

Interactive comment on “Viscosity of erythritol and erythritol-water particles as a function of water activity: new results and an intercomparison of techniques for measuring the viscosity of particles” by Yangxi Chu et al.

Anonymous Referee #1

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Review of manuscript “Viscosity of erythritol and erythritol-water particles as a function of water activity: new results and an intercomparison of techniques for measuring the viscosity of particles” by Chu et al.

The authors report on new measurement of the viscosity of aqueous erythritol particles at different RH. One set of data is obtained by utilizing the rFRAP technique yielding the diffusivity of a large dye molecule and using the Stokes Einstein relationship to estimate viscosity; the other data are obtained by analyzing the shape relaxation of two particles coalescing in an optical tweezer setup. The two methods as well as

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previous bead mobility data agree within error. The new data are used to update a previous parametrization on how the addition of an OH functional group to a linear C4 carbon backbone effects viscosity.

This is a paper well suited for publication in AMT as we need more intercomparison between different measurement techniques to obtain particle viscosity data in the high viscosity range to get a better understanding on the limitations of the different techniques. The paper is well written, the figures illustrate the results adequately and the discussion is based on the experimental findings. I recommend publishing the paper, but ask the authors to consider the following comments.

In section 3.2. the authors explain why they consider previous tweezers measurements compromised. They write this is due to the limited time resolution of the Raman spectroscopy method (being about 1 s). Since this being a technical paper, the reader would greatly benefit from seeing the corresponding “raw” data together with the raw brightfield imaging data versus time. I assume one would then appreciate that the transition to a spherical particle after coalescence is happening on a timescale to fast to be resolved with the Raman method.

In the introduction, it is written that viscosity has implications for predicting size and mass distribution of SOA particles as well as implications for long-range transport of pollutants. I feel it should be made more clear, that it is the diffusivity of a certain molecule in the viscous matrix which is the primary parameter needed for prediction not the viscosity as such. As the authors point out correctly, the Stokes-Einstein relation may fail for small molecules, but of course helps to estimate diffusivities.

Technical comments:

Line 184: It might help to put the normalization factor into eq. (2) to see what is exactly meant by normalization.

Line 337 onwards: I do not understand this regression. As the viscosity of pure water is

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precisely known and an exponential dependence of viscosity with viscosity is assumed for the regression there is only one free parameter, namely the slope in Fig.8. The intercept follows from slope and the value of pure water. Of course, this leads to an uncertainty for the viscosity for the pure erythritol.

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