Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., author comment AC3
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# Reply on RC1

Michael S. Taylor Jr. et al.

Author comment on "Modelling ultrafine particle growth in a flow tube reactor" by Michael S. Taylor Jr. et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-88-AC3, 2022

Specific Responses to Reviewer 2 Comments

Comment: My main comments are: 1) model over-simplification, and 2) scientific significance.

Response: We hope that our general comments above about the SOA formation model explain why a simplified model is used i.e. to simulate the complexity of particle growth kinetics in a flow tube reactor. The reviewer goes on to list many additions that would be required to accurately model SOA formation by alpha-pinene ozonolysis. We agree that these are crucial for accurate modeling of this specific system. However, the goal is not model this system, but to provide a simulated dataset to show how well the interpretive model works (Figure 5 in the revision). The reviewer also makes reference to other more sophisticated SOA formation models, which we will reference when discussing the motivation for our simplified model.

We also hope that our consolidated group of figures along with specific conclusions gained from each will clarify scientific significance. The most important factor related to the scientific significance of this work is Figure 5 in the revision (Figure 10 in the original paper), which shows that the interpretive model used to determine the growth factor reproduces what is actually happening in the flow tube. We also note that the interpretive model can be applied to any system, and we will discuss this more clearly in the revision. In an actual flow tube experiment, one knows (measures) basic experimental parameters – precursor mixing ratios, residence time in the flow tube, inlet and outlet particle size distributions. These measurements plus knowledge of the gas-phase rate constant for precursor + oxidant reaction are all that are needed for the interpretive model.

Comment: I suggest the authors reduce the technicality (where possible) and length of the text (making use of a supplement), reduce the number of figures in the main manuscript to approximately five at most.

Response: Thank you for this suggestion. We will do this as discussed in the general comments above for the five figures in revision.

Comment: Finally, noting the title, "modelling ultrafine particle growth based on flow tube reactor measurements". Please include the measurement data and a brief description of the flow tube in the manuscript.

Response: Based on reviewer comments, we will change the title of the paper in revision. A more descriptive title might be: "Representing Complex Particle Growth Kinetics Within a Flow Tube Reactor". We feel there is too much detail required to discuss actual measurement data. We will point the reader to experimental papers, and we will emphasize in this paper that the intent of this paper is to investigate the robustness of the interpretive modeling approach.

Response to specific comments: Modifications to lines 6 and 92 will be made. Figure 3 of the original paper will no longer appear in the revised paper.