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Mesoscale Modeling of Deflagration-Induced Deconsolidation in Polymer-Bonded Explosives H. KEO SPRINGER, LLNL, J.E. REAUGH, E.A. GLASCOE, J.R. KERCHER, G. FRIEDMAN — Initially intact polymer-bonded explosives can transition from conductive burning to more violent convective burning via rapid deconsolidation at higher pressures. The pressure-dependent infiltration of cracks and pores, i.e., damage, by product gases at the burn-front is a key step in the transition to convective burning. However, the relative influence of pre-existing damage and deflagration-induced damage on the transition to convective burning is not well understood. The objective of this study is to investigate the role of explosive constituent properties, microstructure, and deflagration velocity on deconsolidation. We performed simulations using the multi-physics hydrocode, ALE3D. HMX was used as the model energetic grain. We used a JWL form for the unreacted and reacted equation-of-state of the HMX. Simplified strength and failure models were used for the HMX and the binder. The propensity for deconsolidation increased with increasing grain volume fraction, increasing porosity, decreasing binder strength, and increasing deflagration velocity. These studies are important because they enable the development of deflagration-induced damage models, as well as the design of inherently safer explosives. This work performed under the auspices of the U.S. DOE by LLNL under Contract DE-AC52-07NA27344. This work was funded by the Joint DoD/DOE Munitions Technology Development Program.

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