

Interactive comment on “New particle formation in the sulfuric acid-dimethylamine-water system: Reevaluation of CLOUD chamber measurements and comparison to an aerosol nucleation and growth model” by Andreas Kürten et al.

Anonymous Referee #2

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The study by Kürten et al. presents a revised analyses of their previous study on new particle formation of the sulfuric acid-dimethylamine-water system. The new results show that nucleation is even faster than previously thought and that the derived nucleation rates are in agreement with model simulations. Further, they show that even tiny mixing ratios of dimethylamine are sufficient to explain significant particle nucleation in the boundary layer.

The paper is well written and suitable for publication in ACP after some minor

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revisions. My comments are listed below:

General comments:

Somewhere in the paper it should be stated what the typical concentrations/mixing ratios of dimethylamine and sulfuric acid in the boundary layer are. Are the concentrations that were used in your experiment realistic?

The difference between the Almeida et al. (2013) study and your study (same holds for the Jen et al. (2016) study) becomes not really clear from the manuscript as it is written now. If I understand your study correct your experiment is the same as the one by Almeida et al. (2013) but with an improved set-up which results in a better agreement between measurement and observations. This is of course very nice, but as you write it it sounds like “we are doing it right and Almeida et al. did it wrong” which is not correct. I am sure they did their best at the time they performed their study. Of course, with more time and more experience as well with improving knowledge previous studies can be repeated and improved. This should be more clearly and fair be discussed in the paper.

Specific comments:

P3, I36: add “mobility diameter” so that it reads “.....at a mobility diameter of 1.7 nm.....”.

P4, I47: The abundances of sulfuric acid and dimethylamine are given in different units (concentrations and mixing ratio, respectively). The same unit should be used for both consequently. However, I would prefer if the amounts of both species would be given as concentration and mixing ratio.

P5, I97 and I111: What the abbreviation CLOUD is standing for should be rather given in the introduction in I97 than in I111 of the method section.

P6, I144: The brackets around the reference are obsolete.

P6, I152: Same here, the brackets around the reference are obsolete.

P6, I169 and I172: Is the unit really correct? If yes, why is it $s^{-0.5}$?

P6, I300: Since you compare your results to Almeida et al. (2013) it would be good if you could write more about the Almeida et al. (2013) study. How were their nucleation rates derived. What are the differences between your experiment and their experiment? Were these experimentally derived or from model simulations?

P11, I369: Please give to the concentration the corresponding mixing ratio.

P12, L402ff: Concerning the discussion on the differences between model simulation and measurements. I would say that this part could be improved. Although I agree that the agreement is very good you should also admit that the nucleation rates from the model simulation are slightly higher than the measurements which will affect the development of the size distribution. Further, it seems that the differences between the measurements and the model simulation increase with time. Furthermore, the differences are largest at in between the two modes of the size distribution. That is not discussed at all. I would assume that this is caused by an uncertainty in the model. Is the coagulation really correctly calculated? Can't you play around a little with the model and check if the differences get larger/smaller than the nucleation rate is lower/higher (assuming according lower/higher concentrations of dimethylamine and sulfuric acid)?

Even larger are the difference between the aerosol volumes, but from the discussion it sounds as that the agreement is perfect which is obviously not true.

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P12, I440: Same here as for the Almeida et al. (2013) study, add some more information how Jen et al. (2016) derived their nucleation rates. Was it a similar experiment as the one you performed. If no, what has been done differently etc.

P12-13, I439-478: This text part definitely belong to the method section than to the result section.

P13, I481: The abbreviation DMA has not been introduced yet. I would suggest to keep writing dimethylamine throughout the manuscript. Otherwise the text is quite difficult to read with all the abbreviations that are already used.

P15, I529 and I530: Please give the abundances of H_2SO_4 and dimethylamine as concentrations and mixing ratios.

P15, I550: I would suggest to write: "This study confirms the results derived in previous studies."

P15, I553, I575, I576: please give the according concentrations and mixing ratios.

P15, I605: It should read "numerical model".

P16, I608-609: units for M and W missing or are these dimensionless?

P30, Figure 3 caption: add DMA in brackets after dimethylamine. Give the abundances for H_2SO_4 and dimethylamine in both concentration and mixing ratio.

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