Abstract Submitted
for the SHOCK17 Meeting of
The American Physical Society

Effect of microstructure on the near-failure detonation behavior of vapor-deposited pentaerythritol tetranitrate (PETN) films ROBERT KNEPPER, ERIC FORREST, MICHAEL MARQUEZ, ALEXANDER TAPPAN, Sandia National Laboratories — Physical vapor deposition is an attractive method to produce sub-millimeter explosive samples with precisely controlled microstructure and geometry for studying detonation behavior at near-failure conditions. Pentaerythritol tetranitrate (PETN) is particularly interesting, as the microstructure of vapor-deposited films can be varied substantially by altering the surface energy of the substrate. In this work, we examine PETN films deposited in a sandwich structure with aluminum confinement, elucidating the effect of the confinement layers on the explosive thickness needed to sustain a propagating detonation. The interface energy between the PETN and aluminum can be altered depending on whether the aluminum is exposed to atmosphere prior to PETN deposition, which results in significant changes in density, preferred crystal orientation, and porosity distribution in the films. The resulting microstructures are characterized using scanning electron microscopy and x-ray diffraction. The effects of these changes in microstructure on detonation velocity and failure thickness as a function of confinement thickness are determined, providing an estimate of changes in detonation reaction kinetics with variation in microstructure. SAND2017-1750 A

Robert Knepper
Sandia National Laboratories

Date submitted: 17 Feb 2017 Electronic form version 1.4