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COMPOSITE PROPELLANT CONTAINING BALLISTIC MODIFIERS DERIVED FROM METAL CHELATES

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ABSTRACT OF THE DISCLOSURE

A novel ballistic modifier for use in composite propellant compositions. The ballistic modifier contains a metal salt of a bis(salicyl)aldimine. Metals with atomic numbers from twenty-four to thirty may be used.

BACKGROUND OF THE INVENTION

This invention relates to novel ballistic modifiers, and in particular, to such modifiers used in composite propellant compositions.

Present ballistic modifiers suffer the disadvantages of being easily volatilized during the mix cycle, being difficult to manufacture and not producing a sufficiently high burning rate.

Accordingly, it is an object of this invention to produce a ballistic modifier which will not be lost by entrainment or sublimation during the mix cycle.

Another object of this invention is to produce a ballistic modifier which is more easily manufactured than competitive products.

Another object of this invention is to produce a composite propellant composition with an unusually high burning rate.

SUMMARY OF THE INVENTION

It has been discovered that the chelates of various transitional elements may be used as ballistic modifiers for composite propellant compositions.

More specifically, the chelates of those transitional elements with atomic numbers of from and including 24 to and including 30 may be used.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Composite propellant compositions contain a fuel such as aluminum, a binder such as polybutadieneacrylic acid, a solid oxidizer such as ammonium perchlorate, a ballistic modifier such as copper chromite or iron(II) oxide, and various processing ingredients commonly employed in making composite propellants such as plasticizers, oxidation inhibitors, reinforcing agents, wetting agents, modifiers in general, vulcanizing agents, curing agents, accelerators, burning rate catalysts and the like. This invention employs a novel propellant composition. Specifically, a new ballistic modifier is used.

This invention may best be understood by reference to the following detailed examples, which examples are included for purposes of illustration only, and are not intended as a limitation on the scope of this invention.

Example I

Strand burning rates which were obtained with PBAA (polybutadiene-acrylic acid) composite propellant compositions in which copper(II) bis(salicylideneethanolamine) was used as a ballistic modifier at a 0.3% by weight copper content, resulted in a 120% increase in burning rate.

An increase in the concentration of this modifier in the propellant to 1% by weight copper content resulted only in a modest further increase of 150–175% in burning rate.

Example II

Two experimental propellant compositions (1′ and 2′) were investigated in which the iron(II) oxide was replaced with copper(II) bis(salicylideneethanolamine). The effect on the increase in burning rates over the original propellant compositions (1 and 2, respectively) are contained in the following table:

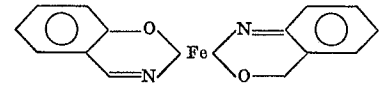
PROPELLANT FORMULATIONS

(weight percent)

	1	1′	2	2′
PBAA prepolymer diepoxide of bisphenol A	15.5	14.6	15.6	14.6
Iron(II) oxide	0.5	0.0	0.125	0.0
Copper(II) bis(salicylidene-ethanolamine) (0.3% copper content)	0.0	1.4	0.0	1.4
Aluminum	16.0	16.0	16.0	16.0
Ammonium perchlorate	68.0	68.0	68.0	68.0
Burning rate (inches per second)	0.4	0.88	0.35	0.77

Example III

Bis(salicyl-1,5-aldimine) Fe(II) analogs of the following basic structural formula have been found to function as a ballistic modifier superior to the ferrocene derivatives and inorganic lead salts.



The Schiff base can be prepared from saliscylaldehyde-Fe(II) and either a monoamino compound (e.g., aniline, nitroaniline) or a diamino compound (e.g., lysine=2,6-diaminohexanoic acid).

The incorporation of small percentages (perferably 1–10%) of such analogs in propellant formulations makes these analogs excellent burning rate catalysts and accelerators for composite propellant compositions. They also may be used as hypergols for improving ignitability and reignitability characteristics.

These ballistic modifiers may be used alone or in combination with other burning rate catalysts, depending upon the desired performance.

It should be understood that the foregoing examples, although describing certain specific embodiments of this invention, are provided primarily for the purposes of illustration and are not intended to impose any limitations upon its broader aspects.

I claim:

1. A propellant composition comprising an intimate mixture of a fuel, a polybutadieneacrylic acid binder, an oxidizer such as ammonium perchlorate and a ballistic modifier selected from the metal salts of bis(salicyl-1,5-aldimine) Fe(II) analogs and copper(II) bis(salicylideneethanolamine).

2. The propellant composition of claim 1 wherein said propellant composition is partially solid.

3. The propellant composition of claim 2 wherein said ballistic modifier comprises from about 1% to about 10% of said propellant composition.

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