SPATIOTEMPORAL TEMPERATURE MEASUREMENTS BEHIND A BLAST WAVE FROM COMPENSATED THERMOCOUPLES IN A LINEAR ARRAY GAUGE

Anthony LoCurto[1], Zachary Loparo[1], Jason Loiseau[2], Akio Yoshinaka[3]
Michael Kessler[1], John-Mark Clemenson[1], Neeraj Sinha[4], Michael Soo[1]

[1] Naval Surface Warfare Center Indian Head Division, MD, United States;
[2] Royal Military College of Canada, Dep't of Chem. and Chem. Eng., 17 Gen. Crerar Crescent, Kingston, ON, K7K 7B4, Canada;
[3] Defence R&D Canada – Suffield Research Centre, Box 4000, Stn. Main, Medicine Hat, Alberta, T1A 8K6, Canada.
[4] Combustion Research and Flow Technology, Inc. (CRAFT Tech), Pipersville, Pennsylvania, USA

Key words: Reacting Multiphase Flow, Metalized Explosive, Thermocouple, Absorption

ABSTRACT

Heterogeneous explosives prove to be challenging environments to study because of their violent energy release and complex multiphase reacting turbulent flows. The simple implementation, cost effectiveness, and robustness of thermocouples makes them beneficial for use in destructive explosive testing. However, the time response of a thermocouple due to its limited bandwidth causes the temperature measurement to lag behind the true local gas temperature. This paper presents a reconstruction method for *in situ* temperature measurements in reactive metal charges by using multiple co-located thermocouples (MTC), of varying fine bead diameters, along a linear array gauge to map spatiotemporal thermal flows. The reconstruction algorithm estimates the time constant of each thermocouple present in the turbulent, temperature fluctuating environment and estimates the local gas temperature using a time-domain based reconstruction technique. The MTCs were used in a series of experiments measuring blast temperature and pressure from spherical charges of gelled nitromethane and aluminum or glass particles to better understand the time scale and energy release of reactive metals. In-fireball blast overpressure measurements from the test series are given in a companion paper [1]. The recorded temperature, and reconstructed gas temperature, at various radial distances from the center of spherical metalized and non-metalized particle laden charges is presented.