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Low-temperature internal friction in quenched amorphous selenium films[1] THOMAS METCALF, XIAO LIU, Naval Research Laboratory, MATTHEW ABERNATHY, NRC Postdoc, RICHARD STEPHENS, University of Pennsylvania — Using ultra-high-quality-factor silicon mechanical resonators, we have measured the internal friction and shear modulus of amorphous selenium (a-Se) films at liquid helium temperatures. The glass transition temperature of selenium lies at a conveniently accessible $40 - 50°$C, facilitating a series of in- and ex-situ annealing and quench cycles. The a-Se films exhibit the low-temperature internal friction plateau ($10^{-4} \leq Q^{-1} \leq 10^{-3}$) found in almost all amorphous solids, which is a result of (and direct measure of) a broad distribution of two-level tunneling systems (TLS), whose origin is still unknown. We find a clear correlation between the post-anneal quench rate and the value of this plateau. The implications of these observations for understanding the microscopic origin of TLS will be discussed. Principally, the observed changes in the internal friction plateau could show the way in which the density of TLS could be manipulated or suppressed in other amorphous systems.

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