Abstract Submitted for the DFD12 Meeting of The American Physical Society

Effects of Initial Conditions on Rayleigh-Taylor Instability in Elastic-Plastic Materials¹ PAMELA ROACH, Missouri University of Science & Technology, Rolla, MO, ARINDAM BANERJEE, Lehigh University, Bethlehem, PA — In contrast to Newtonian fluids, experimental study of Rayleigh Taylor instability (RTI) in accelerated solids is traditionally hindered by difficulty to measure material properties and exceedingly small time scales of the processes. When an elastic-plastic solid is accelerated due to a density gradient, the instability is dependent on the material's mechanical strength, initial conditions, and acceleration that drive the instability. RTI in solids is observed in supernovas, explosive welding, and inertial confinement fusion. A novel experimental technique is used to study the effects of initial conditions and variable accelerations on the growth and instability in an elastic-plastic solid. The experiment consists of a container filled with air and mayonnaise, a non-Newtonian emulsion, with an initial perturbation between the two materials. Single mode perturbations of various amplitudes are analyzed and effects of two-dimensional versus three-dimensional interfaces are discussed. Furthermore, the instability threshold and stable elastic and plastic regions are investigated by controlling the acceleration. The instability threshold and perturbation growth rate are compared to linear analysis of incompressible RTI.

¹The authors acknowledge financial support through DOE-LANL subcontract # 173667-1.

Arindam Banerjee Lehigh University, Bethlehem, PA

Date submitted: 07 Aug 2012

Electronic form version 1.4