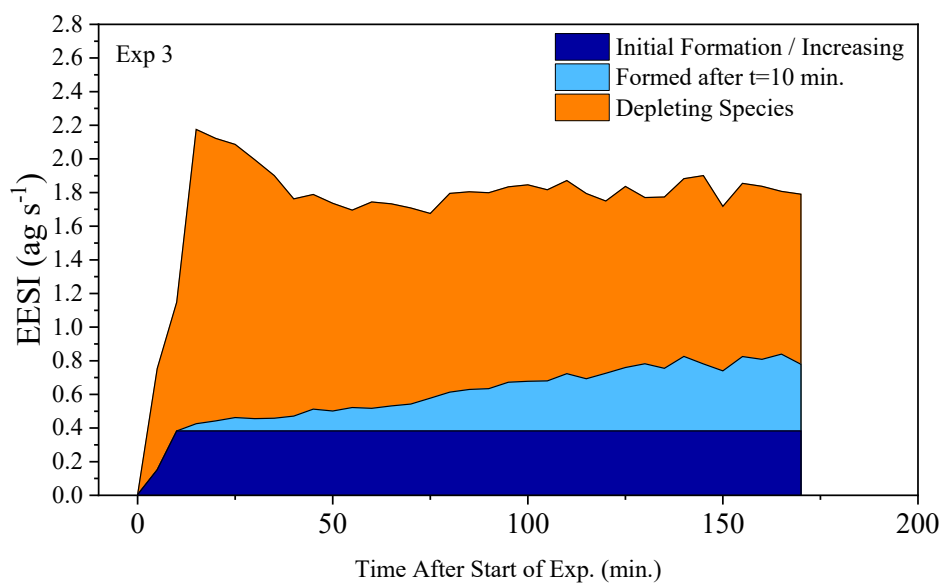
Figure S7: Total EESI-ToF intensity plotted as a function of the contribution from different sources, particle phase formation products determined from those molecular formula that increase during dark aging after t = 10 min, while those decreasing are shown in orange. The data is shown for experiment 3. The species forming in the dark are split into the dark blue (intensity at t = 15 min) and the fraction increasing after that time in light blue.
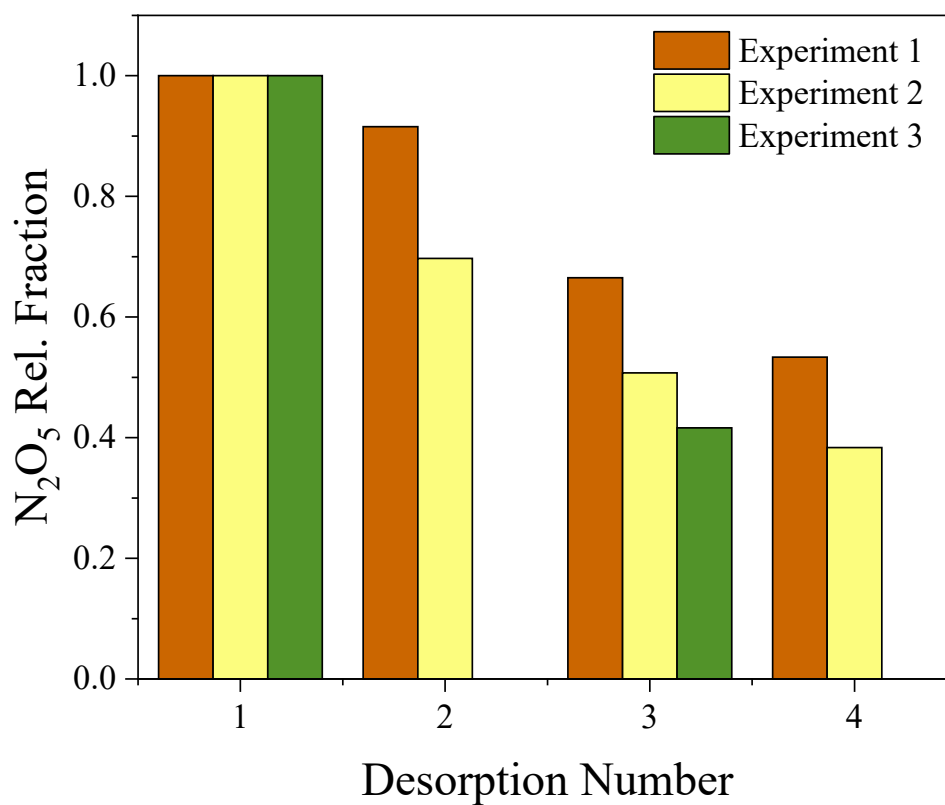
Figure S8: N_2O_5 particle phase relative fraction normalized to the initial desorption measured by the FIGAERO-CIMS. Estimated mass concentrations in the particle phase are $0.03 - 0.06$ µg m^{-3}. The time between each desorption was about 1-1.5h.

References:

Jenkin, M. E., Saunders, S. M., Wagner, V., and Pilling, M. J.: Protocol for the development of the Master Chemical Mechanism, MCM v3 (Part B): tropospheric degradation of aromatic volatile organic compounds, Atmos. Chem. Phys., 3, 181-193, 2003, 10.5194/acp-3-181-2003.

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