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Experimental Results of High Pressure and High Strain Rate Tantalum Flow Stress on Omega and NIF[1] HYE-SOOK PARK, A. ARSENLIS, N. BARTON, L. BENEDETTI, C. HUNTINGTON, J. MCNANEY, D. ORLIKOWSKI, S. PRISBREY, B. REMINGTON, R. RUDD, D. SWIFT, S. WEBER, C. WEHRENBERG, Lawrence Livermore Natl Lab, A. COMLEY, Atomic Weapons Establishment — Understanding the high pressure, high strain rate plastic deformation dynamics of materials is an area of research of high interest to planetary formation dynamics, meteor impact dynamics, and inertial confinement fusion designs. Developing predictive theoretical and computational descriptions of such systems, however, has been a difficult undertaking. We have performed many experiments on Omega [1], LCLS and NIF to test Ta strength models at high pressures ($\sim$ up to 4 Mbar), high strain rates ($\sim 10^7$ s^{-1}) and high strains (>30%) under ramped compression conditions using Rayleigh-Taylor and Richtmyer-Meshkov instability properties. These experiments use plasma drive to ramp compress the sample to higher pressure without shock-melting. We also studied lattice level strength mechanisms under shocked compression using a diffraction-based technique. Our studies show that the strength mechanisms from macro to micro scales are different from the traditional strength model predictions and that they are loading path dependent. We will report the experimental results.

[1] H. –S. Park et al., Phys. Rev. Lett. 114, 065502 (2015).

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