

Abstract Submitted  
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**Lens and dendrite formation during colloidal solidification**<sup>1</sup> GRAE WORSTER, University of Cambridge, JIAXUE YOU, Northwestern Polytechnical University, China — Colloidal particles in suspension are forced into a variety of morphologies when the suspending fluid medium is frozen: soil is compacted between ice lenses during frost heave; ice templating is a recent and growing technology to produce bio-inspired, micro-porous materials; cells and tissue can be damaged during cryosurgery; and metal-matrix composites with tailored microstructure can be fabricated by controlled casting. Various instabilities that affect the microscopic morphology are controlled by fluid flow through the compacted layer of particles that accumulates ahead of the solidification front. By analysing the flow in connection with equilibrium phase relationships, we develop a theoretical framework that identifies two different mechanisms for ice-lens formation, with and without a frozen fringe, identifies the external parameters that differentiates between them and the possibility of dendritic formations, and unifies a range of apparently disparate conclusions drawn from previous experimental studies.

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