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

Anonymous Referee #3

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This manuscript investigates the deliquescence and efflorescence of ammonium sulfate particles coated with palmitic acid using a well established technique, FTIR spectroscopy, combined with AMS and TEM. The main conclusions from this study are that the insoluble organic (palmitic acid) does not have a significant effect on deliquescence unless the organic concentration is approximately 50 wt%, and the insoluble organic does not influence efflorescence even at a concentration of 50 wt%. I rate the paper as very good and recommend it for publication after the authors have addressed the following comments.

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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.,1 Pant et al.,2 Marcolli et al.,3 and Parsons et al.4 Also in section 15, a reference for the recent work by Tervahattu et al.5 seems appropriate. Also in section 20 a reference for the work by Gill et al.6 should be included.

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.

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?

Comment 4, page 2055, section 5: "and 5.006*10ˆ16 molecules/cm2 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 nmˆ2, assuming the monolayer is closely packed. This is equivalent to 5*10ˆ14 molecules/cmˆ2. Please comment on the difference. Have I missed something here?

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.

Comment 6, page 2057, section 10: The others 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.

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

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 gase concentrations in the atmosphere.

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*10ˆ-13 cmˆ2/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 of water in the coating would have to be at least 5*10ˆ-13 cmˆ2/s”

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.

(1) Braban, C. F.; Abbatt, J. P. D. Atmos. Chem. Phys. 2004, 4, 2949. (2) Pant, A.et al. Geophys. Res. Lett. 2004, 31, article number L12111. (3) Marcolli, C.et al. J. Phys. Chem. A 2004, 108, 2216. (4) Parsons, M. T.et al. J. Phys. Chem. A 2004, 108, 11600. (5) Tervahattu, H.et al. J. Geophys. Res. 2005, 110. (6) Gill, P. S.et al. Rev. Geophys. 1983, 21, 903.

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

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