

Project Description

- A need exists to characterize energetic / inert particulate composite materials due to their prevalent use in the defense sector
- Thermomechanical behavior in response to high frequency mechanical excitation (1-100 kHz) is not well understood

Approach

- Laser Doppler vibrometer (1a) identifies resonances in response to excitation from piezoelectric shaker (1b/2c)
- FLIR infrared cameras (2a-b) measures thermal behavior over 15 minute window

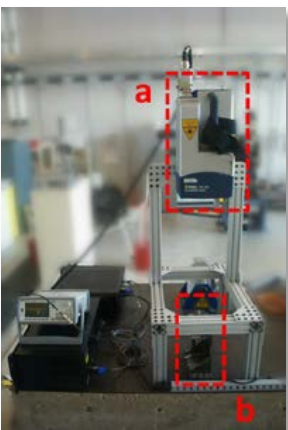


Fig. 1

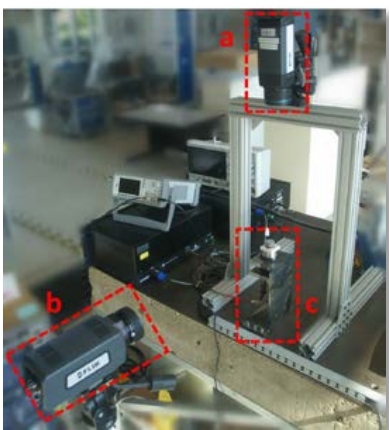


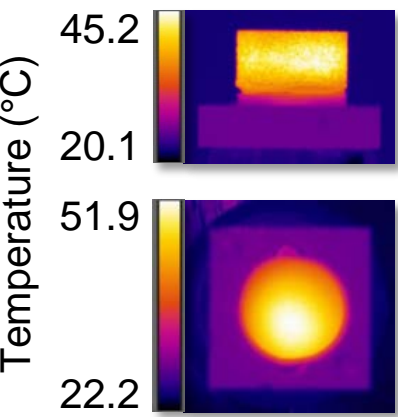
Fig. 2

Discussion

Contact harmonic excitation resulted in temperature rises of approximately 2-4°C per minute, with a maximum surface temperature of 100°C. Particle / binder interactions and viscous heating were observed as components of heat generation across the 1 to 80 kHz frequency range of interest

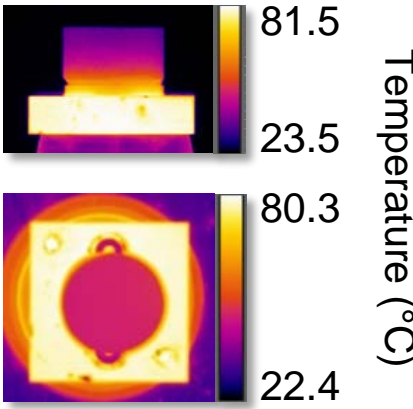
Results

12.86 kHz



At resonances below 20 kHz, heat generation primarily concentrated within the sample. Conduction observed between fixture components at higher frequency resonances.

70.58 kHz



High frequency vibration induces heating in explosive materials.