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Criticality conditions of heterogeneous energetic materials under shock loading ANAS NASSAR, NIRMAL KUMAR RAI, OISHIK SEN, H. S. UDAYKUMAR, University of Iowa — Shock interaction with the microstructural heterogeneities of energetic materials can lead to the formation of locally heated regions known as hot spots. These hot spots are the potential sites where chemical reaction may be initiated. However, the ability of a hot spot to initiate chemical reaction depends on its size, shape and strength (temperature). Previous study by Tarver et al. has shown that there exists a critical size and temperature for a given shape (spherical, cylindrical, and planar) of the hot spot above which reaction initiation is imminent. Tarver et al. assumed a constant temperature variation in the hot spot. However, the meso-scale simulations show that the temperature distribution within a hot spot formed from processes such as void collapse is seldom constant. Also, the shape of a hot spot can be arbitrary. This work is an attempt towards development of a critical hot spot curve which is a function of loading strength, duration and void morphology. To achieve the aforementioned goal, mesoscale simulations are conducted on porous HMX material. The process is repeated for different loading conditions and void sizes. The hot spots formed in the process are examined for criticality depending on whether they will ignite or not. The metamodel is used to obtain criticality curves and is compared with the critical hot spot curve of Tarver et al.

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