Direct measurement of the viscosity of surrogates of atmospheric organic aerosol

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The viscosity (η) is an important and fundamental property to characterize to classify the phase behaviour of organic aerosols. The viscosity of an atmospheric aerosol can influence many particle properties such as mass transfer, morphologies, particle reactivity, composition, and aerosol removal processes.

The aim of this research is to measure the viscosity of proxy organic atmospheric aerosol. Arrange of organic compounds are considered in this study as surrogates for atmospheric secondary organic aerosol components such as disaccharides, diol, triol, and tetraol groups. The viscosity can be inferred from measurements of the binary coalescence process between two trapped aerosol particles using holographic optical tweezers (HOT) which coupled with Raman spectroscopy. The timescale of coalescence is measured by combining three techniques: light scattering, brightfield imaging, and cavity enhanced Raman spectroscopy. The three methods cover with a viscosity range of 12 orders of magnitude (10^{-3} to 10^{9} Pa s) [1]. During measurement, particle size and refractive index of a trapped droplet is determined from the unique fingerprint of whispering gallery modes (WGMs) appearing in the cavity-enhanced Raman spectrum [2].

In this study, we investigate the dependence on RH of viscosity model systems reporting the dependence on compound structure, molecular weight, and the number of OH.

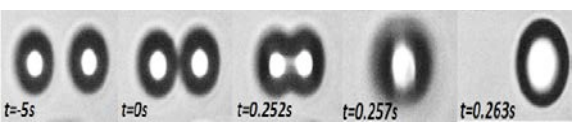

Figure 1. The binary coalescence process. The final radius is 6.2um and their viscosity is 105.79 Pa.s.

[1]Power, R. M., & Reid, J. P., (2014) Rep. Prog. Phys. 77, 1-27 [2] Preston, T. C. & Reid, J. P. (2013), J. Opt. Soc. Am. B 30, 2113-2122.