

***Interactive comment on “Analysis of the
hygroscopic and volatile properties of ammonium
sulphate seeded and un-seeded SOA particles” by
N. K. Meyer et al.***

N. K. Meyer et al.

Received and published: 7 October 2008

Response to anonymous referee #1

p. 8635, lines 20-21: Is the accuracy of both temperature and RH 2% ?

Response: No, the accuracy of RH was 1.5% and of the temperature 0.3 C. Changes were made in the text to reflect this in the sentence on line 20.

p. 8636, line 10 (and later):The mode still clearly keeps growing even after 6h.

Response: We agree with the reviewer that that the mode still keeps to be growing even after 5 hours. After correcting for the wall losses our calculations show that the observed growth after 5 hours is not due to coagulation but still only due to condensa-

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tion. To address this the sentence on p.8636 line 10 has been changed from: "In all experiments, the condensation process is virtually complete within about 5 h" to: "In all experiments, the condensation process becomes equal to the wall loss after 5 h. From this time the total aerosol mass is constant, and after 6 hours the total mass is decreasing (more losses than condensation). Although there was some growth after this period, our interest was in the period leading up to 6 hours after lights on."

p.8636, lines 11-12: "ageing processes become increasingly apparent". I'm sure this is true, but you do not discuss this in later sections. When doing the VH-TDMA scans later on, you should state how long it took. Is there a possibility that ageing changes the aerosol during the measurement so that you are looking at different particles at 40C and 200C? The HGF of the SOA should be increasing during the scans, so it wouldn't directly explain the decreasing HGF you observed, but are there possibly other effects of the ageing? Please add some short discussion on this.

Response: Multiple VH-TDMA scans were conducted in series during one experiment and no significant change was observed between the scans that were around 1 hour apart (time needed for a VH-TDMA scan). To address how long the VH-TDMA scans have taken we have modified the 1st sentence on p.8639 to be: "These measurements were conducted after 5 h since the lights were turned on and have taken around 1 hour for a temperature scan from room to 200C. During this time although there was some condensation of organic species it was not considered significant. Further any aging effects during the VH-TDMA scan of 1 hour were also negligible."

p.8636, line 20: Even with all the scatter, it looks to me as if the ammonium starts to increase when the sulfate starts decreasing. Since you later on use the SMPS mode diameter to calculate the volume fractions, add this line to the bottom graph of Fig. 2 as well.

Response: As the concentration of the sulphate and ammonium are close to the sensitivity limit of the Q-AMS it is really difficult to read too much into this data and we

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therefore think that adding more lines to Fig.2 will not improve it.

p.8636, lines 26-27: The AMS should have no trouble seeing organic sulfates, so why should this explain the reduction?

Response: What we said was: "In principle, a reduction in sulphate mass could also be explained by formation of organic sulphates." Later on we discuss that this option is not likely as we did not see any evidence of organic sulphate formation from the AMS spectral data. We have attributed this to the differences in our experimental conditions (non acidic seeds) compared to the study by Surratt et al. 2007.

Fig. 3: Why are there so few points in the lower panel? Generally, also add time resolution of instruments used in the study.

Response: Figure 3 with the additional missing points has been updated. The time resolution of the HGF measurements was added in the sentence on p.8637, line 18. The modified sentence is: "The evolution of the hygroscopic growth factor (HGF) was measured continuously from the moment the lights in the chamber were turned on every 2 minutes for around 1.5 h."

p.8640, lines 5-7: If the HGF decrease is due to the Kelvin effect alone, HGF* should be constant in the unseeded case as well, but this isn't the case.

Response: HGF* for unseeded particles is indeed constant in the discussed range (140-165) as we have mentioned in the sentence on l.3: "In the temperature range from 140C the HGF* of pure SOA particles remains constant" therefore our statement is correct.

Fig.4: I would also like to see seeded SOA at 85% and pure SOA at 75%. Since the authors can't adequately explain this behaviour, giving more information to the reader might help the interpretation.

Response: We believe that we have correctly explained this behaviour and that there is no need to add additional figures to the manuscript. As stressed in the manuscript

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the reason we have chosen to show the seeded data at RH of 75% is to show that the ammonium sulphate seeds do absorb water even at humidities below their deliquescence point. Figure 4. has been slightly updated so the scaling on the left y-axis of both graphs is the same (from 1 to 1.2).

p.8644, eq.3: ϵ_{DAS} is not explained in the text. I assume it is the same as ϵ_{ADVF} , and in that case you should not use two different notations for the same term in the equation. Response: ϵ_{ADVF} was removed from the text and ϵ_{DAS} used instead.

p.8647, line 21 (and before): Do you have any theoretical explanation for the AS not dissolving completely Response: With the available data we can only speculate on the reasons for AS not dissolving completely. Partial dissolution of the compound with the higher DRH is normal in the RH range between the lower DRH and the higher DRH. This is also found for mixtures of inorganic salts. Although this is a simplified view of a multicomponent system such as ours it offers some theoretical explanation into AS not dissolving completely.

Technical corrections Sometimes you use "un-seeded", sometimes "unseeded". Pick one. Response: "un-seeded" was replaced with "unseeded" in the text.

Fig.2: You have measured ammonium, not ammonia. Response: Ammonia was replaced with ammonium in Figure 2.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 8629, 2008.

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