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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of particle phase state on the hygroscopic behavior of mixed organic–inorganic aerosols" *by* N. Hodas et al.

Anonymous Referee #1

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General comments:

The phase behavior, the hygroscopicity, and viscosity of atmospheric aerosols are important to understand the processes in the atmosphere. More studies on these properties of aerosols have been conducted in the recent few years. However, current studies are still limited. This manuscript investigated the phase behavior and hygroscopicity of selected mixed organic-ammonium sulfate aerosols by measuring the water uptake growth. They also used models to predict the water uptake growth for these mixed systems. This study adds to the understanding of hygroscopicity and phase behavior of particles, especially for the submicron size range. This paper is well written, and results are clearly presented. I have a few minor comments the authors should consider before the final publication.

Specific comments:

In the section 3.1.1, the authors discussed possible reasons why AIOMFAC model predicted RH values at which two-phases merge into one phase are higher than the RH values reported in You et al. (2013). I agree with these two possible reasons. And I am curious if there is any hysteresis in these phase separation-phase merging processes in these two investigated systems. In the You et al. all the results were from experiments when RH decreased from high to low values. In AIOMFAC prediction in this study, RH increased from low to high values. It may be useful to think about it using the phase diagrams, such as phase diagrams in Song et al. (2012a). I think the hysteresis may depend on different mixed organic-inorganic salt systems.

Page 32939, line 26: I suggest you could add the following two papers as references to here, because these two studies investigated samples from ambient environment and could support your statement here. Y. You, L. Renbaum-Wolff, M. Carreras-Sospedra, S.J. Hanna, N. Hiranuma, S. Kamal, M.L. Smith, X.L. Zhang, R.J. Weber, J.E. Shilling, D. Dabdub, S.T. Martin, and A.K. Bertram, P. Natl. Acad. Sci. USA 109, 13188 (2012). C. Pöhlker, K.T. Wiedemann, B. Sinha, M. Shiraiwa, S.S. Gunthe, M. Smith, H. Su, P. Artaxo, Q. Chen, Y.F. Cheng, W. Elbert, M.K. Gilles, A.L.D. Kilcoyne, R.C. Moffet, M. Weigand, S.T. Martin, U. Pöschl, and M.O. Andreae, Science 337, 1075 (2012).

Page 32948, line 16. in Bertram et al 2011, particles containing citric acid mixed with ammonium sulfate were also studied and no LLPS was observed, so you may also want to add it to here as a reference.

Page 32952, second paragraph: the results in Figure 3c, the measurements, and dashed line (AIOMAC+dehydration), are also consistent with recent experiemental results in You and Bertram (2014). LLPS was not observed in particles containing sucrose mixed with ammonium sulfate (mass ratio = 2:1). Y. You and A. K. Bertram. Effects of molecular weight and temperature on liquid–liquid phase separation in particles containing organic species and ammonium sulfate. Atmos. Chem. Phys. Discuss.,

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14, 23341-23373, 2014

Table 1, for the last row, You and Bertram (2014) (mentioned above) also studied the LLPS of particles containing sucrose mixed with ammonium sulfate, dry mass ratio 2:1, and no LLPS was observed, so you may want to add this to here as well.

Technical corrections:

Page 32943 line 5: microscope is more accurate than telescope

Page 32943, line 22: Could you please write out the glass transition temperature of sucrose here, so readers can directly know it when reading.

Page 32954 line 5: it should be You et al. 2013, not 2012 Table 1, for the first three rows, the reference should be You et al. 2013, not 2012

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 32935, 2014.