



Heterogeneous ice nucleation at charged interfaces

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The rate of heterogeneous ice nucleation on an ice-nucleating agent depends, amongst others, on the surface charge of the particle. Despite the known importance of this charge for ice nucleation, still many open questions remain. We combine droplet-freezing assay studies with vibrational sum frequency generation SFG spectroscopy to correlate the interfacial water structure to the surface nucleation strength [1]. We focus on nucleation at atmospherically relevant surfaces like alumina, silica, and mica. The surface charge is varied by changing the pH of the aqueous solution. We find that charge-induced templating of the water molecules at the Al_2O_3 (0001) surface suppresses nucleation, irrespective of the sign of the surface charge. Heterogeneous nucleation is most efficient for the nominally neutral surface. Moreover, we observe at different substrates at the moment of freezing, a transient response with a significantly different intensity with a lifetime between several seconds and several minutes [2]. We demonstrate that this transient signal is not originating from a transient phase of ice, as we can account for the signal by a simple combination of the time-dependent liquid and ice linear and nonlinear responses.

[1] Abdelmonem, A.; Backus, E. H. G.; Hoffmann, N.; Sánchez, M. A.; Cyran, J. D.; Kiselev, A.; Bonn, M. Surface-Charge-Induced Orientation of Interfacial Water Suppresses Heterogeneous Ice Nucleation on α -Alumina (0001). *Atmos. Chem. Phys.* 2017, 17, 7827-7837. DOI: 10.5194/acp-17-7827-2017.

[2] Abdelmonem, A.; Backus, E. H. G.; Bonn, M. Ice Nucleation at the Water–Sapphire Interface: Transient Sum-Frequency Response without Evidence for Transient Ice Phase. *The Journal of Physical Chemistry C* 2018, DOI: 10.1021/acs.jpcc.8b07480.