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Development of numerical framework to study microstructural effects on shock initiation in heterogeneous energetic materials MARTIN SCHMIDT, Computational Mechanics Branch, Eglin AFB, NIRMAL RAI, H.S. UDAYKUMAR, Univ of Iowa — Heterogeneous energetic materials like plastic bonded explosives (PBX) have very detailed and non-uniform microstructure. The heterogeneity is mainly because of presence of HMX crystals embedded in a polymer binder matrix. Also, manufacturing defects often creates pores and cracks in the material. Shock interaction with these heterogeneities leads to local heated regions known as hot spots. It is widely accepted that these hot spots are predominantly the cause of triggering reaction and eventually ignition in these energetic materials. There are various physical phenomenon through which hot spot can be created such as pore collapse, inter-granular friction in HMX crystals, shock heating of HMX crystals and binder etc. Hence, microstructural heterogeneity can play a vital role for shock initiation in PBX. In the current work, a general framework has been established for performing mesoscale simulations on heterogeneous energetic material. In order to get an accurate representation of the microstructure, image processing algorithms have been employed on XCMT images of PBX microstructure. The image processing framework has been built up with massively parallel Eulerian code, SCIMITAR3D. Shock simulation on PBX microstructures has been performed and the effect of microstructure geometry has been studied for different shock strengths case. The simulation results have been shown to resolve hot spots created due to various heterogeneities present in the microstructure.

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