DPP12-2012-001821

Abstract for an Invited Paper
for the DPP12 Meeting of
the American Physical Society

The evolution of a radiative shock system in a high-energy-density regime

CAROLYN KURANZ, University of Michigan

Radiative shocks, which are in a regime where most of the incoming energy flux is converted into radiation, occur in astrophysical systems as well as inertial confinement fusion experiments. This type of shock can be created in a laboratory using a high-powered laser. We have performed experiments on the Omega laser facility that irradiate a 20 μm thick Be disk with about 4 kJ of laser energy in a 1 ns pulse for an overall laser irradiance of $\sim10^{15}$ W/cm^2. The ablation pressure creates a 40 Mbar shock in the Be, which breaks out into Xe or Ar gas at 1.1 atm. The gas is shocked and accelerated and can reach velocities of over 130 km/s. At such high velocities the radiative fluxes become significant, which leads to extensive radiative cooling. The cooling of the shocked material causes compressions of about 20, which are higher than the typical hydrodynamic shock. Diagnostics for this experiment have included streaked and imaging x-ray radiography, optical pyrometry, VISAR and x-ray Thomson scattering. Experimental results to be presented include observations ranging from shock breakout of the Be disk at about 0.5 ns until 26 ns after the laser pulse is initiated. The data will be compared to results from the 3D radiation-hydrodynamic code developed at our Center for Radiative Shock Hydrodynamics. A thorough understanding of the uncertainties in these data is important to our project; these will be discussed. This work is funded by the Predictive Sciences Academic Alliances Program in NNSA-ASC via grant DEFC52- 08NA28616, by the NNSA-DS and SC-OFES Joint Program in High-Energy-Density Laboratory Plasmas, grant number DE-FG52-09NA29548, and by the National Laser User Facility Program, grant number DE-NA0000850.