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Mesoscale thermal-mechanical analysis of shocked induced granular explosives and polymer-bonded explosives XINJIE WANG, YANQING WU, FENGLEI HUANG, Beijing Institute of Technology — The thermal-mechanical response of HMX-based granular explosives (GXs) and polymer-bonded explosives (PBXs) with variable number of crystals from 10 to 100 under impact loading is investigated with finite element software ABAQUS. A series of three dimensional mesoscale calculations are carried out with the crystal plasticity constitutive model for HMX crystals that accounts for nonlinear elasticity and crystalline plasticity and the viscoelastic model for the polymer binder. To make the analysis comparable, the morphology and the size of HMX crystals are kept the same for both GXs and PBXs. In order to quantify the effect of polymer binder under different strain rate, the calculation models are impacted with initial boundary velocities from 10 to 100 m/s. The results shows that the average pressure of PBXs is approximately 50% higher than GXs and that the localized stress and temperature is highly increased with the polymer binder, which indicates the crystal anisotropy as well as the polymer binder plays an important role in influencing the stress and thermal response of HMX crystals. The thermal-mechanical response analyzed here is essential to predict the formation of hot spot and the ignition of explosives.

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