

This manuscript describes the phase state of ambient organic dominated particles in the Southeast US during the SOAS campaign. The phase state is using the aerosol bounce technique. The phase state was measured concurrently with hygroscopicity measurements using a HTDMA and chemical composition using an AMS. The ambient particles are further aged using an oxidation flow reactor and the phase state observed. The manuscript is well-written and I support publication in ACP after the following comments are addressed.

Comments:

- 1) The authors mention that the most interesting effects on phase state occur between 30 -70% RH (for isoprene). However, 75% of the time the ambient RH was above 70% RH. Therefore, the authors are not measuring the ambient phase state of the particles. How can the authors state that at ambient RH the particles will be liquid, if these measurements were never made?
- 2) The data in Figure 3 do not reach zero. Again, how can the authors state that the ambient particles are liquid, if they are bouncing during impaction?
- 3) How can the authors rule out the possibility of two particle types, one solid phase (bouncing) and one liquid phase (sticking) vs. one particle type of intermediate phase (50% bouncing)?
- 4) Page 4 line 25-27: This range and phase transition is true only for a homogeneous distribution. How do the authors know this is the case in the ambient? Bateman et al., 2015 published a relationship between viscosity of sucrose particles and bounce fraction.
- 5) Page 11 line 10-12: Any correlation with the AMS collection efficiency? Was the collection efficiency on the same order predicted by the bounce fraction? Why or Why not?

Minor Comments:

- 1) Page 2 Line 24 -26: Perhaps Shrivasta et al. 2013 and Zaveri et al. 2014 or Scott et al 2015 have used this in their modeling. If not, they might have 2015 or 2016 papers in which these effects are included.
- 2) Page 3 line 5: I believe Bateman et al. 2016 used terms such as liquid particles dominate, but they are not “always” liquid.
- 3) Page 4 line 11: Is eight seconds enough time for kinetically limited particle to uptake water? Berkemier has some calculations and timescales for this.
- 4) Page 4 lines 19 – 21: I have no idea what this means? What do the RH sensors and the CPC offsets have to do with each other? Please clarify this sentence.
- 5) Page 5 line 29-20: how many points were lost from this analysis? How was the external mixture determined?

6) Page 6 Equations 2 – 4: How much will uncertainties in the calculation of these quantities effect the conclusion the authors draw? The authors should comment on this in the manuscript.
Technical Correction:

1) Page 3 line 16: “physical phase state” remove either physical or phase

2) Page 11 line 11: replace bounciness with a term that describes physical state i.e. viscosity, semi-solidness

- 1 Bateman, A. P., Bertram, A. K. & Martin, S. T. Hygroscopic influence on the semisolid-to-liquid transition of secondary organic materials. *J. Phys. Chem. A* **119**, 4386-4395 (2015).
- 2 Scott, C. E. *et al.* Impact of gas-to-particle partitioning approaches on the simulated radiative effects of biogenic secondary organic aerosol. *Atmos. Chem. Phys.* **15**, 12989-13001 (2015).
- 3 Shrivastava, M. *et al.* Implications of low volatility soa and gas-phase fragmentation reactions on soa loadings and their spatial and temporal evolution in the atmosphere. *J. Geophys. Res. Atmos.* **118**, 3328-3342 (2013).
- 4 Zaveri, R. A., Easter, R. C., Shilling, J. E. & Seinfeld, J. H. Modeling kinetic partitioning of secondary organic aerosol and size distribution dynamics: Representing effects of volatility, phase state, and particle-phase reaction. *Atmos. Chem. Phys.* **14**, 5153-5181 (2014).