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The Freezing of Free Films ANTHONY ANDERSON, Northwestern University, STEPHEN DAVIS — We investigate the steady, longitudinal solidification of thin, free, liquid films of pure metallic melts. The dynamics of the liquid films are influenced by several factors when freezing is present: viscosity, capillarity, thermocapillarity, van der Waals instabilities, and flows resulting from volume-change upon solidification. Results are first established for a non-deformable liquid film. We investigate contact conditions, Gibbs-Thompson effects, and volume-change convection using perturbation and transform methods. The analysis is extended to a deformable liquid film. These results provide the foundation for further study of the dynamics and stability of thin liquid films during freezing. The implications of our results for the freezing of metallic foams is discussed and future directions for our work highlighted.

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