Supporting information for: Periodic Ice-banding in Freezing Colloidal Dispersions

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Movie Captions

Movie S1: Approach to steady-state with periodic ice lenses for the pulling speed $V = 1\ \mu\mathrm{m\,s^{-1}}$ (a 4 cm by 3 cm section is shown). The first frame of this movie shows the suspension after it has been frozen from a fixed chill ($V = 0$).After the cell is put in motion, there is initially a single layer of segregated ice (black) forms and the rejected particles aggregate to form the dark-colored layer which thickens over time. Next, a light-colored band form ahead of the ice. This light band thickens until horizontal ice lenses begin to appear. Eventually, the dark layer reaches a constant thickness and the system reaches a steady state with ice lenses forming in regular intervals. Note that a vertical crack develops and persists throughout the movie. A close-up of the region where the ice lenses are forming is shown in Movie S4.

Movie S2: Approach to steady-state with disordered ice segregation for the pulling speed $V = 4$ $\mu\mathrm{m\,s^{-1}}$ (a 4 cm by 3 cm section is shown). In this case, the starting point of the movie is from a

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steady-state obtained at a higher freezing rate. The initially banded state transitions to a disordered state. A thin layer of aggregated particles (dark gray layer) is present in the new steady state.

Movie S3: Steady-state periodic ice-banding for the pulling speed $V = 8\ \mu\mathrm{m\,s^{-1}}$ (a 24 mm by 18 mm section is shown). The ice bands have a noticeably jagged appearance. The suspension appears to be uniform all the way down to the freezing zone (the circular striations are an artifact of the image processing). Near the end of the movie, a defect emerges and persists to form two vertical cracks.

Movie S4: Close-up of the supercooled (frozen fringe) region of freezing suspension showing the initiation of ice lenses at $V = 1\ \mu\mathrm{m\,s^{-1}}$. The supercooled region contains a vertical crack which is propagating along the temperature gradient at the imposed pulling speed. The ice lenses are initiated by fractures, which nucleate and terminate at vertical cracks or at the top of an existing ice lens.

Movie S5: Elastic response of the aggregated layer. This movie shows a thermistor probe entering the dark-colored layer. Once the thermistor reaches the top of the dark layer, stress is instantateously transmitted through the aggregated layer, generating new regions segregated ice in the supercooled (light-colored) region directly below the thermistor. The top of the dark layer becomes deformed as the thermistor moves towards the freezing zone.

Movie S6: Initiation of the light-colored layer (frozen fringe). As the system evolves towards a steady state, the light-colored layer is first initiated at several points in the aggregated suspension at the top of a segregated layer of ice. These points of origin spread laterally and merge into a continuous layer which advances ahead of the segregated ice until it approximately reaches the 0°C isotherm. The formation of the light-colored layer always preceeds the formation of ice lenses. Once steady-state is reached, the edge of the light-colored layer advances in stepwise manner.