Atmos. Chem. Phys. Discuss., 5, S1426–S1428, 2005
www.atmos-chem-phys.org/acpd/5/S1426/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of palmitic acid coating on the water uptake and loss of ammonium sulfate particles" *by* R. M. Garland et al.

R. M. Garland et al.

Received and published: 28 June 2005

We would like to thank Referee 2 for their careful reading of the manuscript and for their thoughtful comments. We have addressed their comments below; their original reviews are in italics with our responses following.

In particular, by analyzing the IR mode close to 1400 cm-1 in the ammonium sulfate system, one is able to determine very nicely whether the ammonium sulfate exists in a solution or solid state. The first paper to note the shift in this mode depending on aerosol physical state is that of Ewing (Weis and Ewing, JGR, 1996), but it has been used extensively by others in studies of the type performed in this paper: e.g. Han

and Martin, JGR, 1999, Braban and Abbatt, ACP, 2004. Although observations of the condensed phase features due to water are informative about the overall water content of the particles, analysis of this ammonium mode may allow one to separate the water uptake due to the AS or the palmitic acid, or whether the deliquescence point of the AS is affected by the presence of the organic.

We have tried to look at that peak, however this ammonium sulfate peak is in the same region as gas phase water and is obscured by these large peaks. In order to increase the relative humidity in the flowtubes we dilute the aerosol with a humidified flow, thus decreasing our aerosol signal significantly as the relative humidity increases. At such relative humidities as the deliquescence point of ammonium sulfate, the subtraction of the gas phase water spectrum from that of the deliquesced aerosol leaves too much noise in the region to clearly identify peaks. In our analysis, we only use peaks that are not obscured by gas phase water. Weis and Ewing perform their analysis on supersaturated aerosols near the efflorescence point of 30 RH, and thus have less gas phase water interference.

Minor points:

Page 2058, last paragraph - "if the palmitic acid were acting as a heterogeneous nucleus"

"Nuclei" was changed to "nucleus."

Page 2058, last paragraph - It is not clear that uptake of water by the palmitic acid via adsorption warrants the statement that the "coating may be liquid-like". There is no evidence that surface water leads to a solid becoming liquid-like.

We have now changed the sentence to read; "The adsorption of water at lower relative humidities indicates that aerosols with a coating may contain water under a wider range of relative humidities than pure inorganic salts."

Page 2058, last paragraph - The statements about the CCN behavior are not quite

ACPD

5, S1426–S1428, 2005

correct. An insoluble component in an aqueous particle increases the likelihood of activation through a size effect alone, i.e. the Kelvin effect is lessened. And so the conclusion made in the first sentence on page 2059 is not necessarily valid.

We have now removed that sentence.

Page 2059 - The discussion at the end of the paragraph seems to assume the coatings were uniform and that water needs to diffuse through the organic coat to reach the ammonium sulfate. Isn't the fact that ammonium sulfate readily deliquesces an indication that the coatings are not uniform and that some of the AS core is not coated?

We agree that it is possible that our particles are not fully coated. We could not probe the surface and thus do not know the morphology and internal mixing states of the particles. The calculation of the diffusion constant was to illustrate that even in the most extreme case, where we produced aerosols that were fully encapsulated by a palmitic acid covering, water can diffuse through the coating in a timescale that is quicker than our measurement time and thus we would not see any change in water uptake. We have clarified this in the discussion section.

Figure 2. I suggest that the gas-phase water lines be subtracted to illustrate the aerosol features more clearly. Also, replace wavenumbers with frequency on the x-axis.

The figure was changed as suggested.

Figures 4 and 5. I suggest that more description of the state of the particles be given in the captions, rather just the temperature of the bath.

We have added more description of the aerosols to these figure captions.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 2047, 2005.