Reply to Community Comment by Alexei Kiselev

Kiselev: Dr. Gabor Vali has very recently attracted my attention to the excellent experimental data set on isothermal freezing of droplets containing ambient INPs, presented in the manuscript by Jonas Jakobsson, Vaughan Phillips, and Thomas Bjerring-Kristensen. I have read it with great interest. I fully agree with the authors that the isothermal freezing experiments are scarce and the data sets containing such experimental data are valuable.

Response: We appreciate the comment here and thank Kiselev for the compliment.

Reviewer: For this reason, I would like to draw the authors' attention to the manuscript we have published in 2016, where we have investigated the freezing behavior of several feldspar specimens in immersion freezing in a droplet freezing assay setup (Peckhaus et al., ACP 2016). Owing to the large number of droplets in our droplet freezing assay setup, we could observe freezing of several hundreds of nL-sized droplets at constant temperature for an hour. Our observations have, in general, confirmed the conclusions of this manuscript: in a simple system containing only one type of ice nucleating active site, the freezing follows a strict exponential pattern, whereas in a heterogeneous system featuring broad or even multimodal distribution of IN active sites, a steady decrease of freezing rate over time is observed. Interestingly, we could account for all observed effects (time dilation of freezing rate, freezing behavior at constant cooling rate, and cooling rate dependency) by using a consistent set of fit parameters within a CNT-based model equation framework (the so-called Soccer-Ball Model, SBM, Niedermeier et al., 2014 and 2015).

Response: I struggle to see any observations published by Peckhaus et al. of a strict exponential decay of the liquid fraction for a simple system. Figure 7 of their paper shows a linear decrease on a log-log plot of liquid fraction and time. But an exponential decrease would need to display a linear decrease on a plot of log of liquid fraction vs time plotted linearly (ie. a straight line on a semilog plot). Their Figure 7, for feldspar samples, shows what we see, a power law (liquid fraction proportional to time to the power of a negative constant) an exponential decay with a relaxation time that increases with time (time dilation). The time for decrease by a certain fraction increases with time.

We agree that variability of amounts of INP material in each drop and of its nucleating efficiency of most active sites would cause such time dilation.

Reviewer: Given the size of our sample and relatively high level of control over the experimental conditions, the authors of this manuscript might be interested in applying their parameterization to our experimental data set, which we will be happy to share. In any case, a mention of the (Peckhaus et al., 2016) in the introduction would make the overview of the previous research more complete.

Response: Thank you for the idea. Yes, this seems to be worth trying, perhaps in a future paper.