Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Dissipative Heating in Porous Solid Explosives: Correlation of Thermomechanical Fluctuations and Microstructure[1] SUNADA CHAKRAVARTHY, KEITH GONTHIER, Mechanical and Industrial Engineering Department, Louisiana State University — Impact induced heating of porous solid explosives is locally influenced by variations in microstructure. Materials having similar effective (or average) porosities and composition, and particle size and shape distributions, may have different impact responses due to spatial fluctuations in these quantities at the particle scale. In this study, a combined finite and discrete element technique is used to computationally examine the inert impact response of aluminized HMX for different effective porosities and metal mass fractions, and explosive and metal particle sizes. Emphasis is placed on examining the statistical correlation between predicted fluctuations in thermo-mechanical fields within and behind compaction waves and the local microstructure. To this end, predicted fields are mapped onto the initial material configuration and analyzed using multivariate Principal Component Analysis (PCA). Preliminary predictions will be given that identify microstructural features, or combinations of features, that result in a high probability of hot-spot formation and their dependence on impact speed.

[1]This research is supported by the Defense Threat Reduction Agency (DTRA) under sponsor award number HDTRA1-10-1-0018, and the Air Force Research Laboratory (AFRL-RWME) under sponsor award number FA8651-09-0021.

Keith Gonthier
Mechanical and Industrial Engineering Department,
Louisiana State University

Date submitted: 25 Feb 2013 Electronic form version 1.4