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A full scale hydrodynamic simulation of pyrotechnic combustion
BOHOON KIM, Seoul National University, SEUNG-GYO JANG, Agency for Defense Development, JACK YOH, Seoul National University — A full scale hydrodynamic simulation that requires an accurate reproduction of shock-induced detonation was conducted for design of an energetic component system. A series of small scale gap tests and detailed hydrodynamic simulations were used to validate the reactive flow model for predicting the shock propagation in a train configuration and to quantify the shock sensitivity of the energetic materials. The energetic component system is composed of four main components, namely a donor unit (HNS+HMX), a bulkhead (STS), an acceptor explosive (RDX), and a propellant (BKNO3) for gas generation. The pressurized gases generated from the burning propellant were purged into a 10 cc release chamber for study of the inherent oscillatory flow induced by the interferences between shock and rarefaction waves. The pressure fluctuations measured from experiment and calculation were investigated to further validate the peculiar peak at specific characteristic frequency (ωc = 8.3 kHz). In this paper, a step-by-step numerical description of detonation of high explosive components, deflagration of propellant component, and deformation of metal component is given in order to facilitate the proper implementation of the outlined formulation into a shock physics code for a full scale hydrodynamic simulation of the energetic component system.

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