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Shock compression response of model polymer/metal composites[1]
DAVID BOBER, Lawrence Livermore National Laboratory, YOSHI TOYODA, Washington State University, BRIAN MADDOX, MATTHEW BARHAM, ERIC HERBOLD, Lawrence Livermore National Laboratory, YOGENDRA GUPTA, Washington State University, MUKUL KUMAR, Lawrence Livermore National Laboratory — Heterogeneous materials do not respond mechanically to an impulse in the manner of homogeneous metals and alloys. The propagation of a wave in a microstructure with chemically distinct identities, that are only in incidental contact with each other, is a complex process and also poorly understood. Here we will report on a series of gas gun plate-impact experiments on a polymer-metal composite, where the volume fraction of the metallic phase is systematically varied from 0 to 40%, while other parameters like the sample thickness is kept a constant. A range of impact velocities was employed and the free surface velocity was interrogated to get a continuum measure of the internal materials processes. These results were then compared to the results of highly resolved mesoscale calculations to understand the wave propagation and visco-plastic effects that were observed in the experimental observations. The unfilled Si-polymer demonstrated a steady single wave shock response; whereas the wave profiles obtained from mixture samples showed structures at the onset of wave that depended on the volume fractio of the fill.

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