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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Heterogeneous ice nucleation on phase-separated organic-sulfate particles: effect of liquid vs. glassy coatings" *by* G. P. Schill and M. A. Tolbert

Anonymous Referee #1

Received and published: 16 January 2013

General Comments

This manuscript describes laboratory experiments of phase separation, deliquescence, efflorescence, and ice nucleation by generated aerosol particles composed of ammonium sulfate mixed with alcohols. Experiments were performed in an environmental cell, and optical and Raman microscopy were used for particle analysis.

The manuscript is clear, concise, well written, and describes an interesting set of experiments. The experimental procedure is particularly well suited to studying particle nucleation and phase behavior, and the authors were creative in teasing out relevant details. The growth of organic coating around the expanding ice, and the particle mor-

phology analysis in section 3.2 are particularly noteworthy. Relevant results from recent literature were used widely and appropriately and to great benefit. The results are highly valuable to the ever-expanding research effort to understand ice nucleating and phase behavior of realistic aerosol mixtures at cold temperatures.

Overall, this high quality work should be published in ACP without major revisions. The authors should address the minor comments listed below.

Specific Comments

The manuscript would benefit from a simple schematic diagram of the experimental procedure. Start from the impacted wet aerosol as placed inside the cell and list all temperature & RH adjustment steps with labels describing the step. One diagram for the deliquescence/efflorescence experiments, one for the ice nucleation experiments. Could be added to Figure 1.

p. 30959 l. 17 and p. 30960 l. 11. Specify if the three repetitive experiments were performed using different particles.

Section 2.4. As written, the experimental procedure is essentially the same as for the deliquescence procedure. The key difference is the lower temperature for the ice nucleation experiments. Make this clear. It is interesting that the ice nucleation experiments require that the particle will freeze before it deliquesces under those conditions.

p. 30964 l. 21. It is surprising that the pure organic mixtures, presumably liquid, seem to act as heterogeneous IN. Can the authors propose an explanation for this? Perhaps the pure C10 organic would act as a heterogeneous IN? The authors might choose to highlight this result in section 5.

Section 4. Add a sentence or two discussing any possible size effects. Particles in the experiment have factors of 100's to 1000's more volume than a typical accumulation mode aerosol particle. One obvious difference is the coating thickness in the LLPS particles and thus the diffusion time for water. Might phase separation be affected?

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Interactive Comment

p.30968 l. 23. Written in this context, it is important to note that Jensen assumed that organic coatings or mixtures did not inhibit ammonium sulfate efflorescence, ie, ERH = 35%.

Fig 2. The organic-to-sulfate ratio at the particle core seems to have increased significantly upon efflorescence. Is this a real effect?

Technical Corrections

p. 30958 l. 26. Use of schlieren here. . .? ("diffused into each other. . .").

Fig 4 caption. Mention that this is an effloresced particle. The 'warmer colors' description is not well applied to the grayscale shading.

p. 30967 l. 26. Specify Aerodyne AMS.

p.30969 l. 11. Wording. "This is accord. . ."

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 30951, 2012.

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Interactive Comment