



## **Effects of aerosol phase and water uptake for understanding organic aerosol oxidation**

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Oxidation reactions of atmospheric organic aerosols strongly influence many important processes in the atmosphere such as aerosol-cloud interactions or heterogeneous chemistry. We present results of an experimental laboratory study with three organic model aerosol systems (maleic, arachidonic and oleic acid) investigating the effect of particle phase and humidity on the oxidative processing of the particle. Two experimental techniques are combined in this investigation. An electrodynamic balance is used to levitate single particles and assess changes in particle size and mass (due to water uptake and/or loss of volatile oxidation products) and phase (liquid or solid) during and after chemical processing with ozone. An aerosol flow tube was used to investigate the detailed chemical composition of the oxidized aerosol with offline ultra-high resolution mass spectrometry. The role of water (i.e. relative humidity) in the oxidation scheme of the three carboxylic acids is very compound specific and the particle phase has a strong effect on the particle processing. Relative humidity was observed to have a major influence on the oxidation scheme of maleic acid and arachidonic acid, whereas no dependence was observed for the oxidation of oleic acid. In both, maleic acid and arachidonic acid, an evaporation of volatile oxidation products could only be observed when the particle was exposed to high relative humidities. Maleic and arachidonic acid change their phase from liquid to solid upon oxidation or upon changes in humidity and efficient oxidative processing of the particle bulk can only occur when the particle is in liquid form. A detailed oxidation mechanism for maleic acid is presented taking the strong effects of water into account. In contrast, oleic acid is liquid under all conditions at room temperature (dry or elevated humidity, pure or oxidized particle). Thus ozone can easily diffuse into the bulk of the particle irrespective of the oxidation conditions. In addition, water does not influence the oxidation reactions of oleic acid particles, which is partly explained by the structure of oxidation intermediates. The very low water solubility of oleic acid and its ozonolysis products also limits the effect of water. The potential relevance of these three model systems to mimic ambient atmospheric processes is discussed.