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Dislocation motion in solid hcp ^{3}He[1] JOHN BEAMISH, ZHI GANG CHENG, University of Alberta — At temperatures above about 100 mK, dislocations reduce the shear modulus of hcp ^{4}He by as much as 90%. This occurs when dislocations thermally unbind from the ^{3}He impurities that pin them, becoming extraordinarily mobile. The elastic softening is accompanied by a thermally activated dissipation peak due to the ^{3}He impurities. At higher temperatures the dissipation has an ωT^4 dependence caused by scattering of thermal phonons from moving dislocations. Previous measurements on the fermi solid, hcp ^{3}He, showed a similar dislocation softening, but the corresponding dissipation was not measured. We have extended these measurements by measuring the temperature, amplitude and frequency dependence of both the shear modulus and the dissipation in hcp ^{3}He. The dissipation behavior is very different from that of hcp ^{4}He. Neither the impurity unbinding peak associated with the elastic softening, nor the high temperature phonon scattering dissipation, were observed. Instead, there is a large and non-thermally activated dissipation which is largest at low frequencies. We believe that this unexpected dissipation is associated with a new dislocation damping mechanism in ^{3}He, perhaps associated with spin rearrangements caused by moving dislocations.

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