SHOCK19-2019-000126

Abstract for an Invited Paper
for the SHOCK19 Meeting of
the American Physical Society

Applying the HERMES Model to Non-shock Ignition and Post-ignition Violence

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The HERMES model (High Explosive Response to MEchanical Stimulus) [1] has been developed to study the behavior of energetic materials using computer simulations that are closely coupled with experiments. The material properties needed to analyze a specific experiment vary, but include the equations of state of the unreacted material and of the product gas mixture. In addition, the resistance of the unreacted solid to shear deformation as a function of stress state (including confining pressure) and deformation rate will generally be required. The resistance may include permanent deformation, widespread fragmentation, localized fracture, and porosity development, which all depend on the applied loads. Our non-shock ignition criterion follows the observation that shear localization with confining stress is the condition for ignition. Our shock initiation criterion is based on CREST [2]. We present examples of ignitions that self-extinguish quickly, ignitions that self-extinguish, but nevertheless produce measurable air blast, and ignitions that lead to delayed detonations. We assess the respective roles of the properties of energetic materials and the properties of the confinement on the violence of the response. 1. J. E. Reaugh, B. W. White, J. P. Curtis, and H. K. Springer, *Propellants Explos. Pyrotech.* **2018**, 43, 703-720. 2. C. A. Handley, *Proceedings 13th Int. Detonation Symp.*, Norfolk, VA, July **2006**, p864-870. JER's work was performed under the auspices of the United States Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-ABS-768150