Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Probabilistic Assessment of the Effects of Microstructure and Voids on the Pop Plot of Heterogeneous Energetic Materials[1] CHRISTOPHER MILLER, DANIEL OLSEN, YAOCHI WEI, Georgia Institute of Technology, DAVID KITTELL, COLE YARRINGTON, Sandia National Laboratories, MIN ZHOU, Georgia Institute of Technology — We report the results of mesoscale simulations of the shock-to-detonation transition (SDT) of pressed HMX using CTH. Variations in the run distance due to material heterogeneities are systematically quantified using a probabilistic approach, allowing confidence levels to be established as a function of material and shock pressure. Grain size, grain morphology, voids, and grain-to-grain variations in the properties of the constituent are considered. The grains have a mean size of 220 μm and the voids have a diameter of 50 μm. The samples considered are 3 by 15 millimeters. The SGL viscoplasticity model, the Mie-Grüneisen EOS, and the History Variable Reactive Burn (HVRB) chemistry model are used. Shock loading is effected via the imposition of piston velocities of 600-1200 m/s, leading to shock pressures of 4-11 GPa. Four cases are considered: homogeneous material, material with microstructure but no voids, homogeneous material with voids but no microstructure, and material with both voids and microstructure. The results are in good agreement with experimental data and show that both microstructure and voids strongly influence SDT behavior and decrease the run distance. The importance of both factors is delineated and becomes less pronounced at higher shock pressures.

[1]This work is supported by the Sandia LDRD AA program, an AFOSR project (Dr. Martin Schmidt), and the NNSA SSGF.

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Date submitted: 28 Feb 2019 Electronic form version 1.4