Abstract Submitted
for the SHOCK15 Meeting of
The American Physical Society

Microexplosive Metallized Fuels for Energetic Materials[1] BRANDON TERRY, School of Aeronautics and Astronautics, Purdue University, MARIO RUBIO, IBRAHIM GUNDUZ, STEVEN SON, School of Mechanical Engineering, Purdue University — Microexplosions have been widely investigated for multicomponent liquid fuels. This phenomenon is caused by internal bubble nucleation and growth from within a fuel droplet (i.e., intraparticle boiling), which induces droplet fragmentation. Microexplosive fuels are advantageous as they promote fuel atomization, which can reduce residence times, increase completeness of combustion, and reduce product agglomeration (if condensed phase products are formed). While this is well understood and utilized with liquid fuels, it has not been fully investigated for metallic fuel particles. Recent work has shown that mechanical activation of aluminum/polymer (inclusion) composites can also cause microexplosions, analogous to liquid emulsion fuels. Gases are produced when the polymer within the composite decomposes below the boiling point of aluminum, causing the composite particle to shatter into smaller particles. Here we show that fully metallic multicomponent fuels (e.g., Al-Li alloy) can also microexplode during combustion and compare this to inclusion composite ignition. Because the two components have a large disparity in boiling points, intraparticle boiling causes the particle to expand and eventually shatter the fuel particle, analogous to missive liquid fuels.

[1]National Defense Science and Engineering Graduate Fellowship, 32 CFR 168a; AFOSR MURI, contract #FA9550-13-1-0004

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Date submitted: 11 Feb 2015 Electronic form version 1.4