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Interactions between SOA-like droplets and water vapor using acoustic levitation

CLARA BECOTE[1], GWENDOLINE BOURDON[1,2], PIERRE-MARIE FLAUD[2], EMILIE PERRAUDIN[2], ERIC VILLENAVE[2] AND SOPHIE SOBANSKA[1]

[1]Institut des Sciences Moléculaires, UMR CNRS 5255, Univ. Bordeaux

[2]Univ. Bordeaux, CNRS, EPOC, UMR 5805

Presenting Author: clara.becote@u-bordeaux.fr

Atmospheric aerosols are well known to impact both air quality and climate change. [1] Through absorbing and evaporating water, aerosols can act as CCN, and induce cloud formation thus affecting the Earth radiative budget. Moreover, the liquid water content of aerosols, which varies with the relative humidity (RH) of the surrounding gas phase, governs phase transitions, liquid-gas partitioning, trace gas uptakes, aqueous phase reactions, and particle microphysical properties as well. Surface properties of atmospheric particles such as surface tension can directly affect interactions of a particle with the water vapor and hence its activation into cloud droplet.[2,3] However, the complexity of aerosol aging processes occurring at the gas/particle interface is not well described. Recent developments using single particle approaches allow studying various chemical aging processes, and microphysical properties at the particle scale. [4,5] In this context, we have investigated the evaporation processes and hygroscopicity properties of individual particles composed of mixtures of MBTCA (3-methylbutane-1,2,3-tricarboxylic acid) and inorganic salts using an acoustic levitator coupled with optical camera and Raman microspectrometer. Complementary, the surface tension of these single droplets were examined using atomic force microscopy (AFM) to better understand evaporation and hygroscopic processes of droplets. Experimental results were compared with thermodynamic models as the d^2-law and Köhler-based theories.[6,7] The results obtained confirm the influence of the chemical complexity of aerosols on their water-related properties that directly, and indirectly influence climate change at the global level.

References

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