

Comment on acp-2021-105

Anonymous Referee #1

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-RC1>, 2021

The authors presented laboratory results of phase behaviour of secondary organic aerosol (SOA) mixed with ammonium sulphate seed particles using smog-chamber experiments and particle bouncing measurements. The key novelty about this study is the usage of "iso-reactive" (see below for a question on this) single- or mixed-precursor volatile organic compounds (VOCs) from both biogenic and anthropogenic sources, while the two hypotheses (RH rules and MR_{org}/inorg dominates) tested are actually well established. The results confirmed the vital role of RH and the dominating effect of the fraction of organics in the aerosol particles in the changes of phase behavior, while also suggested a second-order role of SOA composition (whether it is anthropogenic or biogenic, but not very much related to O:C ratio) when MR_{org}/inorg is close to unity. The experiments of this study were carefully designed and data well interpreted, in support of the conclusions made. The manuscript is also fairly well written. I have a few comments for the authors to clarify, and recommend a Minor Revision before publication.

- "iso-reactive": I assume that this term is referring to a similar reactivity towards a certain oxidant for the VOCs or mixtures chosen (Table 1). The question is, what is the dominating oxidant in the chamber experiments? OH radicals or O₃? Or a mixture of them? If it is the mixture, is it a combined reactivity that makes them "iso-reactive"? Please clarify.

- About AMS results: a) the authors used O:C and H:C ratios and specific ion signals of NO^+ and NO_2^+ in their analysis, but indicated that only V-mode data were available from AMS measurements (L188). How were those data on elemental ratios and specific ion peaks obtained? Approximated from empirical formulas or high-res fitting on V-mode data? b) L192: how is this ionization efficiency defined here? If it is the number of ammonium nitrate molecules ionized per number of ammonium nitrate molecules introduced, it should be a number much lower than 1. c) 196: please specify on what is "real-time" collection efficiency.

- Some minor comments:

- P4/L88: suggest to change "even RH up to 90%" to "even with RH of up to 90%".

- P8/L174 and L177: "don't" to "do not".

- P8/L181: "100 Pa s in volatility"? Should it be viscosity?

- P9/L184: add "and" before "SOA". Also in other places including L204, L234, L235, and L244

