Abstract Submitted
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Critical dislocation speed in ^{4}He crystals[1] JOHN BEAMISH, Univ of Alberta, ARIEL HAZIOT[2], ANDREW FEFFERMAN, FABIEN SOURIS, SEBASTIEN BALIBAR, Ecole Normale Superieure, HUMPHREY MARIS, Brown Univ — Our experiments show that in ^{4}He crystals, the binding of ^{3}He impurities to dislocations does not necessarily imply their pinning. In these crystals, there are two different regimes in the motion of dislocations with impurities bound to them. At low driving strain ε and frequency ω, where the dislocation speed is less than a critical value (45 μm/s), dislocations and impurities apparently move together. Impurities really pin the dislocations only at higher values of $\varepsilon\omega$. The critical speed separating the two regimes is two orders of magnitude smaller than the speed of free ^{3}He impurities in the bulk crystal lattice. We obtained this result by studying the dissipation of dislocation motion as a function of the frequency and amplitude of a driving strain applied to a crystal at low temperature. Our results resolve an apparent contradiction between experiments that showed a frequency-dependent transition temperature from a soft to a stiff state, and other experiments or models where this temperature was assumed to be independent of frequency. The impurity pinning mechanism for dislocations appears to be more complicated than previously assumed.

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