

MAR11-2010-002276

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Dynamics, Defects and Deformation in Solid Helium¹

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The shear modulus of solid ^4He shows remarkable softening above 100 mK, the same temperature range in which the apparent supersolid disappears in torsional oscillator experiments. We have measured helium's shear modulus and dissipation at frequencies from 0.5 to 8500 Hz. The onset temperature for softening/stiffening is broad, frequency dependent, and is accompanied by a dissipation peak - features typical of a dynamical crossover in a disordered system rather than a true phase transition. This behavior can be qualitatively explained if dislocations are mobile at high temperatures but are pinned by ^3He impurities below 100 mK. To better understand the role of dislocations, we have plastically deformed crystals by rapid thermal quenching and used pressure gradient measurements to study subsequent annealing. In our most recent experiments we have sheared solid helium mechanically and looked at the effect of large deformations on the helium's elastic properties.

¹This work was supported by NSERC