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Shockwave interactions with additively-manufactured polymer structures DANA DATTELBAUM[1], BRITTANY BRANCH[2], BRIAN PATTERSON[3], AXINTE IONITA[4], Los Alamos National Laboratory, LOS ALAMOS NATIONAL LABORATORY TEAM — Control of structural topology, via a bottom-up approach, is now possible through the continuing maturation of additive manufacturing techniques. For example, new classes of porous materials with increased strength-to- density ratios, novel thermal and acoustic properties, and even "metamaterial" properties such as negative Poisson ratios have been recently realized by tailoring deformation mechanisms and structural instabilities. *It is the control of organizing features at the mesoscale that has led to a revolution in tailoring materials' mechanical properties and function.* However, extensions to dynamic, high strain rate, large strain conditions have been scarcely explored. Here we will present the results of traditional plate impact methods applied to organized polymer architectures, using velocimetry and x-ray phase contrast imaging at the Advanced Photon Source. These methods allowed for the characterization of the mechanisms of shock wave propagation, localization, and compaction in the structures. In particular, we have investigated the role of interfaces on stress localization within the structures. The experimental results will be discussed in the context of finite element simulations of the same structures, including progress on topological optimization for desired dynamic response.

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