SHOCK15-2015-000627

Abstract for an Invited Paper
for the SHOCK15 Meeting of
the American Physical Society

New regimes of plastic flow at very high pressures and strain rates[1]

BRUCE REMINGTON, Lawrence Livermore National Laboratory

Recent progress in understanding solid-state plastic flow at very high pressures and strain rates for high energy density (HED) science will be described. These results are relevant to hypervelocity impacts, space hardware durability, planetary formation dynamics, advanced designs for inertial confinement fusion, and basic HED science. We use high power lasers to study the Rayleigh-Taylor and Richtmyer-Meshkov hydrodynamic instability evolution in the solid state plastic flow regime on the Janus, Omega, and NIF lasers, spanning peak pressures from 10 – 500 GPa (0.1 – 5 Mbar). We are pursuing time resolved diffraction experiments to understand the lattice level dynamics resulting from high rate compression of samples. EXAFS experiments probe the atomic level structure and phase, and provide a volume-averaged temperature. We use the very bright, high time resolution x-ray probe at LCLS to examine the detailed lattice response and time evolution right behind the shock front. And finally, shock driven samples are recovered so that the residual microstructure caused by the shock can be examined by SEM, TEM, and other characterization techniques. An overview of these recent results, with comparisons to theory and simulations, will be given.

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.