

Atmos. Chem. Phys. Discuss., referee comment RC1
<https://doi.org/10.5194/acp-2020-1324-RC1>, 2021
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Comment on acp-2020-1324

Anonymous Referee #1

Referee comment on "Secondary aerosol formation from dimethyl sulfide – improved mechanistic understanding based on smog chamber experiments and modelling" by Robin Wollesen de Jonge et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2020-1324-RC1>, 2021

Wollesen et al. studied the OH-oxidation of DMS in the AURA smog chamber, using the gas and particle phase chemistry model for laboratory chamber studies (ADCHAM). They investigated the role of some products (and oxidation-pathways, such as HPMTF and addition reaction of MSIA-OH) on secondary aerosol mass yield in the chamber. DMS is an important source of sulfate particles in the atmosphere, and there are many uncertainties and key questions left on its oxidation pathways and products.

This study aims to address some questions in this area. It is a great project, and in general, the topic and the approach are within the ACP scope. However, I think this study can benefit from re-writing (re-structur). The results in the different sections are mentioned without reporting the quantitative values, which makes this difficult to follow the manuscript - see the "specific comments" below for some examples.

Specific comments:

- Page 1 - Line 1: "Dimethyl sulfide (DMS) is the dominant biogenic sulphur compound in the ambient atmosphere." This statement is correct in open ocean waters.
- Page 3 – line 57: "under said conditions" – what are the conditions? Please add briefly what conditions you refer to.
- Page 3 - Line 75 and Page 6 – Line 135: I suggest to use 'mixing ratio' instead of 'concentrations'. The unit ppmv is used for mixing ratios not concentrations.
- Tables 1 and 2: I think it is unnecessary to display "Date" (Is there any point to have 'date' in these tables? The samples already have ids/exp.). Also, I think in the discussion sections, authors refer to only 3 experiments in the tables.
- Page 7 – Line 149: "the leakage of NH₃(g) into the chamber become larger than the sink of NH₃(g) to the particle phase." Why? It is confusing for me. I think this paper lacks a critically evaluating the uncertainties and reporting quantitative errors on both

chamber measurements and model results.

- Page 3 – I suggest to mention what each of the sections include, at the end of the introduction.
- Section 2: This section includes Methods. You can revise the general section and sub-sections. For example, are '1.1 Chamber wall effects - gas to wall partitioning', '2.1.2 Multiphase chemistry', '2.1.3 New particle formation' and '2.1.4 Particle wall losses' all sub-sections of "2.1 ADCHAM - AURA model setup"?
- It would be useful to refer to some studies, for example HPMTF reactions (e.g. Patrick et al, PNAS, 2019) and MSIA addition reaction (e.g. Ghahremaninezhad et al., ACP, 2019).
- Page 24 – Line 595: Please add reference for the Hoppel minimum (e.g. Hoppel and Frick, 1990). Also, what aerosol size are you referring as the Hoppel minimum here?
- It is very difficult to follow the main finding of this study without quantitative results.

For example:

(Abstract - There are some terms such as "strong dependence", "important", "a decrease in the secondary aerosol mass yield", "a strong sink" and "less important than" without any quantitative support.

Line 300: "Initially the model overestimated"

Line 302: "significantly underestimated"

Line 331: "minor importance"

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There are many other examples on different sections including "Conclusions". Even if you display results on figures/tables, it would be helpful to report them in the main body of the manuscript).

Technical Comments:

Abstract: Define abbreviations such as MSA.

Page 2 – Line 40: Add space HOOCH₂SCHO) - (Wu et al.,

Some examples of typographical corrections:

Page 1 – Line 5: Move “both” - DMS oxidation mechanism, capable of “both” reproducing smog chamber and atmospheric relevant conditions.

Page 2 – Line 37: details

Page 2 – Line 37: “mechanism remains” or “mechanisms remain” – I think the second one here is correct.

Page 2 – Line 50: “MSA formation in the gas-phase does, however, remain uncertain, and early studies have suggested alternative production pathways via the MSIA intermediate.”

Page 3 – Line 66: mean

Page 3 – Line 67: compares

Page 3 – Line 72: instrumentations

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