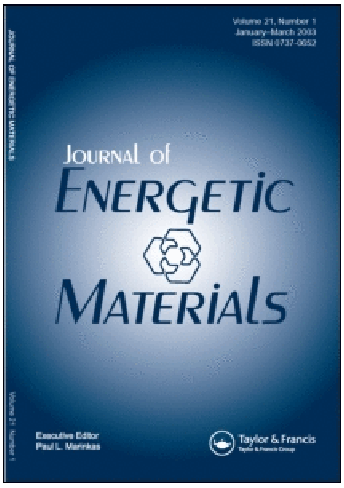

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Remaking and re-using of double based large caliber powders to be used as industrial explosives

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REMAKING AND RE-USING OF DOUBLE BASED LARGE CALIBER POWDERS TO BE USED AS INDUSTRIAL EXPLOSIVES

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ABSTRACT

A possibility of remaking of double based large caliber gun powders of various shapes was verified, using laboratory-scale granulation in double phased liquid system. Loose composition was prepared from obtained granulation product by mixing with ammonium nitrate. This mixture actually corresponds to the simplest industrial explosive. Its efficiency, energetic and detonation parameters were tested and obtained results were comparable with usual range of industrial explosives parameters. Energetic parameters of one mixture are also introduced.

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INTRODUCTION

Small caliber smokeless powders, obtained from delaborated ammunition systems, seem to be the most suitable for utilizing in industrial explosives. Unfortunately, their amount is relatively small in comparison with delaborated rocket propellants and smokeless powders from large caliber weapons. For the reason, these delaborated large caliber smokeless powders and rocket propellants are continually of immediate interest and possibilities are examined of utilizing them as industrial explosives[1].

It is obvious, that homogenity of an industrial explosive plays important role from the viewpoint of its profitable properties (sufficient sensitivity, detonation velocity and handling safety). The homogenity of above mentioned explosives can be ensured just through thorough desintegration of original material. This material usually consists of double based smokeless powder (in the form of sticks, tubes and sheets), homogenous double based rocket propellant or even heterogenous solid rocket propellant. The problem is, that mechanical desintegration of the material can be connected with various technical problems and safety hazards.

Submitted paper is dealing with verification of laboratory-scale procedure, which enables dissolving and following granulation of double based large caliber gun powders in double phased liquid system. This process eliminates above mentioned disadvantages of mechanical desintegration of the propellant as cutting and crushing and therefore decreases hazards of these operations. At the same time, applicability of obtained granulation product was verified in a model system, actually imitating the simplest industrial explosive (amonite); i.e. the mixture with granulation product as a sensitizer and ammonium nitrate.

Detonation parameters of prepared mixture were tested and are also described.

OBJECTIVES OF THE WORK

Main objectives of the work were as follows:

1. Laboratory-scale remaking of double based large caliber gun smokeless powders via granulation in two-phase liquid system.

2. To create mixture by adding ammonium nitrate into granulation product, so that the oxygen balance of prepared mixture should be equal to zero.

3. To determine detonation parameters of prepared mixtures. The objective is to reach desired composition making initiation by blasting cap no.8 possible; with critical diameter equal to 30 mm or below.

PREPARATION OF THE GRANULATION PRODUCT

Remaking double based large caliber powders (in the form of sticks, tubes and sheets; approximately 150-200 mm long) was proceeded in vertically arranged system of two continually stirred vessels, connected to each other and equipped by heating jackets. The 10 l bottom vessel was fitted by coil condenser.

About 250 g of original powder was dissolved in ethylacetate within 5-6 hours in the 3 l top vessel. The vessel was continually stirred at the temperature 60-65 ^{o}C. Obtained viscous solution "lacquer" was gradually poured down into intensively stirred bottom vessel filled with water solution of protective coloide. Temperature in the bottom vessel was given by temperature regime, which proceeded in the range 65-95 ^{o}C. Mass ratio of the system powder/ethylacetate/water was approximately 1:(4-7):(18-20), depending on initial composition of original powder. In the bottom vessel, there was intensively mixing water and lacquer phase, resulting in lacquer phase decomposition in order to create discrete drops. Solid irregular-shaped grain (granulation product; approximately 1-3 mm in diameter) is formed by distilling off volatile solvent. The process in the bottom vessel took about 2-3 hours. Ethylacetate is recycled in the process.

Granulation product was filtered off and gradually air dried. After finishing these operations, 10 - 30 % water remained in the product, approximately, with respect to the course of both filtering and drying.

PREPARATION AND TESTING OF THE EXPLOSIVE MATERIAL

Moist granulation product was mixed with ammonium nitrate, so that the final mixture could have oxygen balance equal to zero. In particular cases, the amount of ammonium nitrate was more than double, compared to the amount of granulation product. This mixture was tested using further given tests. These experiments form part of standard tests of industrial explosives currently proceeded by their inland manufacturer.

As an example, results obtained by standard tests of mixture prepared from remaked double based large caliber stick-shaped powder (stick diameter = 4 mm, length = 145 mm, diglycole dinitrate amount = 36%). Water content of the final blasting mixture was 15 %.

Ballistic Mortar Test: 88.4%

The prepared mixture was compared with Czech industrial amonite-type explosive "Permonex V19" based on mortar swing. The pendullum arm = 3.4 m long, mortar weight = 310 kg, projectile weight = 15 kg and sample weight = 10 g.

Brisance Test of Hess: 14.7 mm

Cylindrical lead block shortening using 100 g of explosive material through steel sheet gap.

Trauzl Lead Block Expansion Test: 0.320 l

Sample weight was 10 g.

Detonation Velocity: 2625 m/s

Electronically measured. The sample, 100 g and 30 mm in diameter was put in paper tube.

Initiation ability using blasting cap no. 3.: no initiation observed.

The charge was in the form of loose explosive mixture put into hardened PVC (polyvinylchloride) tube with 160 mm diameter and 1500 mm long.

Initiation ability using blasting cap no.8.: detonation observed.

Experiment arrangement was analogical.

Critical diameter: 28 mm

The mixture was put into glass tube, 1500 mm long, with wall thickness equal to 2.5 mm. Blasting cap no.8. was used for initiation.

Gap - test: 22.7 mm (for 50 % probability of detonation transfer).

The mixture (acceptor) was put into paper tube of 60 mm diameter and of lenght 200 mm. The TNT cone charge, of 68 mm bottom diameter and of height 56 mm, was used as donor. Gap material PMMA (polymethylmetacrylate, discs of 68 mm diameter), initiation by blasting cap no.8.

CONCLUSION

This work has acknowledged that double based large scale gun powder can be remaked by granulation in double phased liquid system, yielding the form suitable to be used as a key composition of loose industrial explosive of amonite type. The final explosive mixture is created by mixing the granulation product and ammonium nitrate to reach oxygen balance equal to zero. Main advantage of described procedure is easy miscibility of both loose materials. Energetic and detonation parameters of prepared mixture lay on the bottom margin of parameters range of commonly used industrial explosives.

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