# Discontinuous hygroscopic growth of a mixed organic/inorganic aerosol particle levitated in an electrodynamic balance

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The organic fraction is usually internally mixed with inorganic salts within the particles so the phases of the aerosol will be influenced by both mixing the organic substances with each other and mixing between organic and inorganic constituents (Marcolli et al., 2004) in an aqueous aerosol particle. When a liquid-liquid phase separation occurs, the inorganic salt is redistributed between the water-rich-phase and the organic-rich-phase according to the solubility. If the organic substance is a surfactant, it will lower the surface tension. In addition aggregates of the organic monomers, called micelles, may be formed if the concentration of the organic exceeds a certain limit (critical micelle concentration).

In our experiment an electrically charged particle is levitated in an electrodynamic balance (EDB) which is equipped with various spectroscopic light scattering instruments to analyze the particle's physical state, composition and mass (Zardini et al., 2006). We performed measurements using ternary aqueous solution particles consisting of tetraethylene glycol monooctyl ether ($CH_3(CH_2)_7(OCH_2CH_2)_4OH$ or $C_8E_4$) as organic surfactant and sodium chloride (NaCl) as inorganic salt at different temperatures and compositions.

Mie resonance spectra show discontinuous growth with increasing relative humidity at a temperature and relative humidity at which the salt is completely deliquesced and the concentration of the organic surfactant is larger than the critical micelle concentration. We speculate that this discontinuous, step-like, growth is caused by disaggregation of a micelle needed to conserve the monolayer of surfactant molecules on the aqueous aerosol particle surface upon growing. Thus, the number of molecules of the disaggregating micelle can be deduced using the polar surface area of a $C_8E_4$ molecule (57.2 $Å^2$) and the surface area increase of the aerosol particle calculated from the step increase of the radius. This leads to an aggregation of about $10^5$ molecules, which might be due to high salt concentration of the particle, since we did not observe the discontinuous growth with binary $C_8E_4$/water particles.

**References:**

(1) Marcolli, C., and Krieger, U.K., "Phase changes during hygroscopic cycles of mixed organic/inorganic model systems of tropospheric aerosols", *J. Phys. Chem. A* 110, 1881-1893 (2006).

(2) Zardini, A.A., Krieger, U.K., and Marcolli, C., "White light Mie resonance spectroscopy used to measure very low vapor pressures of substances in aqueous solution aerosol particles, *Optics Express* 14, 6951-6962 (2006).