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High-density Polyethylene Damage at Extreme Tensile Conditions ERIC BROWN, JEVAN FURMANSKI, KYLE RAMOS, DANA DATTELBAUM, BRIAN JENSEN, Los Alamos National Laboratory, ADAM IVERSON, CARL CARLSON, National Security Technologies LLC, KAMEL FEZZAA, APS, Argonne National Laboratory, CARL TRUJILLO, DANIEL MARTINEZ, GEORGE GRAY, BRIAN PATTERSON, Los Alamos National Laboratory —
In situ and post mortem observations of the dynamic tensile failure and damage evolution of high-density polyethylene (HDPE) are made during Dynamic-Tensile-Extrusion (Dyn-Ten-Ext) loading. The Dyn-Ten-Ext technique probes the tensile response of materials at large strains (>1) and high strain-rates (>10,000/s) by firing projectiles through a conical die. Depending on the extrusion ratios and velocities, HDPE damage varies from gross deformation with substantial internal damage, to a stable jet with finite particulation, to catastrophic fragmentation. Postmortem sectioning elucidates a mechanism of internal damage inception and progression oblique to the extrusion axis. X-ray computed tomography corroborates a shear damage mechanism with an internal damage zone aligned with the extrusion axis. In situ measurements of damage are made with the impact system for ultrafast synchrotron experiments (IMPULSE) designed for using the advanced imaging and X-ray methods available at the Advanced Photon Source. Time resolved phase-contrast imaging elucidates the evolution of damage features during dynamic loading that is observed in post mortem sectioning and tomography.

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