

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

**Anonymous Referee #1**

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Abdelmonem et al. present a laboratory work on the effects of surface charge on ice nucleation at the interface between aqueous solution and alumina. Droplet freezing assay was used to determine the immersion freezing temperature of aqueous solutions with different pHs whereas the SFG spectroscopy was applied to investigate the interfacial water structures during the freezing processes on the same surface. With SFG information, this study provides some insights on the underlying ice nucleation mechanisms at molecular level. This will be a useful complementary technique additional to the freezing experiments. I recommend it for publication after considering the following comments in the revisions.

Comments:

C1

1. In the Introduction section, it is suggested to have a briefly introduction on the SFG spectroscopy for readers who are not experts.
2. P1, L25-27, this statement is not correct as the heterogeneous ice nucleation could also occur below -38 degree C.
3. P1, L30-32, the sentence is overstated. It is not conclusive yet on the existence of actual active sites that induce ice nucleation.
4. P2, L2, Peacock et al 2016a and 2016b are in ACPD and ACP, respectively, final form should be cited?
5. P3, L15, how  $\alpha$ -alumina (0001) substrate was selected or treated before the freezing experiments, from which manufacturer?
6. P3, L38, and Figure 1, in the SFG setup, what is size of the sample area where the signal was collected, since the water drop in these experiments were large and freezing of ice could be initiated at the interface outside the sampling area. In addition, the  $\alpha$ -alumina (0001) should be homogenous and well cleaned.
7. P4, L20, what is “neat sapphire-c”?
8. P4, L24-26, please provide more information to support this statement. What are the pH values at the temperature close to the point of freezing? P6, L10, what are the uncertainties for the pH of solutions used in SFG experiments?
9. P8, L4-5, more detail description is needed for better understanding the use of this variable.
10. P8, L15, it is not clear what does “OH groups pointing with its H down to the bulk solution” mean? the OH groups near interface pointing away from the interface and into bulk solution?
11. P8, for the most part of the discussion on surface charge or surface, it is not always clear referring to which surface or which side of the interface or water molecular layer.

C2

It will be informative and easy to understand these discussions if authors can provide an illustration.

12. P9, L7-8, apparently, this sentence is over stated since it is possible that the conclusion is only applied for certain types of particles/surfaces and pHs.

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

C3