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Effect of Viscoplasticity on Ignition Sensitivity of an HMX-Based PBX D. BARRETT HARDIN, MIN ZHOU, Georgia Institute of Technology — The effect of viscoplastic deformation of the energetic component (HMX) on the mechanical, thermal, and ignition responses of a two-phase (HMX and Estane) PBX is analyzed. PBX microstructures are subjected to impact loading from a constant velocity piston traveling at a rate of 50 to 200 m/s. The analysis uses a 2D cohesive finite element framework. The focus of is to evaluate the relative ignition sensitivity of the materials to determine the effect of the viscoplasticity of HMX on the responses. To delineate this effect, two sets of calculations are carried out, one set assumes the HMX grains are fully hyperelastic and the other set assumes the HMX grains are elastic-viscoplastic. Results show that PBX specimens with elastic-viscoplastic HMX grains experience lower average and peak temperature rises, and as a result, show lower numbers of hotspots. An ignition criterion based on a criticality threshold obtained from chemical kinetics is used to quantify the ignition behavior of the materials. The criterion focuses on hotspot size and temperature to determine if a hotspot will undergo thermal runaway. It is found that the viscoplasticity of HMX increases the minimum load duration, mean load duration, threshold loading velocity, and total input energy required for ignition.

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