Abstract Submitted
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Experimental studies of material strength in the high energy density regime[1] HYE-SOOK PARK, N. BARTON, C. HUNTINGTON, A. KRYGIER, B. REMINGTON, R. RUDD, P. POWELL, S. PRISBREY, D. SWIFT, C. WEHRENBERG, A. ZYLSTRA, J. MCNANEY, Lawrence Livermore Natl Lab, M. HILL, Atomic Weapons Establishment — A solid material can be placed in the high energy density regime by compressing it to pressures >1 Mbar using a laser driven plasma piston drive. We create a ramped laser drive that keeps the material in the solid state during compression without shock melting. Understanding plastic deformation dynamics of materials under these extreme conditions is of high interest to a number of fields, including meteor impact dynamics and advanced inertial confinement fusion. We infer the strength of Ta, Pb [1,2] and Fe at high pressures (upto 8 Mbar), high strain rates (˜10^7 s^{-1}) and high strains (>30%) by measuring the growth of Rayleigh-Taylor instabilities (RTI) under ramped compression. We find that the RTI growth for materials in the solid state, compressed under high pressure and high strain rates, is reduced compared to the no-strength case. We will describe the experimental results from NIF and compare them to various strength models. [1] H. -S. Park et al., Phys. Rev. Lett. 114, 065502 (2015). [2] A. Krygier et al., Phys. Rev. Lett., submitted (2019).

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