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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of particle size on the ice nucleating ability of mineral dusts" *by* A. Welti et al.

Anonymous Referee #3

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This work is an interesting and valuable contribution to the field of heterogeneous ice nucleation. It describes measurements of the ice nucleating ability of size segregated particles for 4 different particle sizes and 4 different dust samples in the deposition mode. The influence of the different particle sizes on freezing is explored and described nicely. Also differences in freezing due to mineral composition are explored, together with the effort to extract particle properties that are important for the freezing process. The work can be recommended for publication in ACP, once improvements as indicated below will have been addressed.

p 6932, line 10-12: Do you refer to your Figure 8 or to one in Kanji et al. (2008)? As the reader does not know your work, yet, you should not refer to that in the introduction.

p 6932, line 13 ff: Describe more clearly, what you will present in the paper.

p 6933, line 6: Which SMPS? A commercial one? If so, give the reference!

p 6933, line 6: You show the size distributions in Figure 3, so you should refer to that here. And as this then will be the first figure you'll mention, move Figure 3 to become Figure 1.

p 6933, line 9 ff: Which SEM? Did you do the measurements? How did you sample the particles on the grids? Please give some more details!

p 6933, line 21 ff: Which "control measurements" (i.e. which kind of nucleation) do you talk about? I assume you checked if using a neutralizer behind the DMA did change the freezing behaviour of the particles. If so, this is an interesting result. Please describe this more clearly. However, you should cite Winkler et al. (2008) more carefully (if at all), because the kind of nucleation Winkler et al. are looking at differs from the one you are examining, and different factors could be important.

p 6934, line 4: "bi-charged"'and "tri-charged": change to "doubly charged" and "triply charged"

p 6934, line 10: Start a new paragraph after "Fig. 3.".

p 6934, line 13: Please explain the acronym CPC.

p 6934, line 13: ZINC is mentioned here for the first time, so please tell us what this acronym stands for, and where we can find a description of the instrument (move your citation for ZINC to this spot!).

p 6936, line 4 to 8: Move these sentences to line 24, where you really start describing and interpreting Fig. 6, i.e. finish your description/interpretation of Fig. 5 first before you begin a new subject. And begin a new paragraph when you start describing Fig. 6.

p 6936, line 13 ff: The minimum you describe is not found in the ATD data while it occurs at comparable temperatures for the other three samples – make this difference

in the dust samples clearer in the text. However, as your next paragraph (line 18 ff) describes, it's only a very flat minimum, at least for the 800nm particles (you give "around 105%" as RHi for quite a large temperature range). These two statements are contradictory and clearly raise the question of measurement uncertainties (i.e.: give error bars!)

p 6936, line 28 ff: This steep increase at -35°C is really only there for the 200nm Illite particles, and possibly (but not as clearly) for the 100nm Kaolinite particles, but not for 100nm Illite. Please make this clear in your text (e.g. add "For some of the samples," in front of the sentence starting in line 28).

p 6937, line 14: error in spelling – you mean "sigmoidal" (also check Figure 7 and the conclusions).

p 6938, line 4 ff: I do not see this lower dependence on particle size. And why would this indicate efficient active sites? I can not follow your conclusion here.

p 6938, line 10 ff: Is this so? Wouldn't a constant crystal structure exclude active sites? And e.g. Illite is (K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,(H2O)] - there are several possibilities for the chemical composition.

p 6939, line 22 ff: Please explain what Figure 9 shows. Also: Please explain in some more detail, how you obtained the contact angels (you surely made some assumptions, and they have to be given to enable the reader to judge your resulting values).

p 6941, line 17 ff: If you want to pronounce the usefulness of your fit for further modelling, you need to talk about its applicability (including its limitations) prior in the text (end of section 5). Also, in your text, the fit was described prior to the derivation of the contact angle, so you might want to rethink the sequence in the conclusions. As it is now, this last sentence appears to be forcefully glued on to the end of the text.

Figure 4: Blow up the plot with the particle number concentration. Also, try to see if the "bin number" plot looks nicer when you use a logarithmic ordinate. And mention the

type of dust sample that was used here.

Figure 6: The water saturation line misses in one panel (Kaolinit, -35°C)

Figure 9: Temperatures given in the panels differ from those given in the caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 6929, 2009.