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Effects of void anisotropy on the ignition and growth rates of energetic materials. NIRMAL KUMAR RAI, OISHIK SEN, H.S. UDAYKUMAR, The University of Iowa — Initiation of heterogeneous energetic materials is thought to occur at hot spots; reaction fronts propagate from sites of such hot spots into the surrounding material resulting in complete consumption of the material. Heterogeneous materials, such as plastic bonded explosives (PBXs) and pressed materials contain numerous voids, defects and interfaces at which hot spots can occur. Amongst the various mechanisms of hot spot formation, void collapse is considered to be the predominant one in the high strain rate loading conditions. It is established in the past the shape of the voids has a significant effect on the initiation behavior of energetic materials. In particular, void aspect ratio and orientations play an important role in this regard. This work aims to quantify the effects of void aspect ratio and orientation on the ignition and growth rates of chemical reaction from the hot spot. A wide range of aspect ratio and orientations is considered to establish a correlation between the ignition and growth rates and the void morphology. The ignition and growth rates are obtained from high fidelity reactive meso-scale simulations. The energetic material considered in this work is HMX and Tarver McGuire HMX decomposition model is considered to capture the reaction mechanism of HMX. The meso-scale simulations are performed using a Cartesian grid based Eulerian solver SCIMITAR3D. The void morphology is shown to have a significant effect on the ignition and growth rates of HMX.

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