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Interactive comment on "Molecular understanding of new-particle formation from alpha-pinene between −50 °C and 25 °C" *by* Mario Simon et al.

Anonymous Referee #1

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This study investigated low-volatility organics formed during alpha-pinene oxidation in the CLOUD chamber using a nitrate CIMS and a PTR-MS. The paper explores how HOM yields change with temperature as well as how the molecules' volatilities change with temperature. HOM yields drop with decreasing temperature, however, the yields of ultra low volatility products increase with decreasing temperature (due to the dependence of volatility on temperature). The study also investigates how nucleation of the alpha-pinene oxidation products is impacted by temperature, and it shows that the yield of ultra low volatility products better explains nucleation rates than HOM yields.

Quite frankly, this paper is really great. It's thorough and novel, and investigates hypotheses that I have heard people suspecting for the past several years. I recommend publication once some minor comments have been addressed.

L95: Haven't mentioned what autooxidation is yet.

L98: "HOM" was defined in the abstract, but I don't see it in the main text. I *think* the standard is to re-define it.

L201: "HVCF" was defined earlier, not "HV". People will be able to figure this out, obviously, but it might slow people down for a moment.

L242: It's important to give the units for "M_i" here since this is an empirical equation where the units don't match up easily between the right and left-hand sides.

L266: What does the "3" stand for in PRT3?

L347: I think that "negligible" should be "negligibly different".

L367: "under typical conditions" tripped me up here. What does "typical" mean here. Nucleation is not happening in the atmosphere (at an appreciable rate) most of the time.

L410: Please give the approximate times of what's being described in each sentence of the paragraph (right not it only shows up in the first sentence, but it would be useful throughout the paragraph).

Figure S3: This was discussed extensively across several paragraphs. I think it would make sense to make this a main-text figure since there are currently 7 main-text figures, which is not overly long for ACP.

Figure 7, panel d. The fit line for -50 C seems to be incorrect.

L594: I'm not sure what "avoiding any classification" means here.

Figure S5: Make this a main figure too?

L638: "seem" should be "seems".

2020.

C3