METHOD FOR MAKING EXPLOSIVE CHARGES BY FILTERING LIQUID EXPLOSIVE

Vlassov D A

(St-Petersburg Technological Institute)

ABSTRACT The process of sensitive explosive charges making is dangerous and requires complicated technological equipment. In multi-component composition making, different mixing devices necessary cause mechanical effects on the processed material, which can lead to ignition and even to explosion. In St-Petersburg Technological Institute a new method which is free of these shortcomings is worked out for making explosive charge of powerful crystal explosive with melt explosive or liquid polymer.

KEY WORDS explosive, technology, filtering, TNT, RDX.

Most of widely-used explosive mixtures contain RDX and melted TNT as liquid phase. They are called TG and TGA (consisting of 80 to 40 % of RDX and of 20 to 60 % TNT) and similar systems contain octogen.

All these compositions are initially viscous suspensions and can be obtained by mixing in the apparatus called S-500 or in vibrating mixer.

Mixing of crystal RDX or octogen, aluminium with melted TNT is rather dangerous and prolonged. Moreover, the operation of filling the shell with explosive mixture is rather complicated and reqires thorough control.

Large-crystal RDX or octogen being put into the shell forms highly homogeneous system with definite porosity P. Porosity is the ratio of volume of the pores to the system total volume, that is

$$P_{\text{b}} = \frac{V_{\text{por}}}{V_{\text{gen}}} \cdot 100\% \qquad (1)$$

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Proceeding from the solid phase density values (RDX, octogen, Al) the porosity can be calculated according to the following formula:

$$P = (1 - \frac{\rho_s}{\rho_{lim}}) \cdot 100\% \quad (2)$$

where ρ_s is actual density of the solid phase in the shell, ρ_{lim} is ultimately possible density of the solid phase component mixture.

ρ_{lim} for heterogeneous component mixtures can be defined according to the formula:

$$\rho_{lim} = \frac{\Sigma m_i}{\Sigma(\frac{m_i}{\rho_i})} \quad (3)$$

where m_i is the mass of i componemt, ρ_i is the density of i component.

So the summary pore volume of the solid phase (RDX, octogen, Al) in the shell is known and in order to obtain homogeneous charge it is necessary to insert definite quantity of TNT melt or liquid polymer into the pores of the solid phase.

To avoid the resistance of air containing in pores of the solid components, preliminary evacuation can be used. In this case TNT melt filters easily into the solid phase filling pores of the system. So highly homogeneous charge is obtaind without using any mixers.

The technological scheme of making charges by liqud esplosive filtration is shown in Fig. 1.

All the operations proceed on the rotating table-rotor (supplied) with special devices.

The shell is fastened on the rotating table (operation 1). solid components (RDX, octogen, Al) is loaded into the shell (operation 2). To condense the powder, vibration is used for 15～20 seconds with the frequency of 25～30 Hz and amplitude of 0.03～0.08 ms (operation 3).

The vessel with TNT melt is fastened to the shell and the process of evacuation proceeds (operation 4). TNT melt filters into the pores of the solid phase under excessive atmospheric pressure (operation 5). The vessel with the melt TNT is removed (operation 6). A hole for the detonator is formed with a vibrating model (operation 7). A plug is inserted in the detonator hole and the shell is sent to the storehouse (operation 8).

It is necessary to stress that the method described here can be used also for making solid-fuel rocket charges based on oxidizer and liquid polymer binder.

An example of the technological calculation of the process is given as follows.

The shell having volume of 0.005 m^3 is filled with RDX. The actual density ρ_s vibro-tightened RDX is equal to 1100 kg/m^3.

The ultimate density of RDX (that is the monocrystal density) is 1820 kg/m^3, so

the porosity of RDX inside the shell can be calculated according to the following formula:

$$P = (1 - \frac{1100}{1820}) \cdot 100\%$$
$$= 39.6\%$$

Then the summary volume of pores in RDX in the shell is

$$V = 0.005 \times 39.6\%$$
$$= 0.00198\ (m^3)$$

Hence, 1980 cm^3 of TNT melt can be injected into the pores of RDX. The obtained charge density after hardening can be defined according to the formula (3). That equals 1757 kg/m^3

What is claimed is :

1. A relatively secure method for making explosive charges containing solid crystal explosive and liquid thermoplastic or thermosetting (polymerizing) polymer is worked out.

2. The mehtod is suitable for making rocket fuel compositions containing solid oxidizer, metals and liquid polymer binder.

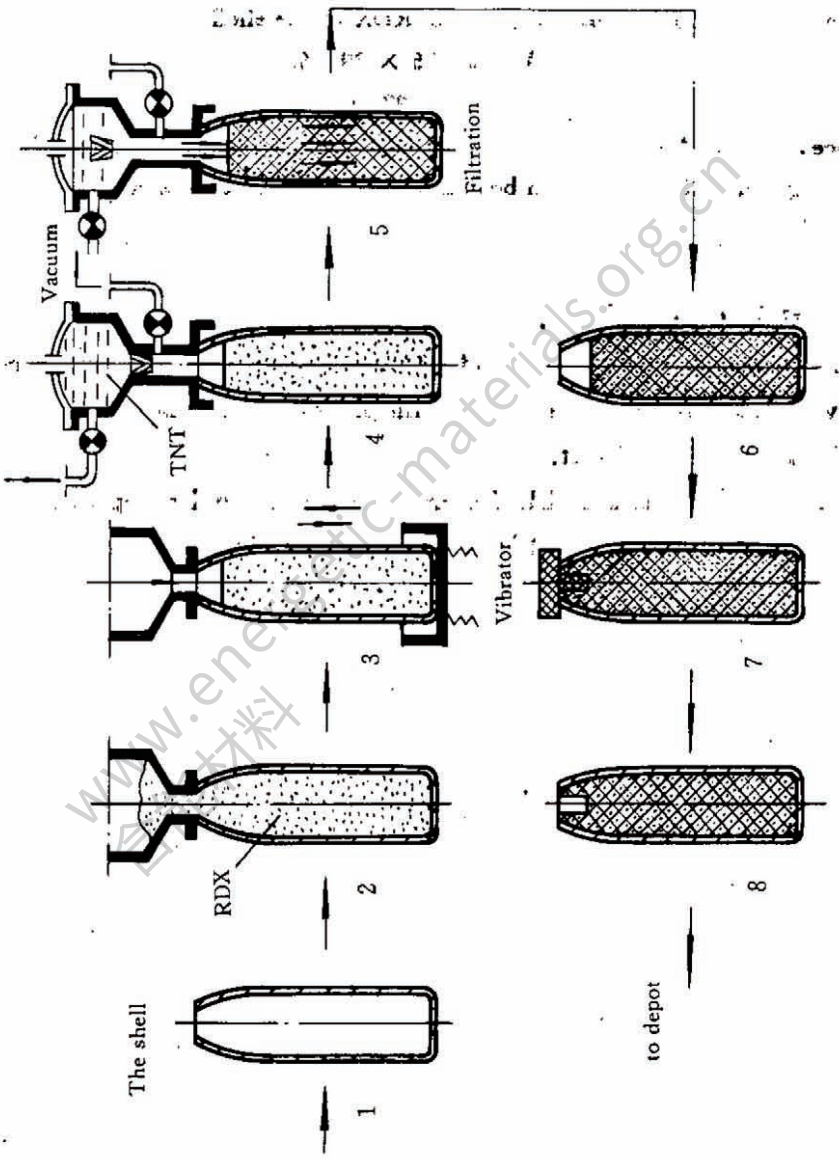

Fig. 1

FILTER TECHNOLOGY