Spectro-microscopy of Atmospheric Particles: Viscocity

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Understanding the phase (liquid-semisolid-solid) of atmospheric aerosols is critical for modeling their atmsopheric aging. The higher the aerosol viscocity, the slower diffusion of products and reactants throughout the aerosols, resulting in a surface composition significantly different than the interior of the aerosol.

To explore aerosol phase, we examine field collected aerosols and laboratory generated secondary organic aerosols (SOA) using a variety of microscopic and spectroscopic techniques. The phase state of ambient particles were determined from measurements of their size and optical density. A comparison is made between the observed phase states of ambient samples collected uring field campaigns in Northa and South America and laboratory samples. The objective is to determine how well the laboratory samples respresent the phase of ambient samples. The optical density is measured using scanning transmission x-ray microscopy/near edge x-ray absorption structure spectroscopy at the carbon edge. The optical density is then plotted versus particle area equivalent diameter. High viscocity/surface tension particles will flatten less upon impaction than less viscous particles, resulting in a steeper slope. The results from five field campaigns show that these field collected particles deform less (are more viscous) upon impaction than the laboratory generated SOA. Additionally, in spite of the wide range of sample collection sites, the ambient particles had, on average, very similar extents of deformation. Current work is examining the effects of the presense of sulfur on the phase state and developing new measurements of viscosity changes as a function of relative humidity.