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Premelting Induced Decoupling as a cause of Nonclassical Rotational Inertia in Solid ^{4}He J.S. WETTLAUFER, Yale University, J.G. DASH, University of Washington — Recent reports by Kim and Chan describe the observation of nonclassical rotational inertia in solid ^4He, which is taken to demonstrate superfluidity of the solid. This exciting possibility was noted as a long standing speculation, based on the hypothesis of Bose-Einstein condensation of zero-point vacancies. Here we suggest an alternative explanation of the experiment: decoupling of the solid from the wall of the container by grain boundary premelting. However, the premelting in question is not at ordinary grain boundaries, but at the interface between the bulk solid and dense adsorbed layers at the container wall. The dense layers, due strong adsorption forces, are responsible for nonzero wetting angles between solid ^4He and copper and glass walls; the contacting surface in question more nearly resembles the interface between two different materials. In view of the sensitivity of premelting to the crystal structure of the solid, and the density difference between the solid and the adsorbed layers at the wall, we propose that premelting occurs at that interface. The reduction in the latent heat of fusion with decreasing temperature enhances the film thickness, which we calculate as function of the parameters of the Lennard-Jones potential to be nearly four atomic layers at the experimental temperatures of 175 mK.

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