Abstract Submitted
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Experimental results of Ta material strength and grain size effect at high pressure and high strain rate[1] HYE-SOOK PARK, N. BARTON, R. CAVALLO, B. MADDOX, M. MAY, S. POLLAINE, S. PRISBREY, B. REMINGTON, R. RUDD, Lawrence Livermore National Lab — We are studying material strength under high pressures (>1 Mbar) and high strain rates (10^6 - 10^8 $\sec^{-1}$) in Ta using Omega lasers. The Ta sample is maintained in the solid state throughout a quasi-isentropic ramped drive using a reservoir-gap-sample configuration. The strength is inferred from the growth measurements of the pre-imposed sinusoidal ripples on the sample via Rayleigh-Taylor (RT) instability properties. The material strength can greatly suppress RT growth rate via an effective lattice viscosity [1]. Our recent experiments include the study of any grain size dependence of strength under these high pressures and strain rates. The conventional Hall-Petch effect predicts that smaller grain sizes correspond to stronger materials. There are neither existing experimental data nor theoretical predictions of the expected Hall-Petch effect under the extreme conditions of our RT experiments. Three different samples of 0.25 μm, 15 μm and 90 μm average grain sizes are fabricated and their corresponding RT-induced ripple growth factors are measured. The details of the measurements, target characteristics, analysis, and final results will be presented. Designs that extend this experiment by an order of magnitude in pressure on NIF will also be shown [1] H. S. Park et al., PRL. 104, 135504 (2010).

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