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Investigating Shock Response of a PETN Based Explosive with Grain-Scale Simulations[1] GRAHAM KOSIBA, KEO SPRINGER, WILLIAM SHAW, RICHARD GEE, Lawrence Livermore National Laboratory — The shock initiation of heterogeneous solid explosives, such as binderized PETN-based explosives, is governed by mesoscopic processes. However, there is a scarcity of direct measurements probing these processes so we employ modeling to improve our understanding of it. We perform grain-scale simulations in the multi-physics code, ALE3D, to investigate the shock response of explicitly resolved energetic grains and pores following planar impact. Non-reactive simulations are used to determine an unreacted equation of state (EOS) for the explosive. The calculated unreacted EOS is compared to historic data as well as an engineering mixture model based on constituent properties and weight fractions. Reactive simulations are performed to investigate the effects of pore size distribution on the temperature field and bulk reaction rate in the shocked explosive. Finally, we probe the combined effects of pulse duration and microstructure on the shock initiation response. These studies are important because they provide insight on mesoscopic processes and form the basis for new morphology aware explosive models.

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