MEASUREMENT OF HEAT RELEASE BY THE DECOMPOSITION OF RDX EXPLOSIVE MIXED WITH TiH_2 PARTICLES WITH VARYING SIZE DISTRIBUTION

INTRODUCTION

Decomposition heat and temperature are among the main characteristics of explosive materials. Calorimeter can be used to measure these properties. Researchers from China used a Calvet Calorimeter to measure the heat released by the decomposition of RDX mixed with TiH_2 powder.

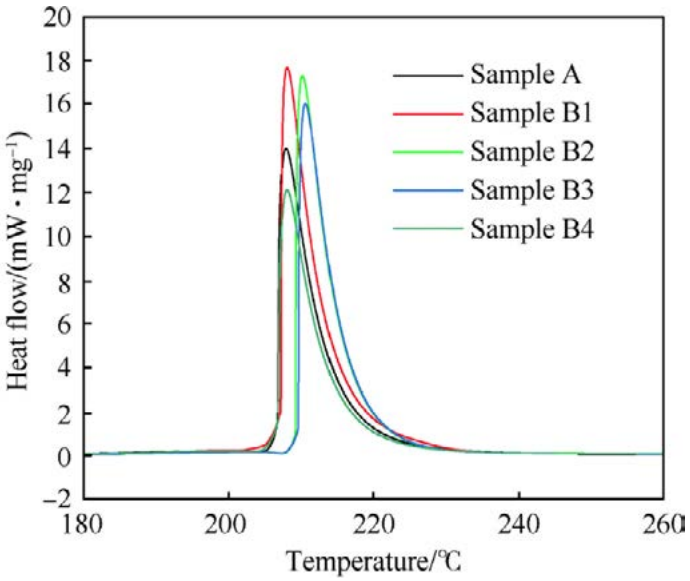
Metallic powders have been investigated in explosive formulation as they increase the detonation efficiency. The effect of particle size is assessed in this work.

EXPERIMENT

- Sample: 25mg of hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) mixed with 5%$_{wt}$ of TiH_2 powder with varying particle size (B1: d_{50}=16.4µm, B2: d_{50}=33.7µm, B3: d_{50}=50.1µm, B4: d_{50}=112µm, A1: no TiH_2)
- Instrument: CALVET (formerly C80)
- Cell: 8.5ml high pressure standard cell
- Condition: heating from 30°C to 300°C at 1°C/min

RESULTS

Heating of RDX formulations leads to a strong exothermic effect above 200°C, preceded by a very weak endotherm. The latter is attributed to the melting of RDX, and the former to its decomposition. The temperature range of fusion and decomposition is very narrow.
Incorporation of TiH_2 with median particle size diameter of 50µm or below leads to an increase in maximum heat release, total heat released and duration of the exotherm. Total heat release ranging from 4495 $J.g^{-1}$ to 6393 $J.g^{-1}$ are measured.



These comparative calorimetric results are in accordance with other typical measurements of explosive performance, such as detonation pressure or temperature measurement. Higher heat release is correlated with higher detonation pressure for example.

Hao Wang, Yangfan Cheng, Shoujun Zhu, Zihan Li, Zhaowu Shen, Effects of content and particle size of TiH2 powders on the energy output rules of RDX composite explosives, Defence Technology, Volume 32, 2024, Pages 297-308

INSTRUMENT

CALVET

Ambient to 300°C

HIGHEST HEAT MEASUREMENT ACCURACY
3D sensor based on thermocouples with Joule effect calibration.

ISOTHERMAL OR TEMPERATURE SCANNING MODES
for increased flexibility and replication of real life conditions.

CONVENIENT INTERCHANGEABLE CRUCICLES AND CELLS
to perform event the most demanding experiments:
- high pressure (1000bar) and high vacuum
- pressure measurement and control
- mixing/stirring experiements.

EXTERNAL COUPLING CAPABILITY
designed to increase your research options in manometry, BET instrumentation, gas analyzers, humidity controllers and gas panels

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