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Micro-PINGUIN: microtiter-plate-based instrument for ice nucleation detection in gallium with an infrared camera

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Supplementary material

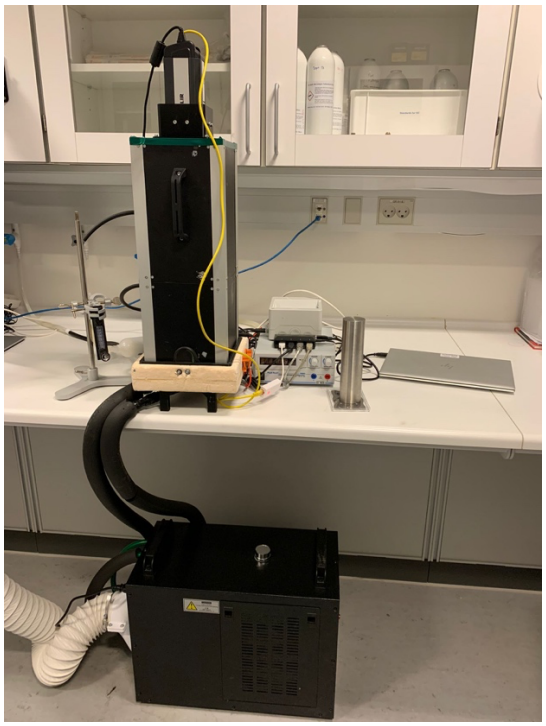

Figure S1: Photograph of the micro-PINGUIN instrument. The water cooling on the floor is attached to the cooling unit of the instrument. A camera tower with the infrared camera is positioned on top of the cooling unit and records the freezing events. The weight used to mount the PCR plate in the gallium is standing next to the computer.

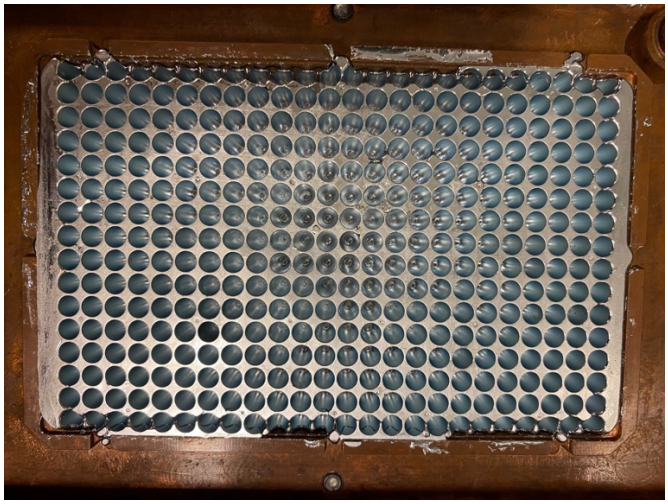

Figure S2: Photograph of the solid gallium after removing the PCR plate. The gallium adapts to the shape of the PCR plate during solidification.

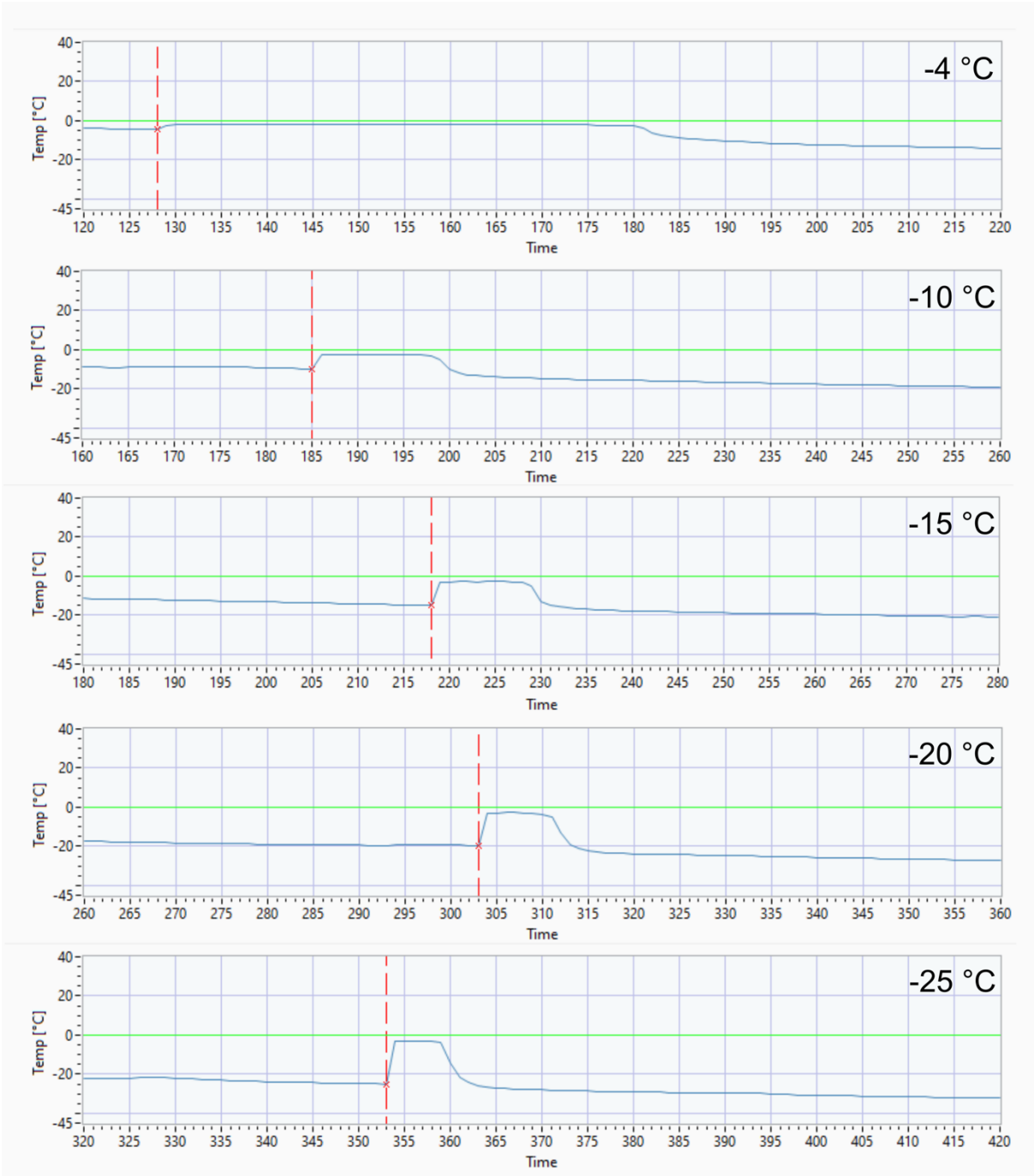

Figure S3: Temperature profiles recorded by the infrared camera for various freezing temperatures. The values on the x-axis have to be multiplied by 5 to obtain the time in seconds as infrared images are taken only every 5 seconds.

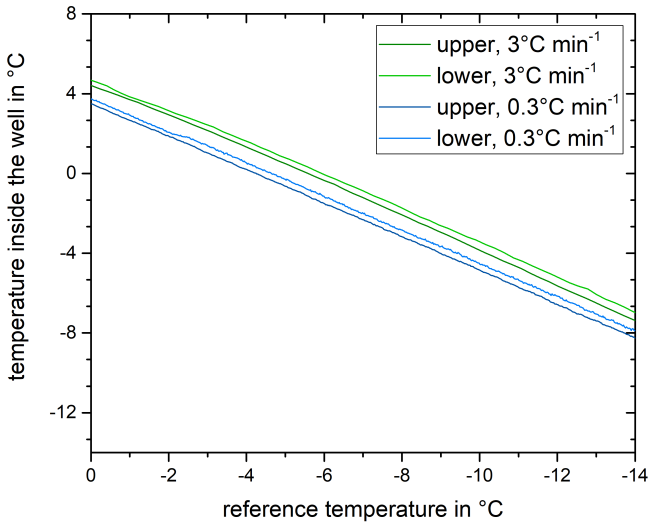

Figure S4: Vertical gradient measured at the top and the bottom of the central well with an external thin thermistor. The gradients are similar for the cooling rate of 0.3 °C min^{-1} and 3 °C min^{-1}.

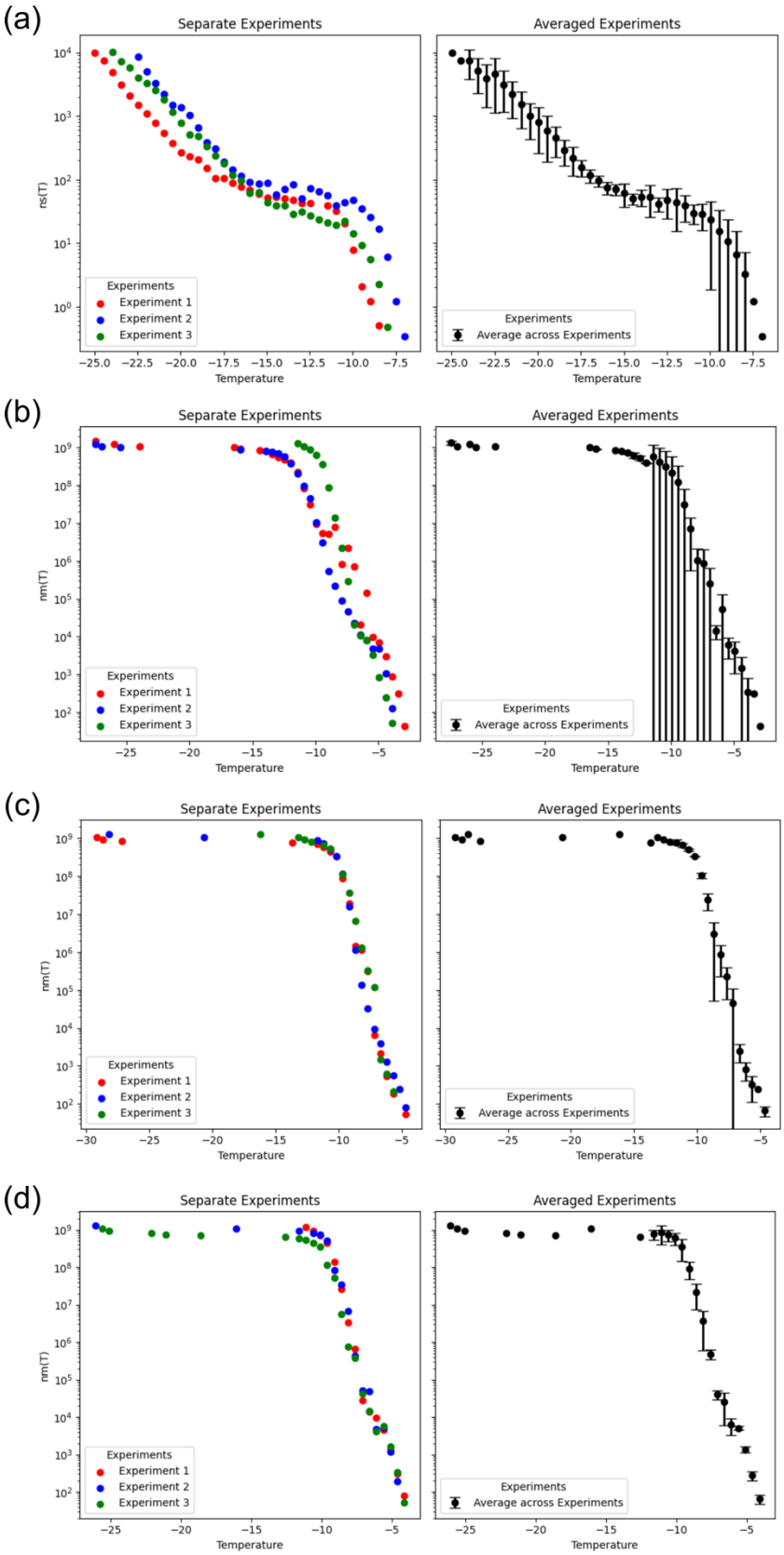

Figure S5: (a) Number of INPs per surface area for three Illite NX suspension measurements. Left: Data for individual experiments binned in 0.5°C temperature bins. Right: Average value and standard deviation between the three measurements. (b) – (d) same as in (a) but for the number of INPs per mg Snomax for three separately prepared suspensions (b), for three frozen aliquots from one suspension and (c) for one suspension divided in aliquots that are measured directly (experiment 1), frozen for 5min (experiment 2) and frozen for one day (experiment 3).

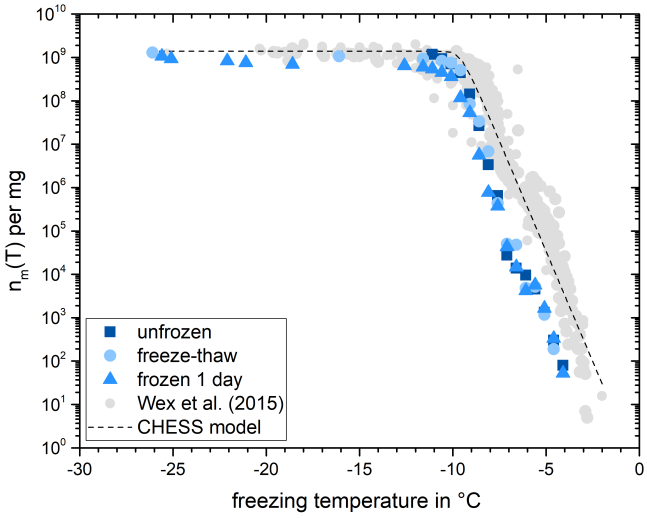

Figure S6: Effect of freezing and thawing on the ice nucleation activity of Snomax. The Snomax suspension was freshly prepared and divided into three aliquots. Two of the aliquots were frozen at -20 °C and one aliquot was measured directly (unfrozen). The second aliquot that was frozen for 5 min, thawed, and analyzed immediately (freeze-thaw). The third aliquot was analyzed after 1 day storage at -20 °C (frozen 1 day).

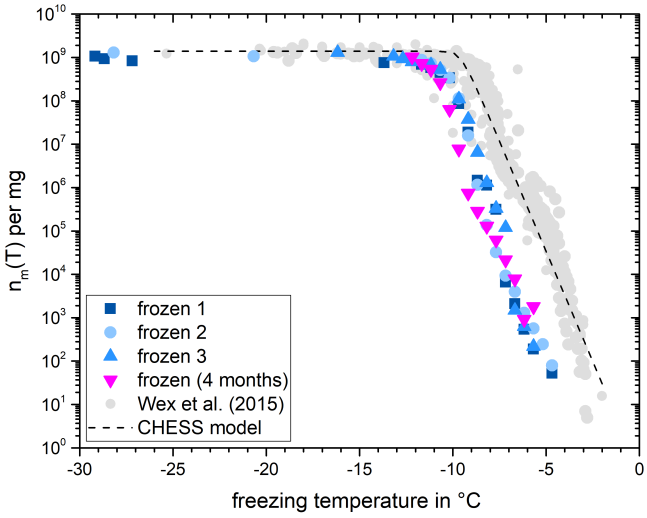

Figure S7: Number of INPs per mg Snomax for measurements with three frozen aliquots after 1 day storage at -20 °C (blue) and after 4 months storage (pink).

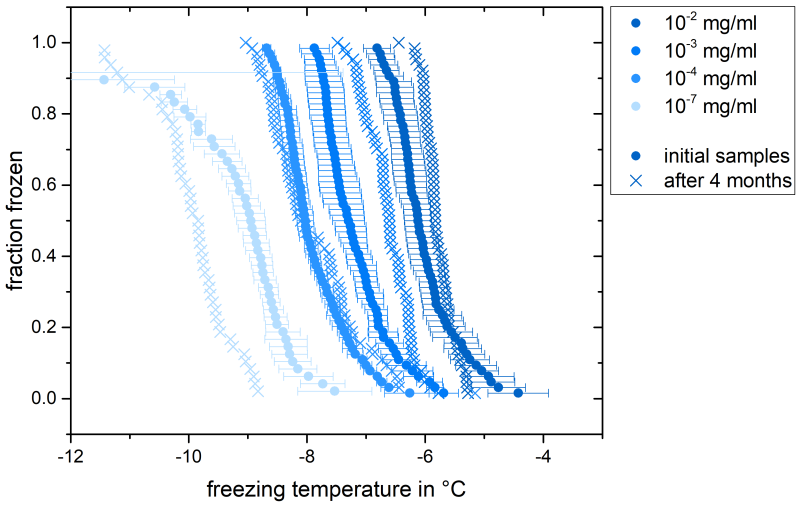

Figure S8: Effect of storage for the Snomax suspension. The round symbols show the average and standard deviation from three aliquots measured after 1 day storage in the freezer and the crosses show the results for one measurement after 4 months storage. The data for 10^{-5} mg ml^{-1} and 10^{-6} mg ml^{-1} are not shown for illustrative purposes.