Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Novel Feed-through Richtmyer-Meshkov Instability (RMI) Experiment for Characterization of Dynamic Material Response[1] SAUL OPIE, SUDRISHTI GAUTAM, ELIZABETH FORTIN, JENNA LYNCH, Arizona State University, ERIC LOOMIS, Los Alamos National University, PEDRO PERALTA, Arizona State University — Hydrodynamic instabilities occur often in applications where forces act across a bimaterial interface. In Rayleigh-Taylor (RT) instabilities, surface perturbations grow exponentially under opposing pressure and density gradients. In the closely related Richtmyer-Meshkov (RM) instability, the same perturbations grow linearly due to an impulsive acceleration, e.g., a passing shock wave. These effects are often analyzed with linear fluid theory, but it is well known that for materials possessing shear strength the perturbation evolution can be significantly affected. A challenge in modeling these effects is that existing knowledge of the interplay between strength and hydrodynamic instabilities in solids is limited for the loads and strain rates that are typically used to study them. We have developed novel feed-through RM instability experiments that are useful to understand and model this interplay. We will describe the experimental setup and show simulations that agree well with experimental results in two materials, one-phase copper, and iron loaded above and below the alpha-epsilon phase boundary, where modeling used a phase-aware strength model. In copper, the growth of surface perturbations is quite sensitive to strength model parameters, and so is the amplitude of the shock front perturbations. This is also observed in iron, along with an additional sensitivity in the modeling results to the parameters used to describe phase change kinetics.

[1]Work supported by Department of Energy (DOE) [grant number DE-SC0008683] from the Office of Fusion Energy Science.

Saul Opie
Arizona State University

Date submitted: 06 Nov 2015 Electronic form version 1.4