Abstract Submitted
for the SHOCK07 Meeting of
The American Physical Society

Metal Particle Heating and Acceleration in Condensed Explosives ROBERT RIPLEY, Martec Limited, FAN ZHANG, DRDC Suffield, FUE-SANG LIEN, University of Waterloo — For condensed explosives containing metal particle additives, a characteristic parameter relating the detonation reaction zone length (L_r) to the particle size (d_p) can be defined as $\delta = d_p/L_r$. The detonation reaction zone length is typically $0.01 < L_r < 100$ mm, whereas metal particle sizes of 100 nm $< d_p <$ 1 mm can be employed. This indicates a potential range of $10^{-6} < \delta < 10^2$. The limiting case of $\delta \ll 1$ involves frozen shock/particle interaction; for $\delta \gg 1$ the interaction consists of a thin-detonation-front diffraction followed by expanding products flow. The intermediate case of $\delta \approx 1$ has been studied previously as a function of metal mass fraction and particle packing to determine momentum and heat transfer during the detonation interaction time. Results indicate a strong dependence of particle acceleration and heating rate on δ for high metal mass fraction conditions. The present study employs 3D mesoscale simulation to further conduct parametric studies in the $0.1 \leq \delta \leq 10$ range by varying the particle diameter, particle metal and explosive material. The results are quantified to determine macroscopic physical models for particle acceleration and heating.

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Date submitted: 21 Feb 2007 Electronic form version 1.4