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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ice cloud processing of ultra-viscous/glassy aerosol particles leads to enhanced ice nucleation ability" *by* R. Wagner et al.

Anonymous Referee #1

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"Ice cloud processing of ultra-viscous/glassy aerosol particles leads to enhanced ice nucleation ability" by Wagner et al. addresses relevant scientific questions within the scope of ACP. The authors discuss the ability of airborne glassy aerosol particles to nucleate ice between 247 and 216 K using the AIDA aerosol and cloud chamber. The manuscript presents novel concepts and data regarding the ice nucleating ability of raffinose, HMMA, levoglucosan and a multicomponent mixture of organic and inorganic compounds. In particular, the authors hypothesize that a preactivation phenomenon accounts for a population of efficient ice nuclei in their experiments. I find the paper to be well written and should be published in ACP after a few minor changes are made. Specific comments are presented below.

Page 8923, line 22 – remove "also"

Page 8924, line 10 – Tg' is defined in the next sentence; however, I would like to see the definition first.

Page 8925, line 13 - This is a really long sentence. I would break this up into 2 sentences.

Page 8925, line 8 - Does Murray et al. (2010) give a hypothesis for why the glassy citric acid particles do not heterogeneously nucleate ice on a first expansion run when the initial temperature is close to Tg'? If so it would be nice to see that explanation in the introduction in case the reader is not familiar with Murray et al. (2010).

Page 8926, line 26 – When the aerosol particles are cooled below Tg', the particles vitrify. Wouldn't this greatly increase the equilibration times? It says decrease on page 8927. And if the ambient RH does not equal the water activity of the particles, how do you know where points X1 and Y1 lie on Figure 1?

Section 3.1 – Is this entire section needed? I feel like most of the particulars are discussed in other publications. Perhaps this section can be moved to a supplemental section or removed all together. Of course the particulars to this specific manuscript should be left in. Maybe the particulars would go in what is now section 3.2?

Page 8932, line 9 – I had to look the word envisaged up in a dictionary. Can a different word be used here?

Figure 4 – There is a lot going on in Figure 4. I like the left 2 plots. Can some of the right 5 plots be removed? In reality I am mostly paying attention to the Sice plot (second one down) and the Nice/cm-3 (fourth one down). I know that the others plots are there for completeness but can they be put into a supplementary section?

Figure 5 (left panels) – I was hoping that the colored traces (second panel) would be labeled as in Figure 4. I had to keep looking back to remind myself what the colors meant.

Figure 5 (left panels) – Now I see why the authors wanted to put the depolarization ratio panel in the figures. If I am not mistaken, it is to point out the reason for a few ice crystals forming prior to homogeneous nucleation. I still think that this can be explained in words and without a full on panel in the figure.

Figure 7 (bottom panel) – The black and the brown line are hard to distinguish from one another. Can a different color be used?

Page 8942, line 5 – I think the authors mean ". . .a typical pair of homogeneous freezing and pre-activation runs, respectively."

Page 8942, line 10 – Do the authors have a hypothesis concerning why ice forms at an Sice value of 1.05 during the 3C pre-activation run and 1.12 in run 2C? It seems the only difference is the starting temperature (224 K in 2C and 230 K in 3C).

Wilson et al. 2012 is referenced a multitude of times (9 times by my count) and some of the analysis of the results are dependent on this paper. Has Wilson et al. been peer reviewed? If not I would like to see this paper published in ACP before Wagner et al. is published.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 8921, 2012.