United States Patent Office 3,695,948 Patented Oct. 3, 1972

3,695,948

CAST EXPLOSIVE COMPOSITION CONTAINING THIOUREA

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No Drawing. Filed May 22, 1970, Ser. No. 39,904
Int. Cl. C06b 19/00
U.S. Cl. 149—2 10 Claims

ABSTRACT OF THE DISCLOSURE

An explosive composition which comprises thiourea and an inorganic oxidizing salt; more specifically the composition includes water to provide a composition which will set up into a stiff to hard mass within a predetermined period of time. The composition is waterproof and can be detonated at low temperatures.

BACKGROUND OF THE INVENTION

The present invention relates to cast explosive compositions which can be prepared without the need to employ high temperatures in the manufacturing process.

SUMMARY OF THE INVENTION

The present invention concerns an explosive composition which can be detonated with a relatively small high pressure booster. The composition comprises the following constituents as percent by weight: thiourea about 5 to about 40 percent, an inorganic oxidizing salt about 30 to about 93 percent, and water from about 2 to about 20 percent. The composition is prepared by mixing together the constituents as defined herein and allowing the composition to set up form a stiff to hard composition. The initial water containing composition will be a pourable slurry which upon standing for a predetermined period of time will set up to form a stiff to very hard composition depending on the exact proportion of constituents employed. The composition thus may be formed into predetermined shapes if desired.

PREFERRED EMBODIMENTS

The present invention concerns an explosive composition comprising the following constituents as percent by weight.

Constituent	Range	Preferred range
Inorganic oxidizing salt	About 30 to about 93	About 50 to about 90.
Thiourea	About 5 to about 40	About 10 to about 30.
H_2O	About 2 to about 20	About 5 to about 10.
Fuel and/or sensitizer	0 to about 30	About 10 to about 15.
Density control agent	0 to about 5	About 1 to about 2.
Thickening or gelling agent	....do	.01 to about 2.

Inorganic oxidizing salts which may be employed in the present invention consist of those normally employed in explosive compositions and consists of alkali, alkaline earth metal and ammonium nitrates, perchlorates, perchlorides, chlorates and bromides. Ammonium nitrate can be employed as the major part of the inorganic oxidizing salts. However, sodium nitrate or other salts may be used to replace a part or all of the ammonium nitrate. Other specific inorganic oxidizing salts which can be employed include, for example, ammonium perchlorate, sodium perchlorate, sodium nitrate, calcium nitrate, calcium perchlorate, sulfates, such as ammonium sulfate, sodium sulfate, and calcium sulfate, and mixtures of these various salts.

Optionally, other constituents such as sensitizers, fuels, thickeners, and density control agents can be included in

the composition to alter its physical and/or chemical properties. For example, particulate metals such as aluminum, magnesium, boron, ferrosilicone, ferrophosphorous, titanium and alloys of such metals can be included as an additional fuel and sensitizer. When a particulate metal is employed it usually ranges in size from about −4 to about +325 mesh (U.S. Standard Sieve Series). However, the size of the metal particles is not critical to the present invention.

Also, self-explosive sensitizers such as pentolite, nitrostarch, nitroglycerin, composition B, TNT, RDX, PETN cyclonite, nitro-cellulose, tetryl and the like may be included. Usually, up to about 10 percent by weight is employed. However, the present explosive composition is sufficiently sensitive to be detonated with a small high pressure booster without the need to use such high explosive sensitizers.

Similarly carbonaceous fuels can be incorporated into the compositions such as, for example, charcoal, coal dust, petrolic liquids, e.g. fuel oil and crude oil fractions, sugar, molasses and the like. Likewise, sulfur, urea and other conventional sensitizer and fuels employed in inorganic oxidizing salt based explosives, may be employed.

Gelling and/or thickening agents such as galactomannans (e.g. guar gum), polyacrylamides, polyesters, polyethers, cellulosic material, starches and other like materials may be added to the initial slurry to keep the particulate ingredients such as metals and inorganic oxidizing salts suspended until the mix has set up. The use of such thickening agents insures that the solid ingredients will be evenly distributed throughout the resulting explosive composition and also adds an additional degree of water resistance to the explosive composition.

Various density control agents such as, for example, void containing materials, such as microspheres made from various materials, e.g. metals, thermosetting resins, plastics, clay, and glass, can also be added to the composition to control the density thereof. Also gaseous forming compounds, e.g. carbonates, may be included to provide gaseous voids. The use of such density control agents among other advantages allows the explosive to be detonated under elevated pressures.

The composition can be employed as a high density blasting agent and as a high density booster for the detonation of less sensitive explosives.

The following examples will facilitate a more complete understanding of the present invention.

EXAMPLE 1

Two compositions were prepared containing the following constituents as percent by weight. The compositions set up into firm masses.

Constituent	Composition, percent by weight A	B
H_2O	9.1	4.8
Thiourea	18.2	19.1
NH_4NO_3	54.6	57.0
$NaNO_3$	18.2	19.1

Hollow glass microspheres were incorporated into samples of these compositions to vary the densities thereof. The resulting compositions were detonated in a standard lead block test with a one-twelfth pound HDP–3 wafer booster. The composition, densities, and lead block deformation (ΔH) in inches, is noted in the following Table I. These compositions even though containing no sensitizers, e.g. metal, detonated very well.

TABLE I

	Composition	Density (gm./cc.)	ΔH (inches)
Shot number:			
1	A	1.18	0.14
2	A	1.12	0.32
3	A	1.09	0.25
4	A	1.04	0.32
5	A	0.99	0.26
6	B	1.26	0.11
7	B	1.13	0.54
8	B	1.06	0.68
9	B	0.96	0.74
10	B	0.90	0.73

EXAMPLE 2

To demonstrate the effect of temperature on the sensitivity of explosive compositions within the scope of the present invention samples of a composition, having various densities, were detonated in a standard lead block test at both 30° F. and 70° F. The base composition consisted of water, 7.7 percent; thiourea, 15.4 percent; ammonium nitrate, 46.2 percent; sodium nitrate, 15.4 percent; and flake aluminum, 15.4 percent. The densities of the compositions, the deformation (ΔH in inches) of the lead block and the temperature at which the composition was detonated are noted in the following Table II.

As evidenced by this data the explosive composition performed well at low temperatures at densities even greater than 1.1 gm./cc.

TABLE II

	Ambient termperature ° F.	Density (gm./cc.)	ΔH (inches)
Shot Number:			
1	70	1.43	0.18
2	70	1.34	0.84
3	70	1.31	0.91
4	70	1.24	0.92
5	70	1.22	0.91
6	70	1.12	0.92
7	70	1.06	0.83
8	70	1.03	0.88
9	70	0.94	0.94
10	70	0.91	0.84
11	30	1.41	0.04
12	30	1.27	0.14
13	30	1.13	0.54
14	30	0.87	0.72

EXAMPLE 3

Two explosive compositions were prepared having the following constituents as percent by weight.

Constituents	Composition, percent A	B
H_2O	9.61	9.61
Urea	6.73	9.61
Thiourea	6.73	3.84
NH_4NO_3	57.66	57.66
$NaNO_3$	9.61	9.61
Al (flake)	9.61	9.61

The densities of various samples of both compositions were varied by the addition of hollow glass microspheres and the resulting compositions detonated in a standard lead block test. The densities, and resulting lead block deformation (ΔH in inches) are set forth in the following Table III.

TABLE III

	Composition	Density (gm./cc)	ΔH (inches)
Shot number:			
1	A	1.33	0.04
2	A	1.24	0.06
3	A	1.13	0.33
4	A	1.12	0.87
5	B	1.39	0.02
6	B	1.28	0.04
7	B	1.03	0.17

As evidenced by these tests increased amounts of urea appeared to densensitize the explosive although at an urea concentration of less than about 7.00 percent and a density of about 1.1 gm./cc. the explosive performed favorably with the composition of Shot No. 6, having a density of 1.12 gm./cc. of Example 2.

Various modifications may be made in the present invention without departing from the spirit or scope thereof for it is understood that I am limited only as defined in the appended claims.

What is claimed is:

1. An explosive composition which comprises a set mass of:
(a) at least one inorganic oxidizing salt;
(b) thiourea; and
(c) from about 2 to about 20 percent of water.

2. The composition as defined in claim **1** containing:
(a) from about 30 to about 93 percent of an inorganic oxidizing salt;
(b) from about 5 to about 40 percent of thiourea; and
(c) from about 2 to about 20 percent of water.

3. The composition as defined in claim **2** including in addition a particulate metal.

4. The composition as defined in claim **2** including in addition a self-explosive sensitizer.

5. The composition as defined in claim **2** including in addition a thickening agent.

6. The composition as defined in claim **2** including in addition a void containing density control agent.

7. The composition as defined in claim **2** including in addition a carbonaceous fuel.

8. The composition as defined in claim **1** which comprises, as percent by weight:
(a) from about 50 to about 90 percent of an inorganic oxidizing salt;
(b) from about 10 to about 30 percent of thiourea;
(c) from about 5 to about 10 percent water; and
(d) from about 10 to about 15 percent of a compound which is a fuel or sensitizer.

9. The composition as defined in claim **8** including in addition up to about 30 percent of a particulate metal.

10. The composition as defined in claim **8** wherein the major proportion of the inorganic oxidizing salt is ammonium nitrate.

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U.S. Cl. X.R.

149—18, 19, 20, 21, 43, 44, 46, 60, 61