

Interactive comment on “Surface charge-induced orientation of interfacial water suppresses heterogeneous ice nucleation on α -alumina (0001)” by Ahmed Abdelmonem et al.

Anonymous Referee #2

Received and published: 27 April 2017

Authors describe an experimental study where they studied immersion freezing of droplets that consist of known chemical compounds and are made of different pHs. Their conclusion is that droplet freezing temperature depends upon the pH and is more efficient when solution is neutral. Further, they use vibrational sum frequency generation spectroscopy technique to understand the structure of the water molecules at the interface of oxide material that is used to catalyze the nucleation. SFG results shows the sensitivity towards droplet freezing and intensity values (3400 and 3200 per cm). The results are novel, and they would help wider community to understand the more about the heterogeneous ice nucleation. I have the following comments, and after they are addressed, I recommend the manuscript for the publication.

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General comments:

Introduction section needs text on atmospheric relevance of surface charge on the aerosol. How one can interpret/use these results in the context of understanding atmospheric ice formation. Some text describing how varying pH of droplets can be used to understand about the surface charge (interface between droplet and substrate) is required. Few details (OH group orientation etc) are already described on page 8.

Experimental: Describe rate of cooling and step size experiment. Not clear if it is cooled for one degree and hold T constant. Brief description of the cold-stage needs to be included. In section 3, it is mentioned that rate of cooling is 5 deg/min, this rate is different than described above. How droplets were visualized, using microscope? What is the typical size of droplet as you used different solutions or they remained constant, and can any images showing before and after freezing events be added in the main text. There is camera shown in figure 1. More details particularly magnification and model name are needed. How frozen fraction was calculated. How do you define a spectra?

Conclusion section is short and lacking many details. Describe what technique (because this is new about this work) was used, why alumina substrate was used and elaborate key results followed by the atmospheric implications. Remove any speculation and literature review text to add more clarity and improve readability.

Page 2, line 14-15: Needs reference

Page 2, Line 26-27: Elaborate and revise the sentence further.

Page 3, Line 1-3: Please add more specifics or details to understand why you want to take this particular approach.

Page 3, Line 12: Revise the sentence.

Page 4, Line 10-11: Revise the sentence.

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Page 5, Line 11: pH 7.2 – is this water.

Page 5, Line 26: . . .investigated. . .

Page 8: Line 27. Can Fig 2c and d be included in Fig 4. These figure panels are not described until this point.

Minor comments: Peckhaus 2016a and b are similar.

Provide a space between references included within the text. Also a space is needed after 'period' located at the end of the sentence. See page 3, Line 10, 11.

Supplement section is incomplete.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2017-224, 2017.