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METAL AZIDE ELECTRICALLY CONDUCTIVE PRIMING COMPOSITION AND MANUFACTURE THEREOF

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ABSTRACT OF THE DISCLOSURE

Process of manufacturing electrically conductive priming compositions for rapid acting gap detonators comprising the steps of (1) forming a homogeneous mixture of an electrically conductive material and a secondary explosive and (2) admixing the mixture thereby obtained with an initiating explosive. The resulting compositions can be ignited within a very few microseconds by very low energies.

The relation relates to a process for the manufacture of electrically conductive priming compositions for rapid acting gap detonators. More particularly this invention relates to the manufacture of electrically conductive compositions for rapid acting gap detonators which can be ignited within a few microseconds by very low energies.

Such detonators are increasingly needed by the art and particularly for piezoelectric detonators. They are supposed to be able to be ignited within a few microseconds and by means of very low energies (less than 20 microwatt-seconds).

Such detonators have been manufactured, for example, in the following manner. A priming composition is pressed into a narrow gap of a few microns in width, which forms a spark gap. The priming charge is ignited by a bridging spark.

Alternatively an electrically conductive priming composition is pressed into a gap of narrow width. A priming composition of this kind can be rapidly ignited utilizing low energies if it is based on a composition which is recognized by the art as appropriate for such purpose.

A number of methods are known for the preparation of electrically conducting priming compositions. One process has been proposed wherein initiating exposives such as lead azide or silver azide are mixed with an amount of graphite. It is difficult to prepare a homogeneous mixture from these materials. As in all mixing processes, a certain amount of time is required for the mixing itself and it has been established that a fairly long time is needed for the preparation of a homogeneous mixture of the foregoing components which, in this case, entails considerable danger. Here the initiating charge becomes so friction sensitive and shock sensitive that detonation occurs during the mixing operation. According to another process some hydrazine is added to the silver azide to reduce a part of the azide to silver, which then forms the conductive agent of the priming charge. In this case only a small percentage of the azide is supposed to be reduced. It has been found, however, that a homogeneous mixture is not obtained by this method, and instead only small conductive foci are usually formed in the reduction.

According to another method, the silver azide is reduced by ultraviolet radiation. This procedure has not proved satisfactory either because the upper strata are reduced considerably more than the underlying material, i.e., a homogeneous mixture is not obtained.

In accordance with the invention it has now surprisingly been found that electrically conductive priming compositions for rapid acting gap detonators can be obtained without any of the above-mentioned disadvantages by mixing in a first step an electrical conducting agent with a secondary explosive and thereafter in a second stage mixing the mixture thus obtained with an initiating explosive. By a secondary explosive is meant a highly brisant explosive having a detonation speed of more than 5000 meters per second.

The compositions in accordance with the invention can be ignited by means of very low energies and specifically with energies of less than 20 microwatt-seconds. The induction period is characteristically very low, ignition taking place in less than 10 microseconds. This is particularly important as the priming compositions are often used in shaped charges.

Instances of suitable secondary explosive include nitropentaerythritol, nitromannitol, hexogen and trinitrotoluene.

Instances of suitable electric conducting agents are, for example, graphite and colloidal silver.

Silver azide and lead azide are examples of initiating explosives of practical importance.

The amount of electrically conducting agent present in the mixture varies with the resistance desired and the gap width of the detonation. The resistance of the detonator may vary with 20Ω to 50,000Ω depending on the intended application and preferably amounts to from about 2 to about 15 wt. percent. If the electrically conducting agent is graphite, the same is preferably used in amount of from 5 to 15 wt. percent referred to the total composition and if silver is used the same is preferably used in an amount of about 2 to 10 wt. percent.

The secondary explosive is required to be present in an amount of at least 10 wt. percent and is preferably present in an amount of more than 25 wt. percent referred to the total composition.

The following examples are given for the purpose of illustrating the invention and are in no wise to be construed as a limitation thereof.

Example 1

55 parts by weight of nitropentaerythritol were mixed with 5 parts of graphite so as to produce a homogeneous mixture. The product thereby obtained was mixed with 40 parts of lead azide until a homogeneous mixture had again been formed. The mixture was then compacted by the conventional methods. The resulting mixture could be reliably ignited over a gap of 0.2 mm. width with an energy of 2 to 10 microwatt-seconds. The induction period of the ignition amounted to about 2–3 microseconds.

A charge which consisted of the above mixture had an extremely high detonation rate, required very little energy for ignition, and is extremely safe to handle both in manufacturing and processing.

Example 2

The procedure of Example 1 was repeated using 8% graphite, 32% nitromannitol and 60% lead azide. The resulting mixture could be readily ignited over a gap width of 0.2 mm. width with an energy of 10–15 microwatt-seconds. The induction period of the ignition amounted to about 5–7 microseconds.

Example 3

When 6% graphite, 44% hexogen and 50% lead azide were employed in the process of Example 1, the resulting mixture could be readily ignited over an 0.2 mm. gap width with an energy of 5–10 microwatt-seconds and had an induction period for the ignition amounting to 3–5 microseconds.

In accordance with the method of the invention, priming compositions are made available wherein the three critical components are present in the mixture in any desired ratios. However, for the realization of an adequate initiating effect the percentage of the initiating explosive must amount to at least 30%.

We claim:

1. An electrically conductive priming composition for rapid acting gap detonators comprising an electrically conductive material selected from the group consisting of graphite, carbon black and colloidal silver, a secondary explosive selected from the group consisting of pentaerythritol tetranitrate, mannitol, hexanitrate, cyclotrimethylenetrinitramine and trinitrotoluene and an initiating explosive selected from the group consisting of silver azide and lead azide.

2. An electrically conductive priming composition according to claim 1 consisting essentially of:

	Parts by weight
Pentaerythritol tetranitrate	55
Graphite	5
Lead azide	40

3. An electrically conductive priming composition according to claim 1 consisting essentially of:

	Percent
Graphite	8
Mannitol hexanitrate	32
Lead azide	60

4. An electrically conductive priming composition according to claim 1 consisting essentially of:

	Percent
Graphite	6
Cyclotrimethylenetrinitramine	44
Lead azide	50

5. Process for the manufacture of electrically conductive priming compositions for rapid-acting gap detonators, which comprises mixing in a first step an electrically conductive material selected from the group consisting of graphite, carbon black and colloidal silver with a secondary explosive selected from the group consisting of pentaerythritol tetranitrate, mannitol hexanitrate, cyclotrimethylenetrinitramine and trinitrotoluene, and thereafter in a second step mixing the mixture thereby obtained with an initiating explosive selected from the group consisting of silver azide and lead azide.

6. Process according to claim 5 wherein said secondary explosive is pentaerythritol tetranitrate, said electrically conductive material is graphite and said initiating explosive is lead azide.

7. Process according to claim 5 wherein said initiating explosive is present in an amount of at least 30% referred to the total composition.

8. Process according to claim 5 wherein said electrically conducting agent is present in an amount of from 2 to 15 wt. percent referred to the total composition.

9. Process according to claim 8 wherein said electrically conducting agent is graphite and is present in an amount of from 5 to 15 wt. percent referred to the total composition.

10. Process according to claim 8 wherein said electrically conducting agent is silver and is present in an amount of from 2 to 10 wt. percent referred to the total composition.

11. Process according to claim 5 wherein said secondary explosive is present in an amount of at least 10% referred to the total composition.

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