Abstract Submitted
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Thermal Quenching and Pressure Gradients in Solid Helium[1] ABDUL SUHEL, JOHN BEAMISH, University of Alberta — Torsional oscillator measurements on solid ^{4}He show a frequency increase at low temperatures that suggests mass decoupling or "non-classical rotational inertia" (NCRI). The magnitude of the NCRI varies from about 0.02% to 20% in different oscillators, although the temperature dependence is essentially the same. The amount of mass which decouples appears to be larger when the helium is frozen and cooled rapidly. Annealing at high temperatures usually reduces the NCRI, with an accompanying drop in pressure, suggesting that defects are involved. We have built a cell to measure the temperature dependence of the pressure and the magnitude of pressure gradients in solid helium. The helium can be melted in a few seconds using a heater embedded in the crystal and can be refrozen and quenched to low temperature in about 10 seconds. From the maximum pressure differences in the cell, we infer a yield stress of order 0.1 bar for solid ^{4}He. The pressure gradients relax when the temperature is raised above about 0.5 K. We describe the temperature dependence of this annealing process.

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