Results of Rayleigh-Taylor strength experiments at high pressure and high strain rates on NIF and Omega*

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Understanding the high pressure, high strain rate plastic deformation dynamics of materials is an area of research of high interest to a number of fields, including meteor impact dynamics and advanced inertial confinement fusion designs. Developing predictive theoretical and computational descriptions of such systems, however, has been a difficult undertaking. We have performed many strength experiments on Omega [1] and NIF to test Ta strength models at high pressures (upto 8 Mbar), high strain rates (~10^7 s^{-1}) and high strains (> 30%) under ramped compression condition using Rayleigh-Taylor instability properties. Our studies show that the work hardening dominates in this regime. We will describe the experimental results of the high pressure, high rate plastic deformation dynamics of tantalum from Omega and NIF in comparison with the various strength models including Livermore Multiscale Model [2].

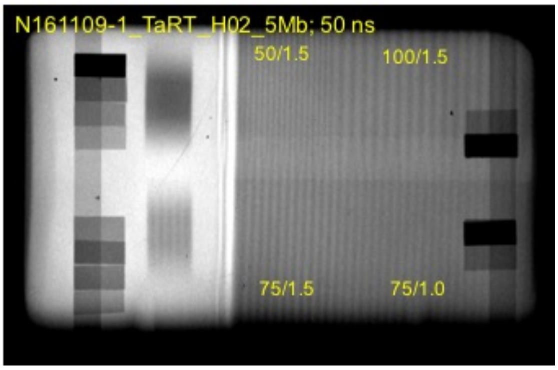

Figure 1: Drive tantalum ripple radiography at 5 Mb peak pressure. There are four different ripple recipes of ripple patterns to further constrain the strength models in addition to the step wedge an x-ray knife edge to calibrate radiometric response and spatial resolution of the image.

[1] H. –S. Park et al., Phys. Rev. Lett. 114, 065502 (2015).
[2] N. Barton, et al., J. App. Physics, 109, 073501 (2011).

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