# COMBUSTION OF SHOCK-DISPERSED ALUMINUM - SOME PARAMETRIC STUDIES

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At the previous Conference, we introduced the concept of shock-dispersed-fuel (SDF) charges, and presented results from a preliminary feasibility study (Neuwald et al., 2003). To recapitulate: the miniature SDF charges consist of a spherical booster charge of 0.5-g PETN, embedded in a paper cylinder of ~ 2.2-cm$^3$, which is filled with powdered fuel compositions. The tests were performed in closed steel vessels, which we call barometric calorimeters, since we diagnose energy release by monitoring the build-up of quasi-static pressure in the vessel. Though we investigated a number of fuels the presentation will focus on the results for shock-dispersed aluminum flakes. Up to now this material has proven to give the fastest and most complete reaction among the tested fuels.

In the initial study we varied the volume of the barometric calorimeters, while keeping the aspect (L/D) ratio at about 1. In the continuation of the project we designed two further set-ups, which are comparable to the smallest calorimeter in volume (6.3 l), but provide different aspect ratios: L/D = 4.6 and 12.5. In addition, tests in a tunnel-like environment with an L/D = 37.5 have been performed.

Our basic goal is an assessment of the combustion-related pressure built-up. To provide an experimental baseline, tests in an air atmosphere were supplemented by tests in a nitrogen atmosphere which inhibited oxidation / combustion of the fuel.

The experimental base line experiments and theoretical estimates on the expected overpressure allow one to formulate various indicators for the experimentally observed combustion performance in terms of maximum quasi-steady overpressure. For shock-dispersed aluminum flakes we find a consistent trend in a number of such performance indicators showing that the combustion efficiency decreases not only with increasing volume of the barometric bomb, but also with increasing aspect ratio at constant volume. This bears importance to the performance of SDF charges in tunnel environments. At least a part of these performance losses are due to changes and constraints of the mixing between fuel and air.