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Dynamic-Tensile-Extrusion of Polyurea JEVAN FURMANSKI, CARL CADY, PHILIP RAE, CARL TRUJILLO, G.T. GRAY III, ERIC BROWN, Los Alamos National Laboratory — Polyurea was investigated under Dynamic-Tensile-Extrusion (Dyn-Ten-Ext) loading where spherical projectiles were propelled at 440-509 m/s through an extrusion die with an area reduction of 87%. Momentum of the leading edge imposes a rapid tensile deformation on the extruding material. Polyurea is an elastomer with outstanding high-rate tensile performance of interest in the shock regime. Previous Dyn-Ten-Ext work on semi-crystalline polymers (PTFE, PCTFE) resulted in small-scale fragmentation of the polymer, and did not provide clear information on the evolution of tensile damage in those materials. The polyurea behaved very differently; the polymer first extruded a jet of apparently intact material, which then broke down via void formation and coalescence, followed by fibrillation and tearing of the material. Most of the material in the jet elastically retracted back into the die, and only a few fragments of torn material were liberated from the sample. The surface texture of all failed surfaces was rough indicating a considerable amount of energy was absorbed by sub-critical failure mechanisms. It is interesting to note that while damage nucleation appeared pervasive in the extruded jet, the samples were nevertheless recovered largely intact, with limited fragmentation.

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