

## Microphysical Properties of Single Secondary Organic Aerosol (SOA) Particles

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Secondary Organic Aerosols (SOA) deriving from the oxidation of volatile organic compounds (VOCs) can account for a substantial fraction of the overall atmospheric aerosol mass.[1] Therefore, the investigation of SOA microphysical properties is crucial to better comprehend their role in the atmospheric processes they are involved in. This work describes a single particle approach to accurately characterise the hygroscopic response, the optical properties and the gas-particle partitioning kinetics of water and semivolatile components for laboratory generated SOA.

SOA was generated from the oxidation of different VOCs precursors (e.g.  $\alpha$ -pinene, toluene) in a photochemical flow reactor, which consists of a temperature and relative humidity controlled 300 L polyvinyl fluoride bag. Known VOC,  $\text{NO}_x$  and ozone concentrations are introduced in the chamber and UV irradiation is performed by means of a Hg pen-ray. SOA samples were collected with an electrical low pressure impactor, wrapped in aluminium foil and kept refrigerated at  $-20^\circ\text{C}$ .

SOA samples were extracted in a 1:1 water/methanol mixture. Single charged SOA particles were generated from the obtained solution using a microdispenser and confined within an electrodynamic balance (EDB), where they sit in a T (250-320 K) and RH (0-95%) controlled nitrogen flow. Suspended droplets are irradiated with a 532 nm laser and the evolving angularly resolved scattered light is used to keep track of changes in droplet size. One of the key features of this experimental approach is that very little SOA solution is required because of the small volumes needed to load the dispensers ( $<20 \mu\text{L}$ ).

A number of diverse experiments were performed in order to characterise different microphysical properties of SOA. The equilibrium hygroscopic response of SOA was determined with comparative evaporation kinetics experiments (CK-EDB) of suspended probe and sample droplets.[2] The variation of the refractive index of SOA droplets following to water or SVOCs evaporative loss was measured as a function of water activity by fitting the collected light scattering patterns with a generated Mie-Theory library of phase functions.[3] Long trapping experiments (up to  $>20000$  s) allow the observation of slow SVOCs evaporation kinetics at different T and RH conditions. Water condensation/evaporation kinetics experiments onto/from trapped SOA droplets following fast RH step changes ( $<0.5$  s) were also performed in order to evaluate possible kinetics limitations to water diffusion in the condensed phase resulting from the formation of a viscous matrix.

[1] Fuzzi et al., Atmos. Chem. Phys. 15, 8217–8299 (2015). [2] Rovelli et al., J. Phys. Chem. A 120, 4376–4388 (2016). [3] Cotterell et al., Phys. Chem. Chem. Phys. 17, 15843–15856 (2015).