Abstract Submitted
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The Energy Diameter Effect PETER VITELLO, P. CLARK SOUERS, LLNL — The diameter (size) effect is the well-known increase of detonation velocity with increasing radius. We ask if a similar effect is seen with the detonation energy. To see this, it is necessary to perform the Cylinder test on small-radius samples of non-ideal explosives, which detonate with a low velocity. We fired nine ammonium nitrate/aluminum and AN/NM Cylinder shots with diameters of 12.7 to 50.8 mm using Fabry and heterodyne velocimetry for the wall velocities and pins for the detonation velocity. It is the use of the ultra-narrow 12.7 mm copper cylinders that give us points low enough to be sure that the effect exists. We find that the detonation energies at the three standard Cylinder relative volumes (2.2, 4.4, 7.2) vary roughly as the square of the detonation velocity. This is confirmed in numerical simulation calculations. A simple derivation of the relations of energy, detonation velocity, reaction zone length and detonation rate are given. We define a generalized inverse radius that can be applied to data for both explosive cylinders and outwardly-detonating spheres. The relation that detonation rate is proportional to the diameter effect slope can be used to derive the inverse radius equation. This work was performed under the auspices of the U.S. Department of Energy by the University of California Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

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