The Summer Undergraduate Research Fellowship (SURF) Symposium
August 3 2017
Purdue University, West Lafayette, Indiana, USA

The Influence of Macroscale Stress Concentrations on the Near-Resonant Thermomechanics of Mock Energetic Materials

Lauren A. Cooper[1,2], Allison R. Range[2,3], and Jeffrey F. Rhoads[2,3,4]
[1]Department of Engineering, Western Kentucky University, KY 42101, USA
[2]Ray W. Herrick Laboratories, Purdue University, West Lafayette, IN 47907, USA
[3] School of Mechanical Engineering, Purdue University, West Lafayette, IN 47907, USA
[4] Birck Nanotechnology Center, Purdue University, West Lafayette, IN 47907, USA

ABSTRACT

The characterization of particulate composite energetic materials, both with and without stress concentration, is currently of great interest to the defense community. This work seeks to further characterize the self-heating effect of composite energetic plates, particularly around regions of high stress, when subjected to harmonic excitation near resonance. Mock energetic plates with macroscale stress concentrations are prepared in various compositions based on the PBXN-109 formulation, and are tested near the first resonant frequency using an electrodynamic shaker. The resulting mechanical and thermal responses are recorded using a laser Doppler vibrometer and an infrared camera, respectively. Upon comparison between the regions of heightened strain and stress, a strong correlation was found between the respective areas of heightened response. Additionally, the effect of the type of stress concentration on the resulting levels of stress and strain is discussed. This characterization will aid the defense community in their mission to better understand particulate composite energetic materials.

KEYWORDS

Explosives, energetic materials, thermomechanics, vibration, viscoelastic materials, defects, stress concentrations, localized heating