

Atmos. Chem. Phys. Discuss., referee comment RC2
<https://doi.org/10.5194/acp-2021-105-RC2>, 2021
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Comment on acp-2021-105

Anonymous Referee #2

Referee comment on "Phase state of secondary organic aerosol in chamber photo-oxidation of mixed precursors" by Yu Wang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-105-RC2>, 2021

The manuscript by Wang et al. reports particle rebound fractions (as a measure of particle phase states) measured for SOA particles produced from the photooxidation of single and binary VOC precursors in an environmental chamber. Compared to previous studies mainly focusing on organic aerosols, this study also examined the role of ammonium sulfate seed particles by varying the organic-to-inorganic mass ratio. The authors found that particle phase states to the first order depend on the RH and organic-inorganic ratio, while the VOC precursor type plays a relatively minor role. The experiments were carefully designed and executed. The paper was well written. However, I do have a few comments that need to be addressed before I can recommend publication.

- The authors claim *o*-cresol as a representative anthropogenic SOA precursor. The manuscript explains that the *o*-cresol was chosen mainly because of its OH reactivity similar to the biogenic precursors and its modest SOA yield. However, a major source of *o*-cresol can be biomass burning, either from manmade or natural sources. This is not discussed in the manuscript and I think it can be misleading to simply claim that *o*-cresol is anthropogenic.
- The presence of inorganic species can significantly alter the rebound curve, and the composition and O:C of organic species play a relatively minor role. I wonder if it is possible to develop a simple mixing rule to predict the liquid-to-nonliquid phase transition? For example, is the transition RH related to liquid water content or hygroscopic growth factor?
- Line 104-105: some studies do find that alpha-pinene SOA coating can influence the deliquescence of ammonium sulfate, although the effect is relatively smaller than isoprene SOA:

<https://www.tandfonline.com/doi/full/10.1080/02786826.2010.532178>

<https://acp.copernicus.org/articles/12/9613/2012/acp-12-9613-2012.pdf>

4. Were the rebound measurements performed for monodisperse or polydisperse aerosol particles? If polydisperse, were there particles smaller than the cutoff diameter of the impactor? This information might be provided in the literature cited in this paper, but it would be nice to briefly describe it here as well.