

Responses to Referee #1's comments

We are grateful to the reviewer for your valuable and helpful comments on our manuscript "Reaction of SO₃ with H₂SO₄ and Its Implication for Aerosol Particle Formation in the Gas Phase and at the Air-Water Interface" (MS No.: **egusphere-2023-2009**). We have revised the manuscript carefully according to reviewer's comments. The point-to-point responses to the Referee #1's comments are summarized below:

Referee Comment:

The revised manuscript is a significant improvement upon the initial submission. The authors have done a very thorough job in revising the manuscript and answering all the review comments.

Response: We would like to thank the reviewer for the positive and valuable comments, and we have revised our manuscript accordingly.

Major issues

Comment 1.

I only have one minor correction before I can advise publication. The authors have not adequately addressed reviewer #1 comment 2 and reviewer #2 comment 24 regarding the nomenclature of using the phrase nucleation potential about an ion at the interface.

The discussion on page 16, line 15-26 about nucleation: "... showing S₂O₇²⁻ ion at the air-water interface has stronger nucleation ability than X in the gas phase. Therefore, we predict that S₂O₇²⁻ at the air-water interface has stronger nucleation potential."

Nucleation refers to a phase transition. It does not make sense to talk about nucleation potential of an air-water interface. You can say that the S₂O₇²⁻ at the air-water interface would lead to increased particle growth instead.

Response: Thanks for your valuable comments. We agree with the reviewer's statement and according to the reviewer's suggestion, the sentence of "we predict that S₂O₇²⁻ at the air-water interface has stronger nucleation potential" has been changed as "we predict that S₂O₇²⁻ at the air-water interface would lead to increased particle growth" in Lines 25-26 Page 17 of the revised manuscript.