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Comment on acp-2022-188

Anonymous Referee #1

Referee comment on "Hygroscopicity and CCN potential of DMS-derived aerosol particles" by Bernadette Rosati et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-188-RC1, 2022

The study by Rosati et al. investigated nucleation, hygroscopicity, and CCN activity of secondary aerosol particles from DMS as a function of temperature and relative humidity. Important findings include reduction in nucleation and particle growth rates at lower temperature (258 K) than that at 293 K. The kappa values for CCN activity were higher for lower temperature. Considering that temperature dependent particle formation from DMS has rarely been conducted, this study will serve as a good starting point for the more detailed studies in the future. The manuscript is well written, although some figures/tables can still be improved. I suggest publication of this manuscript after addressing the following comments.

Major comments

Precursors of ammonium and nitrate

The experimental procedure (section 2.2) describes that the authors injected H2O2 and DMS. Figure S7 suggests that particles generated in the chamber contained organics, nitrate, and ammonium, in addition to sulfate and MSA. It was not clear to me how ammonia and NOx concentrations were controlled. Ammonia is especially important both for nucleation and hygroscopic processes. So, the concentration of ammonia should clearly be summarized in Table 1. It seems that the authors measured NOx concentration using a NOx analyzer. It would be helpful for readers to understand the paper if the data from the instrument were to be available.

Formation mechanisms of organic compounds and its influence on hygroscopicity/CCN activity

Figure S7 shows that the particles generated by the chamber contained 10 ~30 % of organics. I am wondering how they formed. It will be great if the authors could describe the corresponding formation mechanism. I also wondered if the organics could assist hygroscopic growth of aerosol particles. It would be great to have some additional discussion on this point.

Minor comments

Table 1

It is better to show H_2O_2 concentration by using mixing ratio.

Section 2.2.3

It seems that all the aerosol instruments were operated at room temperature, even though the chamber temperature was cooled down to 258 K. I wonder if potential changes in gas-particle equilibrium could be induced by the temperature change. I also wondered if the change in the equilibrium could influence the nucleation/particle growth rates in addition to chemical composition. It would be ideal to have some discussion about this point in the manuscript.

Section 2.3.5.

The authors mention that the HTDMA measurement was conducted at RH = 80%. Deliquescence relative humidity of ammonium sulfate is slightly lower than 80%. Considering the chemical composition of the particles, I personally think that it would have been better to conduct the HTDMA measurement at higher RH. Could the authors explain the reason why they selected this condition?

Figure 1a

There is a cyclic oscillation in the nucleation rate at 273 K. Is it possible to explain the potential cause?

L309 Such a size trend can be expected

I could not understand the reason why it can be expected. Please describe it in more detail.

Figure 2

It requires a lot of efforts and focus to see this figure. I suggest updating the figure so that the readers can easily get the main message of the figure.

Table 2

The formats of tables 1 nad2 are significantly different. It would be getter to have a

standardized table format for a manuscript.