1st TMS/ABM International Materials Congress TMS CO-ORGANIZADOR
ANAIS PROCEEDINGS ISSN 1516-392X

MATERIAL DEFORMATION DYNAMICS AT ULTRAHIGH PRESSURES AND STRAIN RATES

Bruce Remington[1]

Abstract

Solid state dynamics experiments at extreme pressures, P >1000 GPa, and strain rates(106-107 s-1)are being developed for the NIF laser. The experimental methods are being developed on the Omega, EP, and Jupiter laser facilities. Velocity interferometer(VISAR)measurements establish the ramped, high pressure conditions. Recovery experiments offer a look at the residual microstructure. Dynamic Laue diffraction measurements allow phase and possibly defect density to be dynamically inferred. Dynamic Bragg or Laue diffraction allow an estimate of shear stress(strength)at the lattice level to be inferred. Constitutive models for material strength are currently tested at ~Mbar pressures by comparing 2D simulations with experiments measuring the Rayleigh–Taylor instability evolution in solid state samples of vanadium(V)and tantalum(Ta). New multiscale models for V and Ta, combining MD, DD, and continuum simulations is tested. Our analysis for the vanadium experiments suggests that the material deformation at these conditions falls into the phonon drag regime. We also make an estimate of the(microscopic)phonon drag coefficient, by relating to the(macroscopic)effective lattice viscosity.

1 Lawrence Livermore National Laboratory.