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IGNITION MATERIAL CONTAINING TELLURIUM DIOXIDE, BORON AND FLUOROPOLYMERIC BINDER

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ABSTRACT OF THE DISCLOSURE

A combustible material, particularly suited for electrically initiated ordnance devices, consists of tellurium dioxide as the oxidizer and a fuel composed of boron and a fluoroelastomeric binder.

BACKGROUND OF THE INVENTION

This invention relates to an initiating explosive mixture, such as is used in ordnance and quasi-ordnance devices. It is triggered by an electric bridge wire, or by any other means of rapidly raising the temperature to the ignition point, e.g. a laser beam. When fired, the initiator may be used in a number of ways, as by employing the resulting high pressure to rupture, fracture, or move a physical member, or by sudden heat generated to trigger another and larger combustible or explosive device.

Ignition or explosive mixtures of the type forming the subject matter of this invention are many and varied. They are customarily triggered or ignited by a sudden elevation in temperature as by current through a bridge wire or more recently by energy from a laser beam. One of the serious shortcomings of such explosive mixtures is that they are subject to unwanted triggering by uncontrolled electrostatic charges, high energy radio frequency signals, and other extraneously generated and applied electric current sources. The mixture of the present invention is highly resistant to these random and uncontrollable electric currents because of its very high electric resistance. It responds normally, however, to high heat sources, such as are usually used to trigger devices of this sort, for example bridge wires and laser beams.

SUMMARY

The present invention is essentially a non-conductive or very high resistance ignition mixture. It consists of tellurium dioxide as an oxidizer and a fuel consisting of boron and a binder.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention consists preferably of a stoichiometric mixture of a fuel and an oxidizer. The fuel comprises boron and a binder.

The preferred fluoroelastomeric binder is a copolymer of vinylidene fluoride and hexafluoropropylene marketed under the trademark Viton B by E. I. du Pont de Nemours & Co. having a repeating structure generally corresponding to the formula $—CF_2—CH_2—CF_2—CF(CF_3)—$. Its function is to give the mixture acceptable physical handling properties. It is also a fuel, however, and should be taken into account when determining the stoichiometric proportion of oxidizer.

The oxidizer is tellurium dioxide in powder form of 2 microns±1 micron.

The boron is preferably elemental and non-compacted and has a particle size of approximately 300 angstroms.

The binder, prior to being mixed into the compound, is dissolved in N-butyl acetate, which serves as a transient

carrier that does not enter significantly into the ignition reaction. Most of it in fact evaporates during the compounding of the mixture.

In general it has been found that acceptable ignition mixtures should lie somewhere close to a stoichiometric mixture between oxidizer and all fuel components. Either component, oxidizer or fuel, may vary as much as ±10% from strict stoichiometric proportions and still produce an acceptable ignition material for the purposes of the present invention. When the fuel proportion is quite high, as for example up to 25% of the total mixture, the remaining 75% being oxidizer (tellurium dioxide), the mixture is suited for use as a propellant in gas generators, rockets and the like.

For use in initiator, ignition, and detonator devices, the mixture of the present invention is preferably substantially stoichiometric, i.e. has the following composition by weight:

tellurium dioxide, 88.4 parts±5%
boron, 6.6 parts±2%
binder, 5.0 parts±2%

A stoichiometric mixture as specified immediately above has successfully withstood the discharge of 30,000 volts DC from a 500 picofarad capacitor, through a column of the mixture 0.87 inch long. The mixture did not fire or ignite, nor was it in any way damaged or deteriorated. It thereafter functioned properly, i.e. fired, when energized with a 3.5 ampere current pulse passing through a conventional bridge wire embedded in the material.

When assembled as an initiating charge in a conventional electric blasting cap, the mixture of the present invention has been tested with pulses of 60,000 volts from shorted circuit to case without causing uncontrolled firing or any damage or deterioration to the units. Thereafter, when heated by conventional bridge wires, such units fired properly.

The mixture when used in various physical firing cartridges has been subjected to radio frequencies in the *x* band up to 6 watts of energy without firing or being subjected to any deterioration. Radio frequency energies have been supplied directly through the mix from circuit to circuit and from shorted circuit to case. No firing or deterioration was noted and all units subsequently fired normally when subjected to normal bridge wire current.

A mixture of the present invention has been found to accept up to 670° F. without firing. This is about 250° F. higher than most of the commonly used initiating mixtures. This property of the present mixture reduces the heat shielding necessary in areas close to rocket propulsion chambers and nozzles. It also makes possible a reduction in heat shielding required in space capsule skin areas, which might be subject to heat due to air friction. This property also makes the mixture quite usable in deep oil wells where heat is a problem.

Use of the present mixture in known configurations of initiating devices eliminates the requirement for special and exotic physical designs now required to shield ignition mixtures from uncontrollable electric energies, such as discussed hereinbefore. It also allows redundancies to be accomplished by one simple system with two reliable circuits in one small device rather than two complete separate systems.

Use of the present mixture also improves confidence levels and reliabilities by allowing simple, straightforward initiator, igniter, and detonator designs, rather than requiring configurations with separate cavities for each circuit, special insulation barriers or bathtub-type cavities manufactured into a simple assembly header. The present mixture, by permitting elimination of metallic, electrostatic, and radio frequency shields, simplifies and renders more efficient various missile and space craft designs.

Whereas the present invention has been shown and described herein in what is conceived to be the best mode contemplated, it is recognized that departures may be made therefrom within the scope of the invention which is, therefore, not to be limited to the details disclosed herein, but is to be afforded the full scope of the invention as hereinafter claimed.

What is claimed is:

1. Combustible mixture comprising: tellurium dioxide, and a fuel consisting of boron and a fluoroelastomeric binder, the portions of tellurium dioxide and fuel each being within plus or minus 10% of stoichiometric proportions.

2. Mixture in accordance with claim 1, wherein said fluoroelastomeric binder is a copolymer of vinylidene fluoride and hexafluoropropylene.

3. Combustible material comprising substantially tellurium dioxide and a fuel consisting of boron and a fluoroelastomeric binder mixed in the following proportions by weight:

tellurium dioxide, 75 to 97 parts;

fuel, 10 to 25 parts.

4. Combustible material comprising: tellurium dioxide and a fuel consisting of boron and a fluoroelastomeric binder, mixed in the following proportions by weight:

tellurium dioxide, 88.4 parts, plus or minus 5%;

boron, 6.6 parts, plus or minus 2%;

fluoroelastomeric binder, 5.0 parts, plus or minus 2%.

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