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The Influence of Thermal Conditions on the Thermomechanics of Particulate-Composite, Mock Explosive Samples under Near-Resonant Excitation

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ABSTRACT

Vapor detection is one of the most effective ways to find hidden plastic-bonded explosives in the field today. In recent years, it has been demonstrated that providing near-resonant vibratory excitation to explosives dramatically increases their vapor pressure, allowing for easier detection. Unfortunately, there currently exists a limited understanding of the thermomechanics of energetic material. This study seeks to help fill this technical void by exploring the thermomechanics of mock plastic-bonded explosives using direct mechanical excitation with varying thermal conditions. Using two different ambient thermal boundary conditions (insulated geometric boundaries and boundaries with free convection), a 7" by 10" by 0.5" HTPB/Ammonium Chloride particulate-composite plate was tested by fixing it to an electrodynamic shaker and vibrating the sample at low frequencies (under 1000 Hz). Vibratory and thermal data was collected using a Polytec scanning laser Doppler vibrometer and a FLIR infrared camera. It was determined that insulating boundary conditions, allow the mock energetic material temperature to increase significantly as compared to the convective boundaries under near-resonant excitation. Future work will investigate alternate thermal boundary and initial conditions, as well as alternate mock energetic materials.

KEYWORDS

Energetic, Vibratory Excitation, Insulation