

## ***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 3 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.

*Comment 1, page 2049, section 15: the authors reference several studies that have investigated the water uptake of mixed inorganic and water soluble organics. The authors should probably also reference some of the more recent studies on this topic. Possible references include: Braban et al.,<sup>1</sup> Pant et al.,<sup>2</sup> Marcolli et al.,<sup>3</sup> and Parsons et al.<sup>4</sup> Also in section 15, a reference for the recent work by Tervahattu et al.<sup>5</sup> seems*

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appropriate. Also in section 20 a reference for the work by Gill et al.6 should be included.

These additional references have been added.

*Comment 2, page 2053, section 10 and Figure 3: Images of mixed palmitic acid and ammonium sulfate particles are discussed. Please indicate the composition of the mixed particles in the figures.*

We have now added the composition of the particles into the figure caption.

*Comment 3, page 2054, section 5: "The size distributions accompanying the mass spectra are shown in Figure 5." Please indicate briefly how the size distributions were obtained. What peaks were used in the analysis?*

The size distributions were created using the particle time of flight (PTOF) in the AMS. The peaks probed were m/z 48 and 64 for sulfate, m/z 16 for ammonium and m/z 43 and 55 for organics. This explanation has now been added into the text.

*Comment 4, page 2055, section 5: "and  $5.006 \times 10^{16}$  molecules/cm<sup>2</sup> if it acts as a cylinder" This seems high. From surface pressure measurements (using a film balance) the area per molecule of stearic acid (which is similar to palmitic acid) at the air-water interface is  $0.2 \text{ nm}^2$ , assuming the monolayer is closely packed. This is equivalent to  $5 \times 10^{14}$  molecules/cm<sup>2</sup>. Please comment on the difference. Have I missed something here?*

The  $5.006 \times 10^{16}$  molec/cm<sup>2</sup> is actually a typo. The value of  $5.006 \times 10^{14}$  molec/cm<sup>2</sup> was used in all the calculations. The text was changed accordingly.

*Comment 5, page 2056, section 25: "It does not appear that palmitic acid actually deliquesces, but more likely, we are measuring water adsorbing to the surface of the particle." Is this comment based on just the shape of the deliquescence curve? Please explain.*

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This comment is based on the fact that there is no hysteresis in the efflorescence experiments. Thus, we do not believe we see deliquescence. We have added this explanation to the text.

*Comment 6, page 2057, section 10: The authors argue that the palmitic acid coating dictates water uptake prior to deliquescence. Could the water uptake prior to deliquescence also be due to incomplete efflorescence of a few of the particles prior to the deliquescence experiment? Perhaps the organic coating prevents a small percentage of the particles from completely crystallizing (due to slow water loss) and these particles exhibit water uptake prior to deliquescence.*

We believe that the ammonium sulfate is fully effloresced before entering the coating oven and thus will be fully effloresced upon entering the flowtubes. In deliquescence and efflorescence experiments for the coated ammonium sulfate aerosols, the pure ammonium sulfate aerosols passes through a diffusion drier and over a 96 wt

*Comment 7, page 2058, section 20: I would remove the comment regarding a liquidlike surface as this is speculative.*

We have now changed this to “may contain water”.

*Comment 8, page 2058 section 25 and page 2059: “These CCN studies, together with our hygroscopicity study suggest that the atmospheric impact of coatings on aerosols are minimal.” This is maybe too strong of a statement. For example, organic coatings may still reduce the uptake of trace gases into aerosol particles, and hence this may have an impact on trace gas concentrations in the atmosphere.*

We have now deleted that sentence.

*Comment 9, page 2059, section 20: “In order for the water to diffuse through a coating of 100 nm in the time allowed in our flowtube, the coating would have to have a diffusion constant of at least  $5 \cdot 10^{-13} \text{ cm}^2/\text{s}$ ” Should this be “In order for the water to diffuse through a coating of 100 nm in the time allowed in our flowtube, the diffusion constant*

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*of water in the coating would have to be at least  $5 \cdot 10^{-13} \text{ cm}^2/\text{s}$*

True. That sentence has been changed accordingly.

*Figure 3b: Based on the images, do the particles have a uniform coating, and are there cracks or pores in the coating? It is hard to tell from the figures.*

We do not believe we can elucidate that information from the TEM images due to the possibility that the particles have changed morphology in collection and sampling.

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

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