OH-initiated heterogeneous aging of highly oxidized organic aerosol

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The oxidative evolution ("aging") of organic species in the atmosphere is thought to have a major influence on the composition and properties of organic particulate matter, but remains poorly understood, particularly for the most oxidized fraction of the aerosol. Here we measure the kinetics and products of the heterogeneous oxidation of highly oxidized organic aerosol, with an aim of better constraining atmospheric aging processes of oxidized compounds, which are found primarily in the condensed phase. Submicron particles composed of model oxidized organics—1,2,3,4-butanetetracarboxylic acid ($C_8H_{10}O_8$), citric acid ($C_6H_8O_7$), tartaric acid ($C_4H_6O_6$), and Suwannee River fulvic acid—were oxidized by gas-phase OH in a flow reactor, and the masses and elemental composition of the particles were monitored as a function of OH exposure. In contrast to our previous studies of less-oxidized model systems (squalane, erythritol, and levoglucosan), particle mass did not decrease significantly with heterogeneous oxidation. Carbon content of the aerosol always decreased somewhat, but this mass loss was approximately balanced by an increase in oxygen content. The estimated reactive uptake coefficients of the reactions range from 0.37 to 0.51 and indicate that such transformations occur at rates corresponding to 1-2 weeks in the atmosphere, suggesting their importance in describing the atmospheric lifecycle of organic particulate matter.