Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Modeling the effect of plasticity and damage in β-HMX single crystals under shock loading CAMILO DUARTE, MARISOL KOSLOWSKI, Purdue University, NICOLO GRILLI, Unversity of Oxford — $\beta-$HMX is an energetic crystal commonly used in polymer-bonded explosives (PBX). In PBXs, ignition may occur due to the formation "hot-spots" in the material, which are regions of localized thermal energy. Several mechanisms of hot spot formation have been proposed such as void collapse, plastic flow, crack propagation, and crack surface/interfacial friction. Additionally, it is believed that regions of high stress concentration in the energetic crystal such as micro-cracks and voids are preferential nucleation sites of hot spots. However, experimental observation of hot-spots in energetic materials remains difficult due to the short time and length scale of the reactions. In order to understand which mechanisms may mitigate or not the formation of hot spots we study the effect of plasticity and fracture evolution in shock-loaded β-HMX single crystals. A thermodynamically consistent finite strain model is used with a crystal plasticity model for the energetic crystal. Fracture evolution is modeled using a phase field model of damage. Numerical results are compared with gas gun experiments on β-HMX crystals containing engineered defects.

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Date submitted: 02 Mar 2019

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