Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

In situ observation of material flow in composite media under shock compression[1] DAVID BOBER, JONATHAN LIND, MUKUL KUMAR, Lawrence Livermore National Laboratory — Internal reverberation, multiphase drag, and particle-particle force transfer determine the rate of compression in a shock loaded particulate composite. Since it is nearly impossible to deconvolve these effects using bulk velocimetry data, it has been difficult to develop models or simulations capable of predicting the outcome of novel compositions or loading scenarios. Instead of trying to solve this difficult inverse problem, we have conducted in situ radiography to directly observe the evolving internal configuration of an impact loaded composite with enough spatiotemporal resolution to build accurate direct numerical simulations. Tracking the motion of individual particles with nanosecond precision reveals how momentum transfer proceeds between the phases. This is complemented by measurements of the flow field in the surrounding polymer. Using dense tungsten particles embedded in a soft/light polymer matrix creates a strong impedance mismatch and a useful model system in which to explore shear mediated effects. These observations make it possible to parametrize a simple shear resistance model for the polymer matrix at the extreme pressures and strain rates encountered. This in turn leads to simulations of the bulk composite that better reproduce conventional velocimetry results.

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

David Bober
Lawrence Livermore Natl Lab

Date submitted: 01 Mar 2019 Electronic form version 1.4