PROCESS FOR DESENSITIZING SOLID EXPLOSIVE PARTICLES BY COATING WITH WAX

Arthur E. Gardner, Ottawa, Ontario, Canada, assignor to Ministry of National Defence of Her Majesty's Canadian Government

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ABSTRACT OF THE DISCLOSURE

Solid explosive particles are coated with a wax desensitizer by a method in which a solution of the wax in a solvent heavier than water and of boiling point below 100° C. is poured onto a water slurry of the explosive particles which is under stirring and at a temperature at which the wax does not solidify.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to the coating of an explosive substance and to the coated explosive composition so formed. More particularly, it relates to the coating of crystalline cyclotrimethylene-trinitramine (known as RDX) and to the coated RDX explosive so formed.

BACKGROUND OF INVENTION

RDX is commonly used as a chief explosive ingredient for ammunition, for example, shells, depth charges and bombs. However, RDX itself is too sensitive to be used as a main filling for shells and the like, being more sensitive to impact than, for example, tetryl. Accordingly, taking advantage of the general principle that coating an explosive with wax will reduce the sensitivity, RDX has been coated with wax, suitable commercially available polyolefin waxes, for example, low molecular weight polyethylene wax or low molecular weight polypropylene. Nevertheless, it was found that it was difficult to coat RDX crystals even with wax, especially with a polyolefin wax.

When used in explosives, RDX is usually mixed with TNT (trinitrotoluene) and the mixture becomes liquid above about 80° C. Consequently, it is desirable to use waxes which have melting points just about 100° C. Waxes which melt at a temperature below about 100° C. tend to become liquid and agglomerate during the casting of the explosive. On the other hand, waxes which have melting points above about 100° C. are generally hard and it is known that softness is a requirement of effective desensitization.

Even when polyolefin waxes of melting point just above about 100° C. were used to coat RDX, the procedure used heretofore has not been satisfactory. The usual procedure used heretofore has been to pour liquefied wax onto the surface of an agitated aqueous RDX slurry. The wax was found to solidify substantially immediately on addition to the slurry and consequently does not properly coat the explosive.

Accordingly, a prime feature of the present invention is the provision of a process for coating a desensitizing wax on an explosive which is substantially removed by melting or by entering into solution with other ingredients, such as TNT (trinitrotoluene) at temperatures up to the maximum temperature of a water bath (i.e. about 100° C.).

A subsidiary feature of this invention is the provision of a process for coating a polyolefin wax on RDX.

A further feature of this invention is the provision of an explosive composition comprising crystalline explosive particles uniformly coated with a desensitizer.

STATEMENT OF INVENTION

It has now been found that by dissolving the desensitizer, i.e., the polyolefin wax, in a suitable solvent, e.g., trichloroethylene, and by maintaining the temperature of said slurry at a suitable temperature, i.e., 50-70° C., the explosive in the slurry may be uniformly coated with the desensitizer.

Thus, according to one aspect of the present invention, there is provided a process for coating explosive particles uniformly with a desensitizer, which comprises:

(a) preparing a solution by dissolving said desensitizer in a solvent therefor;
(b) inhibiting evaporation of said solvent by superposing thereon a layer of water above said mixture;
(c) agitating an aqueous slurry of said explosive;
(d) pouring said solution onto said agitating slurry; and
(e) maintaining the temperature of said solution at a level sufficient to inhibit the tendency of said desensitizer to solidify immediately;

whereby droplets of said solution gravitate downwardly through said slurry, thereby coating said explosive uniformly with said desensitizer. By another aspect of this invention there is provided an explosive composition comprising particles of explosive each uniformly coated with desensitizer.

Any of the conventional waxy desensitizers having a melting point of about 100° C. may be used in the present invention. Examples of suitable such desensitizers include natural materials, such as, for example, beeswax, and synthetic materials, such as, for example, polyolefin waxes, i.e., low molecular weight polyethylene wax (of M.W. 1500) with or without low molecular weight polypropylene (of M.W. about 3000) and microcrystalline waxes.

The solvent which may be used is any one which is a solvent for the particular desensitizer used, is denser than water and has a boiling point under 100° C. Non-limiting examples include chlorinated hydrocarbons, such as, for example, trichloroethylene, and similar solvents which are heavier than water and are readily dispersed into droplets which tend to sink through the water-explosive slurry.

The temperature at which the solution is maintained is one which, depending upon the parameters mentioned hereinabove, controls the viscosity of the slurry to such an extent that there is no immediate tendency of the desensitizer to solidify and so that droplets of the desensitizer-solvent mixture gravitate downwardly through the agitated slurry, thereby coating the explosive. When the desensitizer is polyethylene wax and the solvent is trichloroethylene, a suitable temperature is 50-70° C.

Any explosive may be coated with a desensitizer according to the present invention provided it is insoluble in water and is not molten at the temperature at which the water bath may be used. Examples include RMX (cyclohexylmethyltetranitramine) and PETN (pentamethylene tetranitramine).

The amount of desensitizer coating on the explosive is usually variable to a great extent. Suitable limits should be selected to provide reasonable desensitization with a minimum of desensitizer. Proportions generally found feasible are 1.0-9.0% by weight, with 1.67% being preferable to provide equivalent sensitivity to tetryl (trinitrophenylmethylnitramine).
EXAMPLE

The following example is given to explain the present invention:

One gallon of water for every four pounds of crystallized RDX is placed in a suitable vessel. The mixture is agitated and raised to a temperature of about 70° C. Slightly more than one ounce of low molecular weight polyethylene wax is placed in a smaller sized vessel and water to a depth of one inch is added to prevent evaporation. 96 cc. of trichloroethylene are poured onto each ounce of polyethylene and the mixture is heated to a temperature of about 65° C. and allowed to stand until the trichloroethylene fully dissolves the polyethylene.

This mixture is then slowly poured onto the surface of the agitated slurry of RDX and water. As the density of the trichloroethylene is 1.49, the droplets formed tend to gravitate toward the bottom passing the crystals of RDX which are revolving in a rotary fashion. This fall is checked by slowly raising the temperature, when the trichloroethylene vaporizes and the droplets tend to rise. As the boiling point of trichloroethylene is 86.7° C. at normal pressure of 760 mm. of mercury, almost all trichloroethylene is removed, when the mixture is heated to 92° C. The final temperature is raised to 98° C. and agitation is continued for 75 minutes. The charge is then cooled to 35° C., then discharged to a stationary filter where excess water is removed leaving the waxed RDX containing 6-10% water.

This process produces 1.67% wax covering most of the RDX, namely, it provides reasonable desensitization with minimum of wax. In addition, the coating is a great deal more stable than coatings applied by known methods.

While the invention has been described herein with reference to certain specific embodiments thereof, such are intended by way of illustration and not in limitation except as may be defined in the appended claims.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A process of uniformly coating solid explosive particles with a plastic desensitizer which comprises:
   forming a solution of a wax having a melting point of about 100° C. in a solvent which is denser than water and has a boiling point below 100° C.,
   providing a layer of water over said solution to prevent evaporation of the solvent therefrom,
   agitating an aqueous slurry of said explosive particles to cause the particles to revolve therein,
   pouring said water-covered solution of the wax onto said agitated slurry which is maintained at a temperature at which said wax does not solidify and droplets of said solution gravitate downwardly through said slurry to coat said explosive particles with said wax,
   and slowly raising the temperature of said agitated slurry below 100° C. to evaporate the solvent therefrom.

2. A process as defined in claim 1, wherein the wax is a polyolefin wax.

3. A process as defined in claim 1, wherein the wax is a polyethylene wax.

4. A process as defined in claim 1, wherein the wax is a polyolefin wax and the solvent is trichloroethylene.

5. A process as defined in claim 1, wherein the wax is a polyethylene wax and the solvent is trichloroethylene.

6. A process as defined in claim 1, wherein the explosive is cyclotrimethylethrienitramine.

7. A process as defined in claim 2, wherein the explosive is cyclotrimethylethrienitramine.

8. A process as defined in claim 3, wherein the explosive is cyclotrimethylethrienitramine.

9. A process as defined in claim 1, wherein the wax is a polyethylene wax, the solvent is trichloroethylene, and the water-covered solution of the polyethylene wax is poured onto the agitated aqueous slurry which is maintained at a temperature of from about 50-70° C.

10. A process as defined in claim 9, wherein the explosive is cyclotrimethylethrienitramine.

11. A process as defined in claim 9, wherein the explosive is cyclotrimethylethrienitramine and the aqueous slurry containing the wax-coated explosive particles is cooled and filtered.

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CARL D. QUARFORTH, Primary Examiner
S. J. LECHERT, Jr., Assistant Examiner

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