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Optical Measurements of Grain Boundary Melting ERIK THOMSON, Yale University, JOHN WETTLAUFER, Yale University, LARRY WILEN, Ohio University — Bulk properties of polycrystalline solids are strongly influenced by effects of grain boundary melting. While numerical simulations and theory support the idea of disorder along grain boundaries, direct experimental access to the interface of two crystals in thermodynamic equilibrium remains difficult. Polycrystalline ice, however, possesses unique properties which lend it to experimental probing. In addition to its transparency and birefringency the melting temperature of ice, which is relatively close to ambient temperatures, make it an ideal solid within which to experimentally explore grain boundary melting. Here using light scattering by a 4mW Helium-Neon laser we directly explore the boundary in an ice bicrystal, prepared within a thin ice growth cell. Reflected light intensity is measured as a function of the thermodynamic variables, temperature and impurity concentration. C-axis orientation of individual crystals can be determined by systematically measuring the difference between incident and transmitted polarized beams. Assuming the index of refraction for bulk water, for any melted layer, we anticipate a greater than 10% change in reflected signal strength for a 15 angstrom melt layer. Experimental results are compared with a recent theoretical study of impurity driven grain boundary melting.

Erik Thomson
Yale University

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