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Elastic properties of polycrystalline aluminum and silver films down to 6 mK[1] ANDREW FEFFERMAN[2], ROBERT POHL, JEEVAK PARPIA, Cornell University — Many mechanical resonators, from nanoscale beams to gravitational wave detectors, are coated with polycrystalline or amorphous films, and it is important to understand the contribution of the film to the elastic properties of the composite structure. We have made elastic measurements on high purity micron-thick polycrystalline aluminum and silver films with the double paddle resonator technique, using a single crystal silicon substrate with internal friction $Q^{-1} \approx 2 \times 10^{-8}$ below a few kelvin. We observed large $Q^{-1} \approx 10^{-4}$ in both films, indicating that these films can contribute substantially to the damping of mechanical resonators, even at very low temperatures. In aluminum, we also observed remarkable agreement between the relative change in sound speed $\delta v/v_0$ and Q^{-1} of the aluminum and the predictions of the tunneling model for an amorphous superconductor well below T_c. This agreement might be due to tunneling of dislocation kinks in a modulated kink-Peierls potential. However, previous measurements on polycrystalline bulk metal and films have shown that other glassy properties such as the thermal conductivity and heat capacity are not in agreement with the tunneling model predictions.

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