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Effect of aluminization on ignition sensitivity of PBX

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ABSTRACT

Thermomechanical response of aluminized HMX/Estain PBX under impact loading is analyzed. The study focuses on the effect of aluminum on the hotspot evolution and initiation of PBXs. This analysis utilizes mesoscale simulations which account for constituent elasticity, viscoelasticity, elasto-viscoplasticity, fracture, internal contact, frictional heating, and heat conduction. The probabilistic nature of heating and initiation is assumed to arise from stochastic variations in microstructures which have statistically similar attributes with HMX grain sizes ranging from 50 to 400 μm. For the microstructure configuration studied, it is found that aluminization with particles 50 μm in diameter delays the initiation of chemical reaction in the material as compared to that for the corresponding unaluminized PBX. To understand the mechanisms leading to the ignition delay, the differences in overall internal stresses, dissipations due to fracture and inelasticity, and hotspot field characteristics are quantified. The microstructure–response relations obtained can be used to assess the performance of PBXs.