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Comparing Hydrodynamic simulations to Rayleigh-Taylor Instability Experiments at High pressure and at high strain rates for tantalum: constraining strength models* DANIEL ORLIKOWSKI, A. ARSENLIS, N. BARTON, L.R. BENEDETTI, Lawrence Livermore Natl Lab, A. COMLEY, Atomic Weapons Establishment, UK, C.M. HUNTINGTON, J.M. MCNANEY, H.S. PARK, S.T. PRISBREY, D. SWIFT, S.V. WEBER, R.E. RUDD, C.E. WEHRENBERG, Lawrence Livermore Natl Lab — High pressure strength modeling has long been an outstanding problem affecting many design applications, like inertial confinement fusion experiments. Recently Rayleigh-Taylor Instability (RTI) experiments on tantalum at pressures (>3 Mbar) and at strain rates ($\sim 10^7$ s^{-1}) have been achieved at National Ignition Facility. These highly resolved measurements of the early growth of the sinusoidal perturbations in Ta are compared to hydrodynamic simulations with different strength models and parameters. At LLNL we have developed a multi-scale strength (LMS) model based on calculations and simulations spanning length scales from atomistic, to dislocations, to continuum. Simulations of the RTI based on the LMS model are comparable to the experimental growth factors at modest pressures ($\sim$ 1 Mbar), whereas traditional strength models are too weak to capture the RTI growth. However, current experimental growth factors at >3 Mbar indicate that the parameterization from lower pressures is not adequate to simulate these higher pressure experiments. We discuss here the insights that these experiments provide to our high pressure strength modeling effort. *Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA273

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