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In-situ probing of Low Density Porous Materials

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The shock response of porous materials is of interest in High Energy Density Physics because the PdV heating from void closure allows off principle Hugoniot states for modeling many astrophysical processes. While continuum models exists of shockwave propagation in foams the relevant physical phenomena spans three different length scales: the micro-length scale defined by the pore size and length between solid structures in the foam (10 to 1000nm), the shock front thickness which determines material and energy flow (0.1 to 100nm), and the hydrodynamic length scale associated with the expanding spherical wave (>10 μm), all of which impact the shock response of the low density foam. With the advent of new HED experimental facilities for generating shockwaves at x-ray light sources this gives new tools for performing pump probe experiments to understand the microstructural response of low density materials. Currently, we have used x-ray radiograph to make Hugoniot EOS measurements the of shock compressed low density SiO2 and Carbon based foams. We will show recent result of measurements of experiments conducted on the Omega laser facility and discuss imaging shockwaves in low density foams on the soon to be commissioned DCS end station at APS and the MEC end station at LCLS. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.