Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Mesoscale Simulations of the Shock and Release of an Aluminum-Polymer System JOHN BORG, Marquette University, RUSS MAINES, Eglin Air Force Base, RAYMOND RYCKMAN, Jacobs Technology, Inc. TEAS Group, LALIT CHHABILDAS, Eglin Air Force Base — Fundamental questions remain in developing a more complete understanding of the dynamic behavior of heterogeneous materials; the development of which is complicated by a lack of experimental data at the mesoscale. Whereas experiments measure the bulk response, mesoscale simulations facilitate a more complete understanding of the system's response. In this work mesoscale simulations were used to explore the dynamic response of aluminum foam filled with polyvinylidene fluoride (PVDF) over a range of impact velocities from 350 to 2220 m/s (20 GPa). The results are compared to experiments. The simulated bulk Hugoniot states agree with experiments; the distribution of stress and temperature along the Hugoniot will be presented. The release paths however are more sensitive to the polymer's equation of state (EOS). Like other polymers, PVDF exhibits a variety of complicated responses including a non-linear shock velocity-particle velocity Hugoniot especially at low particle velocities, a low melt temperature, a polymorphic phase transformation near 30 GPa and possibly an increase in the Grueneisen parameter with an increase in density. An EOS for PVDF that includes all of these phenomena was constructed; the result improved the simulated release paths when compared to the experimentally measured release paths. The effect of each phenomena on the shock and release will be presented; the Grueneisen parameter had the strongest affect on release.

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Date submitted: 25 Feb 2013 Electronic form version 1.4