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High pressure, high strain rate material strength experiments in Ta and V using the Rayleigh-Taylor instability[1] BRUCE A. REMINGTON, Lawrence Livermore National Laboratory — Constitutive models for material strength are currently being tested at 1 Mbar pressures by comparing 2D simulations with experiments measuring the Rayleigh-Taylor (RT) instability evolution in solid state samples of vanadium (V) and tantalum (Ta) [1,2]. The multiscale strength models being tested combine molecular dynamics, dislocation dynamics, and continuum simulations. Our analysis for the V experiments suggests that the material deformation at these conditions falls into the phonon drag regime, whereas for Ta, the deformation is due to a mix of phonon drag and thermal activation. Using the Ta multiscale model, we decompose the strength as a function of strain rate into its components of thermal activation, phonon drag, and work hardening, and show where each mechanism is predicted to dominate. This predicted decomposition becomes particularly interesting at the 5 Mbar conditions that correspond to the first NIF experiments, that will commence in the near future. [1] H.S. Park et al., PRL [3] 104, 135504 (2010); PoP 17, 056314 (2010). [2] N.R. Barton et al., JAP, in press (2011).

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