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Study of void collapse leading to shock initiation and ignition in heterogeneous energetic material[1] NIRMAL KUMAR RAI, Univ of Iowa, SUSHILKUMAR PRABU KOUNDINYAN, University of Illinois at Urbana-Champaign, H.S. UDAYKUMAR, Univ of Iowa — In heterogeneous energetic materials like PBX, porosity plays an important role in shock initiation and ignition. This is because the collapse of voids leads to the formation of local high temperature regions termed as hot spots under the application of shock loading. The formation of hot spots can take place because of several mechanisms such as plastic deformation of voids, hydrodynamic impact on voids leading to the formation of high speed material jets etc. Once these hot spots are formed, they can lead to reaction and ignition in the explosive material. However, diffusive phenomenon like heat conduction can play an important role in shock initiation because depending on the size and intensity of void collapse hot spots, local ignition conditions can be smeared out. In the current work, void collapse leading to shock initiation and ignition in HMX has been studied using a massively parallel Eulerian code, SCIMITAR3D. The chemical kinetics of HMX decomposition and reaction has been modeled using the Henson-Smilowitz multi-step mechanism. Based on the current framework an ignition criterion has been established for single void collapse analysis for various shock strengths. Furthermore, the effects of void-void interactions have been analyzed demonstrating the important role of the combination of void fraction, reaction chemistry and heat conduction in determining the ignition threshold.

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Nirmal Rai
Univ of Iowa

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