This study did chamber experiments to investigate the impact of temperature on formation and ageing of SOA particles formed from isoprene and α-pinene mixtures. With the temperature ranged from 213 K to 313 K, the authors found that isoprene strongly suppressed α-pinene dimer formation at 213 K. Volatility and phase state of SOA particles at different temperatures were also estimated. With temperate-dependent SOA yields considered in a chemical transport model, predicted SOA concentrations increased. As chamber experiments done as low as 213 K for SOA formation and ageing, particularly for SOA formed from mixed precursors, are still limited, and the related mechanism is not fully understood, I recommend the publication of this study after a major revision.

Major Comments:

My major concern is the writing of this manuscript. Some key information is missing in method section or when describing figures.

(1) Please specify how to derive the mass-based stoichiometric yields (α) at the four volatility bins, that are key values used in chemical transport models for simulating SOA formation. How can four α values be derived if only one AMF value is achieved at each experiment (Fig. S2)? In addition, as the authors noted that phase state of SOA particles plays a role in SOA formation, when deriving stoichiometric yields at different temperatures listed in Table S2, is phase state considered? Furthermore, Line 177-181 in method section 2.4, using '*243 K ⩽T < 273 K, parameters from Exp 2 (243 K)*' as an example, I am wondering how the simulated SOA concentration would change if you adopt parameters from Exp 3 (273 K) when 243 K ⩽T < 273 K? Similarly for other temperature ranges. I don't mean to do further sensitivity simulations but at least, the authors should discuss how the chosen of stoichiometric yields would affect the predicted results of SOA concentrations.

(2) There is only one sentence describing Fig. 1 in the main text. Please expand the description. Are the SOA concentrations shown in Fig. 1 wall-loss corrected? Concentration variations of VOC precursors are hard to spot for experiments at 213 K and 243 K. Adjust the maximum values of y-axis. From Fig. 1, I suppose the authors use time-varied AMF values deriving stoichiometric yields shown in Table S2 (Pathak et al., 2007)? I have major concerns in Fig. 1, and Fig. S2 with Table S2 commented above, because these updated stoichiometric yields varied with temperatures can be applied by chemical transport modeling community to improve SOA simulations.

(3) Similar to Comment 2, there is only one sentence describing Fig. 3 in the main text: '*However, by comparing the particle volatility distribution at different temperatures based on the gas- and particle-phase measurement at each temperature and based on the Clausius-Claepery equation (Figure 3), the strong temperature dependence on the ISO-AP dimers to AP-AP dimers between 213-273 K is suggested to be chemistry-driven.*' Such a long sentence is very hard to follow. I suggest describing the two methods deriving volatility distributions in separate sentences. Is the Clausius-Clapeyron equation applied after the chemical-composition-based volatility estimation for 298 K (Li et al., 2016)? Is C^* shown in Fig. 3 for the volatility at experimental temperatures? Also for Line 255-256, at low temperatures, why is the rate coefficient of isoprene + OH higher? Better split the long sentence for readers to follow.

Specific Comments:

(1) Page 3, Line 119-120: Why for the experiment at 213 K, the injection of VOC precursors and

O_3 were done two times, different from other experiments? Was it because the SOA concentration formed at thus low temperatures was too low? In addition, '*213 K experiment*' in Table 1 seems not match the description here on Line 119-120. Exp. 6 and 7 in Table 1 are not described in Method section.

(2) Page 8, Line 237: Change '*shown as Figure 2g and 1h*' to shown as Figure 2g and 2h.

(3) Figure 4: It is hard to follow the trend of these small symbols. Using solid vs open symbols for warming start and end may be clearer than current version. Page 12 Line 320, I did not see slope of 3.25 in Fig. 4.

(4) Figure 5 and Line 323, Line 359, why the authors choose to calculate the compounds lost based on FIGAERO-CIMS instead of using AMS to calculate the mass loss after warming? In the Conclusion section Line 518, however, the authors use *mass* to describe the loss after warming.

(5) Page 13, Line 338-344, the T_g calculation is better put in the method section for readers to follow. What is the value of hygroscopicity parameter used? Is the T_g estimated (e.g., Line 345) considering water uptake by SOA particles?

(6) Page 14, Line 401-403, during warming, as evaporation leads to lower-volatility compounds enriched, why does the entire VBS shift toward higher volatility? Is Fig. 6 and Fig. S11 for C^* estimated at experimental temperatures instead of 298 K?

(7) Page 16, Line 440-442, the authors stated that lower temperature enhanced the formation of both ISO-AP cross dimers and AP-AP dimers, which seems contrary to Line 260 and Line 508 that ISO-AP cross dimers suppress the formation of AP-AP dimers. Please explain this.

(8) Page 18, Line 519-520: it is stated that SOA formed directly at higher *T* is more volatile than SOA formed at lower temperatures and subsequently warmed, which seems contrary to Line 459-460 that higher volatility of $SOA_{273K \rightarrow 298K}$ is observed than that of SOA_{298K}.

(9) Supplement: Section S3: Fig. S8 did not match the description in Section S3. Please double check the Figure number cited in SI. Furthermore, '*Based on this method to determine SOA compound volatility, all compounds in the α-pinene isoprene derived SOA particles at 213 K should have a low volatility*', '*this method*' in the above sentence refers to which method? Please specify the difference of '*this method*' and the volatility estimated from chemical composition.

Reference:

Pathak, R. K., C. O. Stanier, N. M. Donahue, and S. N. Pandis (2007), Ozonolysis of a-pinene at atmospherically relevant concentrations: Temperature dependence of aerosol mass fractions (yields), J. Geophys. Res., 112, D03201, doi:10.1029/2006JD007436.