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A framework for analyzing the ignition response of energetic materials under dynamic loading SEOKPUM KIM, ANANDA BARUA, MIN ZHOU, Georgia Institute of Technology — A multiphysics finite element framework is developed to analyze the ignition response of energetic materials under dynamic loading. The framework uses a cohesive finite element method (CFEM) to capture large deformation, microcracks, and frictional heating. Chemical reactions are incorporated into this framework by accounting for the decomposition of energetic granules according to chemical kinetic models. As an application, the dynamic response of HMX-Estane polymer-bonded explosive (PBX) is analyzed. The focus is on the effect of loading intensity and microstructural attributes on hot spot evolution, coalescence, and ignition. Results suggest that the time taken to form critical hotspots (order of microseconds) from thermo-mechanical dissipation processes is several orders of magnitude smaller than the time taken for ignition to occur (order of milliseconds). Microstructure-performance relations obtained from this analysis can be used to design explosives with tailored attributes and safety envelopes.

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