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Simulation of Polyurea Shock Response under High-Velocity Microparticle Impact JOSHUA GORFAIN, CHRISTOPHER KEY, Applied Physical Sciences Corp., DAVID VEYSSET, Institute for Soldier Nanotechnologies, MIT, KEITH NELSON, Department of Chemistry, MIT — On-going research into the complexities of polyurea behavior under shock loading has led to some breakthroughs in the predictive simulation of how this nominally soft polymer responds under high velocity impact conditions. This work expands upon a previously reported modified pressure-dependent viscoelastic constitutive model for polyurea and its performance under ballistic impact. Specifically, we present recent enhancements to the model including nonlinearites in the Hugoniot and improvements in the high-temperature viscoelastic behavior, which substantially improved accuracy and extended the models range of applicable conditions. These improvements are demonstrated through correlation of computations for a suite of normal and pressure-shear plate impact experiments well documented in the open literature. Additionally, microparticle impact experiments were performed on polyurea using a laser-induced particle impact test (LIPIT) technique. High-speed imaging of the impact mechanics revealed elastic particle rebound at low velocity but penetration at high velocity. Simulation of these LIPIT experiments demonstrates good accuracy of the polyurea model under these conditions as well as provides insight into the mechanisms governing the results observed.

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