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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Changing shapes and implied viscosities of suspended submicron particles" *by* Y. Zhang et al.

Anonymous Referee #2

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Zhang et al. introduce a new experimental approach to estimate viscosities of suspended SOA particles. It is based on particle coagulation leading to dimer, trimer and higher-order agglomerates of non-spherical shape which eventually through plastic flow form spherical particles. The time needed to change shape is closely connected to viscosity allowing to retrieve RH dependent viscosity. In particular the technique can be used in situ which avoids some of the uncertainties of other techniques. This is a very nice piece of work, the paper is well written and the conclusions are supported by experiment. I recommend it for publication in ACP but ask the authors to take the following considerations into account.

Sec. 1 Introduction: I feel it may help to put some of the material now in section 3.4 already into the introduction. It is not clear to a reader not well acquainted with the

topic that the parameter most important for atmospheric implications is actually the diffusivity and that viscosity most often serves only to determine diffusivity and from that characteristic mixing times. In this context I feel the work of Abramson et al. cited on the top of page 6824 need to be singled out and discussed in more detail, since they first measure not viscosity but directly a diffusion constant and second do that also without removal from the aerosol suspension.

Page 6824, line 13: add Zobrist et al. 2011 (already in the list of references) to the citations as they determine water diffusivity as do Price et al.

Page 6825, paragraph starting from line 4: Again I feel the Abramson et al. study should be mentioned here, because it uses suspended aerosol as well and retrieve directly diffusion constants.

Page 6827, line 20: Could you please briefly discuss whether the high concentrations used my lead to SOM not entirely representative of atmospheric SOM?

Page 6830, line 23: I would expect a size dependence of the RH at fixed exposure time to elevated RH. This seems not obvious in the data of Fig. 4a. Could you please discuss this?

Page 6833, line 22: Please cite the source of the diffusion coefficient of water in alpha-pinene SOM.

Page 6834, line 16: it would be worthwhile to discuss the caveats! May be a short discussion of the results of Power et al.?

Figure 4: What are the lines plotted in both panels? If these are fits, please explain. Otherwise write "to guide the eyes" or similar.

Technical correction: Page 6836: The section starting from line 7: For low and . . . is repeated at the last paragraph on the same page.

References: Abramson, E., Imre, D., Beranek, J., Wilson, J., and Zelenyuk, A.: Experimental determinationof chemical diffusion within secondary organic aerosol particles, Phys. Chem. Chem. Phys., 15, 2983–2991, 2013.

Zobrist, B., Soonsin, V., Luo, B. P., Krieger, U. K., Marcolli, C., Peter, T., and Koop, T.: Ultra-slow water diffusion in aqueous sucrose glasses, Phys. Chem. Chem. Phys., 13, 3514–3526, 2011.

Power, R. M., Simpson, S. H., Reid, J. P., and Hudson, A. J.: The transition from liquid to solid-like behaviour in ultrahigh viscosity aerosol particles, Chem. Sci., 4, 2597–2604, 2013.

Price, H. C., Murray, B. J., Mattsson, J., O'Sullivan, D., Wilson, T. W., Baustian, K. J., and Benning, L. G.: Quantifying water diusion in high-viscosity and glassy aqueous solutions using a Raman isotope tracer method, Atmos. Chem. Phys., 14, 3817–3830, 2014.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 6821, 2015.