Blast Performance of Shock Dispersed Fuel

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Abstract:

In recent years, the shock-dispersed-fuel (SDF) charge concept has been introduced as a possible source of blast energy by deliberately exploiting afterburning with ambient air as a source of additional energy release. The concept has been tested at a few grams scale in closed chambers of various shapes and sizes. It has been predicted that nearly all of the aluminum fuel is consumed during the first few milliseconds of the simulation. In this paper, results of a test using a similar SDF charge at a kilogram scale in a vented structure, and a corresponding predictive numerical simulation are presented. The main objectives of the test and the simulation were: (1) To measure its blast performance on a much larger scale than previously tested in a two room (semi-confined) structure, (2) to test predictive capabilities of a computational fluid dynamics code, SHAMRC, on the SDF charge and (3) to estimate the amount of afterburn energy that was released in the event. Based on a good comparison between the measured data and predicted values, it was found that SHAMRC does a good job. It predicts that the charge releases nearly 79% of the available energy in 20 milliseconds and 97% by 75 ms. The relatively slow reaction time is attributed to poor mixing of aluminum flakes with oxygen in air. The blast performance of the SDF charge was not as high as expected. Detailed results of the test and the simulation are presented. Its performance is compared to that of a non-ideal explosive in a similar test configuration.