

DESCRIPTION

The invention relates to an explosive for warheads and a rocket solid propellant, consisting of a high-energy secondary explosive with inorganic perchlorate and a metal content of high oxygen affinity as well as desensitizing and binding agent.

From the literary text "Engineering Design Handbook" from "Explosives Series Properties of Explosives of Military Interest", U.S. Army Materiel Command, January 1971, an explosive consisting of hexogen, potassium perchlorate, aluminium with binding agents is known.

A similar explosive emerges from US-A 4 042 430, in which respect this relates to a high-temperature-resistant explosive. In the case of these known explosives it is a common factor that the oxidizing agent is present with stoichiometric excess. As a consequence, upon the detonation the surplus perchlorate is decomposed along with the consumption of energy. The oxygen released can only then re-react with the metal. Therefore a multi-stage reaction is present, whereby the conversion of energy is relatively slow.

US-A-2,992,086 relates to a high-energy blasting agent which contains metal powder. The composition in accordance with the Table in column 2, Example 1: 54 Al, 36 ammonium perchlorate, 4 TNT, 6 RDX, 3 binder is preferably adjusted in such a way that the amount of oxidizing agent is precisely sufficient for the metal combustion and the explosive content is so calculated that the oxygen is released as completely as possible and the temperature necessary for the metal/oxygen reaction is reached. A further teaching with respect to the stoichiometry between secondary explosive and oxidant is not contained therein.

The problem underlying the invention is to provide an explosive having a high energy content per unit of volume. In this respect, the conversion of energy is to be effected very rapidly and be complete.

The invention solves this problem in that, in the case of a secondary explosive, the oxygen balance is balanced by the perchlorate content approximately to give a complete reaction into carbon dioxide and water.

As a result of the complete reaction of the combustible contents contained in the explosive, a very large amount of explosive gases which are particularly well and easily reducible by metal arises. In this way a considerable increase in performance compared with the known explosives is achieved.

As a result of the higher affinity of the metal with oxygen, compared with carbon and hydrogen, a violent reaction

of the metal with carbon dioxide and water is effected. These are, in this respect, reduced and a considerable amount of energy is released. In this way the explosive-gas mixture is additionally heated up, whereby the performance capacity of the explosive is considerably increased. Particularly favourable values are obtained if the stoichiometry of the metal content brings about a reduction of the explosive gases to hydrogen and carbon monoxide. If, with a reduced volume of explosive gas, a particularly large release of heat is desired, then, as a result of a further increase in the metal content, a reduction of the explosive gases to elementary carbon and hydrogen is undertaken.

Furthermore, as a result of the high energy surplus, a very rapid vaporization of the metals is brought about, whereby the reaction readiness thereof is considerably increased.

In accordance with claim 2, the perchlorates of the alkaline and alkaline-earth metals are provided as perchlorates. Such perchlorates are cost-favourable, easily accessible and preparable.

In accordance with claim 3, with 100g of hexogen or octogen 40-50g of sodium perchlorate are present. As a result of the indicated range in the case of the sodium perchlorate, in accordance with the respective use suitable amounts of binding and desensitizing agent can be provided; without the stoichiometry of the reaction with the secondary explosive changing.

In accordance with claims 4 and 5, provision is made for the fact that sodium or calcium perchlorate are used as perchlorate. Potassium perchlorate offers, by reason of its low hygroscopicity, particularly processing-technology advantages. Calcium perchlorate acts on the other hand, by reason of its higher density and of the higher specific oxygen content, in a performance-increasing manner.

In accordance with claim 6, an advantageous further development of claim 1 is indicated. As a function of the type of metal used, a content of 25 to 45 percent by weight is provided for the reduction.

With the pre-requisite of the high oxygen affinity, in accordance with claim 7 various light metals can be used.

In the case of an explosive having high density, in accordance with claim 8 also heavy metals of high oxygen affinity, such as zirconium, can be used.

An energy-rich, relatively dense and cost-favourable rocket propellant is present in accordance with claim 9. The explosive is, in this respect, mixed with rocket-solid-propellant-specific desensitizing and binding agents as well as light metals.

Materially intrinsic for the invention is:
Universal explosives or respectively explosive recipes with maximum energy yields are present. The explosives in accordance with the invention can easily be correlated with application-technology requirements, in which respect the energy content is higher than in the case of known explosives. Also higher volumes of explosive gases and blast effects than in the case of conventional metal-containing explosives with oxidizing agent are present.

The invention is also usable without essential variation for rocket solid propellants, by metals which are as light as possible and specific desensitizing and binding agents being used.

In the case of an explosive the constituents of which are indicated in percentages by weight, the following result has been achieved. Explosive contents:

50.2% RDX
21.2% Na ClO₄
25% zirconium
3.6% binder

The following results have been achieved on steel having a plate thickness of 8mm with an explosive body having a weight of 15g and the dimensions of 20mm in diameter and 20 mm in height.

The plate has been pierced, in which respect the hole diameter amounts to 7mm.

Upon comparison with the known explosive HWC (94.5% hexogen, 4.5% wax, 1% graphite), a plate of the same thickness has not been pierced. An only just perceptible crack arose.

A test carried out in the same way with the explosive Hexal (70% hexogen, 30% aluminium) showed that the plate was not pierced. Also no crack arose.

An explosive of the following composition

36% HMX
16.9% KClO₄
45% zirconium
2.1% binder

supplied, upon an underwater blasting, a percussion pressure higher by 41.5% than a sample, having the same volume, of the underwater explosive SSM TR 8870 (41% TNT, 30% RDX, 24% Al, 5% desensitizing agent).

The metal is to be converted explosively. For this it is necessary first of all to vaporize the metal. As is well known, for this a high energy is necessary, since the vaporization heat of aluminium, calcium, silicon is very high. Upon the admixing of metals to normal explosives, usually the relatively low explosion heat thereof is hardly sufficient to vaporize the metal rapidly and completely.

Also in this respect much of the explosion heat is consumed and prior to the metal combustion thus the temperature becomes lower, whereby a retardation of the reaction is the result. Therefore, first of all the energy of the co-used explosive must be increased.

In accordance with the invention this is achieved in that a reliable explosive such as TNT, hexogen, octogen or nitropenta is cast, fused, mixed with such a large amount of perchlorate or bound by a solvent that it leads to a complete combustion with a balanced oxygen balance, e.g. 16 mol TNT + 21 mol $\text{Ca}(\text{ClO}_4)_2$ or 8 mol hexogen + 3 mol $\text{Ca}(\text{ClO}_4)_2$.

This basic mixture is intimately mixed and fused or bonded with the metal dust. The proportion of the metal is at least so high that the water is reduced to hydrogen and the carbon dioxide is reduced to carbon monoxide. Upon further reduction the energy is increased, but the volume of explosive gas decreases, since the carbon monoxide is reduced to carbon. The arising amounts of energy are very high without a re-combustion with the atmospheric oxygen being present.

If an explosive having great heat effect is to be provided, in which respect of course the volume of explosive gas is very low, the above mixture of TNT/ $\text{Ca}(\text{ClO}_4)_2$ can have added to it a mixture of 37.6% Al, 62.4% $\text{Ca}(\text{ClO}_4)_2$ with a specific weight of 2.67 g/cm³. The energy amounts, in this respect, to 31.4 MJ/dm³.

Energy-rich rocket solid propellants are provided by desensitizing specifically ammonium-perchlorate-containing mixtures.



CLAIMS

Explosive for warheads and rocket solid propellant, consisting of a high-energy secondary explosive with an inorganic perchlorate and a metal content of high oxygen affinity, as well as desensitizing and binding agent, characterised in that between the components the following stoichiometric conditions are simultaneously present:

- the oxygen balance of the secondary explosive is balanced by the perchlorate content approximately to give a complete reaction into carbon dioxide and water; and
- the metal content is selectively so correlated with the arising volume of reducible explosive gas (CO_2 and H_2O) that this is reduced either to carbon monoxide and hydrogen or to carbon and hydrogen.

2. Explosive according to claim 1, characterised in that the perchlorates of the alkaline and alkaline-earth metals are provided as perchlorates.

3. Explosive according to claim 1, characterised in that with 100g of hexogen or octogen 40-45g of sodium perchlorate and appropriate amounts of binding and desensitizing agent are provided or with 100g of TNT 140-150g of NaClO_4 are provided.

4. Explosive according to claim 1, characterised in that lithium, potassium or calcium perchlorates are provided as perchlorates.

5. Explosive according to claim 3, characterised in that with 100g of hexogen or octogen 40-44g of calcium perchlorate and appropriate amounts of binding and desensitizing agent are provided.

6. Explosive according to claim 1, characterised in that depending on the type of metal the explosive contains 25 up to 45 percent by weight of metal content.

7. Explosive according to claim 1, characterised in that silicon, magnesium, calcium, aluminium or mixtures or alloys consisting thereof are provided as metals.

8. Explosive according to claim 1, characterised in that zinc, manganese, titanium, zirconium or mixtures or alloys consisting thereof are provided as metals.

9. Explosive for use as rocket solid propellant according claim 1, characterised in that the explosive has suitable rocket-solid-propellant-specific desensitizing and binding agents, as well as light metals and mixtures or alloys thereof.