Abstract Submitted
for the SHOCK11 Meeting of
The American Physical Society

Determining the Source of Oxygen in Post-Detonation Combustion of Aluminum JEREMY MONAT, JOEL CARNEY, JAMES LIGHTSTONE, Naval Surface Warfare Center, Indian Head Division, NOBUMICHI SHIMIZU, Woods Hole Oceanographic Institution — Aluminum is often added to explosive formulations in the form of micron-sized particles to increase the energy released. Aluminum particles combust by reacting with oxidizers from the detonation products (such as CO) and the surrounding atmosphere (O_2). Quantifying the oxygen contribution from these sources is important for improved modeling and formulation. This work will determine the ratio of oxygen from detonation products to oxygen from the atmosphere using isotopic labeling. We detonated a 10-20 g aluminum-containing explosive formulation in a simulated air atmosphere where the oxygen was $^{18}O_2$. We collected the solid detonation products after detonation and analyzed them using secondary ion mass spectrometry (SIMS) to measure the ratio of ^{18}O to ^{16}O and thus the percentage of oxygen of aluminum combustion from the detonation products versus from the atmosphere. Preliminary results of detonations performed in a rigid chamber showed $\sim$60% of the oxygen came from the atmosphere. In further experiments, we will create a free-field condition by performing detonations in flexible, thin-walled plastic spheres of known radius containing an $^{18}O_2$-enriched air atmosphere. We will then isolate the post-detonation aluminum oxide and determine the oxygen isotope ratio using SIMS analysis.

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Date submitted: 18 Feb 2011 Electronic form version 1.4