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Shock Propagation and Deformation of Additively-Manufactured Polymer Foams with Engineered Porosity DAVID LACINA, University of Dayton Research Institute, CHRISTOPHER NEEL, Air Force Research Laboratory-RWMW, JONATHAN SPOWART, Air Force Research Laboratory-RXCCM, GEOFFREY FRANK, ANDREW ABBOTT, University of Dayton Research Institute, BRITTANY BRANCH, Los Alamos National Laboratory — Additively-manufactured (AM) polymeric structures containing multiple length scales of engineered porosity have been developed to promote enhanced shock dissipation and shockwave propagation directionality (i.e. a "shock diode"). Light gas-gun planar impact studies of both cube-shaped and asymmetrically shaped specimens, with porosities built in different "fractal" geometries, have been carried out. Equation of State information, in-situ particle velocity profiles, and deformation histories were obtained using photon Doppler velocimetry (PDV), embedded electromagnetic gauges, and high-speed video, respectively. The results of this work show that certain asymmetrical fractal geometries do induce a degree of directionality in shockwave propagation. Anisotropy in the Hugoniot for some of these AM polymeric structures was also observed and has been attributed to AM print orientation. This data has been used to validate a finite element analysis model for the dynamic impact of printed solids. These results also provide information which AM manufacturing can use to tune shock properties of AM printed structures to obtain more favorable shock response behavior.

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