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Atmospheric Measurement Techniques Discussions

Interactive comment on "Captive Aerosol Growth and Evolution (CAGE) chamber system to investigate particle growth due to secondary aerosol formation" *by* Candice L. Sirmollo et al.

Anonymous Referee #3

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The authors describe a new type of enclosure chamber which allow to observe particle growth by seeding a real mix of ambient atmospheric air exposed to outside light conditions. Long residence time of the seed particles is provided by rotating the cylindric chambers around the center axis which reduces gravitational settling and convective mixing. Gas exchange is provided by permeation through a membrane, such that the injected seed particles are not subject to flush out. The latter concept was also applied before (QUALITY camber). The presented chambers provide still a quite substantial progress compared to the previous versions. The results are overall presented well and look promising. And I think the manuscript shows indeed proof of concept. However, from the descriptions in the manuscript, I could not understand all features of

the new chamber. Some important information is missing. The manuscript is within the range of AMT and could be published after the authors addressed the comments below.

Comments

In the manuscript the authors seem not to distinguish between mixing time and exchange time (e.g. line 22, abstract).

In my opinion there is a difference. If the mixing time is short compared to the residence time, the chamber will be always well mixed, even when the boundary conditions are (slowly) changing. Isn't fast mixing a prerequisite for treatment of the chamber as a continuously stirred tank reactor? If the chamber is not mixed fast, in how far is the sampling from one (or two?) points inside the chamber representative for the processes in and state of the chamber? Please describe, how the mixing within the volume of the chamber is assured, the mixing time and mixing behavior in the CAGE chamber?

A bit related to the previous point. You are taking samples for measurements from the chamber by two DMAs, APS, and AMS. How large is the total sample flow? I guess it is significant compared to the residence time? How much does this sample flow affect the exchange time? Does the sample flow enhance the mixing in the chamber?

Was the sheath for the DMA(s) taken from the chamber? If not in how far could not using sheath air from the chamber and drying of the aerosol have affected the observation that only condensation took place (that growth rate always > 0)?

Line 126: I have difficulties to understand how the sampling is done. Is the centers axis a tube which serves as a sampling line at the same time? Is that little perpendicular extension in Figure S2 to the very right one of the sampling tubes? Do you sample from both tubes or are you using one for sampling and the other for injection of seed particles? Do all instruments sample from the same point?

Line 323: I think you use "Dp" as size parameter for the size distributions and as mode

diameter. I suggest using two different notations and call latter Dmode, or so.

Line 423 and Figure 15. I can see that the traces look different, but also different quantities are plotted. Please, extent the description why exactly we can see from this Figure the difficulty in determining secondary aerosol production from mass measurements. I guess you have all information to calculate the mass production from your growth rates using an average particle density (from AMS measurements)? Or I don't understand at all what you want to address.

Line 459: Since O3 is substantially lower in the night than during day time, ozonolysis ([VOC]*[O3]) is probably not driving the night time maximum.

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