Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Microscopic modeling of ignition and burning for well-arranged energetic crystals in response to drop-weight impact[1] YANQING WU, FENGLEI HUANG, State key Laboratory of Explosion Science and Technology, Beijing Institute of Technology — It has long been recognized that during impact of energetic crystalline solids, some form of energy localization must focus the impact energy into hot spots. However, it was insufficient to obtain just the energy required to cause ignition of an individual hot spot. Hot-spots ignition as well as the subsequent burning together determines the possible occurrence of explosion. A micromechanics theoretical approach was developed, to model hot-spots formation and growth to burning for a single layer of impacted energetic particles. To provide supporting evidence for theoretical analyses, numerical simulations were performed to investigate the thermo-mechanical interactions among the well-arranged energetic crystals. Once hot- spots ignition occurs, the macrokinetics of chemical reactions can be determined by hot-spots density, combustion wave velocity and geometric factor. Considering the micro-particle plasticity, frictional heating, melting, fracture, and chemical reaction at particle level, effects of loading parameters and sample characteristics on ignition and burning were discussed. The resulting reaction may or may not develop into a violent event, may be sustained or be extinguished, which can be predicted by the present model. Visual information obtained by high-speed photography and measured pressure-time data using our self-established experimental device are used to validate the calculated results.

[1]National Natural Science Foundation of China (11172044)

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Date submitted: 05 Feb 2013 Electronic form version 1.4