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Description

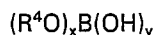
The invention is concerned with a novel group of compositions. It more particularly relates to a synergistic grease composition comprising grease, metal hydroxy-containing soap thickener, borated epoxide and phosphorus and sulfur moieties.

U.S. Patent No. 4,410,438 relates to lubricant compositions, including greases, comprising borated epoxides in which boron is present in excess. Also, certain other forms of epoxides have been used in lubricants. For example, U.S. 4,244,829 describes the use of epoxidized fatty acid esters as lubricity agents in lubricating oils.

In accordance with the invention, there is provided a grease composition consisting essentially of (1) a major amount of a grease and at least about 15% by weight of a hydroxyl-containing soap thickener (2) from 0.01% to 10% by weight of a reaction product made by reacting an epoxide of the formula



wherein R, R¹, R² and R³ are hydrogen or a hydrocarbyl group containing from 8 to 30 carbon atoms at least 1 of which is hydrocarbyl, with at least a molar amount of a boron compound selected from boric acid, boric oxide and an alkyl borate of the formula



wherein x is 1 to 3, y is 0 to 2, their sum being 3, and R⁴ is an alkyl group having 1 to 6 carbon atoms and (3) from about 0.01% to about 10% by weight of a phosphorus and sulfur compound or a mixture of phosphorus-containing and sulfur-containing compounds to supply a like amount of phosphorus and sulfur.

Preferably the borated product contains more than a stoichiometric amount of boron.

The borated epoxides of the invention can be made by reacting an epoxide with boron compound, such as boric oxide, boric acid or an alkyl borate, or mixtures thereof. The resulting products are primarily monoborate esters, but other possible products present are the products of reaction between epoxide dimers, or higher oligomers, and a boron compound to form the corresponding borate esters. Included within the scope of the epoxides as set forth above, are 1,2-epoxyoctane, 1,2-epoxydecane, 1,2-epoxydodecane, 1,2-epoxytetradecane, 1,2-epoxypentadecane, 1,2-epoxyhexadecane, 1,2-epoxyheptadecane, 1,2-epoxyoctadecane, 1,2-epoxyeicosane and mixtures of such epoxides, as well as mixtures of other epoxides. These include epoxides of mixtures of C₂₂ to C₃₀ olefins and of mixtures of C₂₄ to C₂₈ olefins. Also included are epoxides from dimers of octene, dimers of decene, dimers of mixed octene and decene, epoxides from decene trimers and the like. Hydrocarbyl is meant to include alkyl, aryl, cycloalkyl or cycloalkenyl groups containing from 8 to 30 carbon atoms, preferably 10 to 22 carbon atoms. Preferably, hydrocarbyl is an alkyl group.

As noted hereinabove, the boron compound used is boric acid, boric oxide or an alkyl borate, preferably boric acid. The alkyl borates include the mono-, di- and trialkyl borates, such as the mono-, di- and triethyl borates.

The reaction to form the borate ester can be carried out at from 80°C to 260°C, preferably from 110°C to 180°C. The temperature chosen will depend for the most part on the particular reactants and on whether or not a solvent is used. In carrying out this reaction, it is preferable that quantities of reactants be chosen such that the molar ratio of epoxide to boron compound be from 0.2 to 1, preferably from 0.5 to 0.9. The epoxide can be reacted with an excess of the borating species to form a borate ester containing from 0.1% by weight of boron to more than 10% of boron.

While atmospheric pressure is generally preferred, the reaction can be advantageously run at from 100 to 500 kPa (1 to 5 atmospheres). Furthermore, where conditions warrant it, a solvent may be used. In general, any relatively non-polar, unreactive solvent can be used, including benzene, toluene, xylene and 1,4-dioxane. Other hydrocarbon and alcoholic solvents, which include propanol and butanol can be used. Mixtures of alcoholic and hydrocarbon solvents can be used also.

The times for the reactions are not critical. Thus, any phase of the process can be carried out in from 1 to 20 hours.

A narrow class of thickening agents is preferred to make the grease of this invention. Included among the preferred thickening agents are those containing at least a portion of alkali and alkaline earth metal soaps of hydroxyl-containing fatty acids, fatty glycerides and fatty esters having from 12 to about 30 carbon atoms per molecule. The metals are typified by sodium, lithium, calcium and barium. Preferred is lithium. Preferred members among these acids and fatty materials are 12-hydroxystearic acid and glycerides containing 12-hydroxystearates.

The entire amount of thickener need not be derived from the aforementioned preferred members.

Significant benefit can be attained using as little thereof as about 15% by weight of the total thickener. A complementary amount, such as up to about 85% by weight of a wide variety of thickening agents, can be used in the grease of this invention. Included among the other useful thickening agents are alkali and alkaline earth metal soaps of methyl-12-hydroxystearate, diesters of a C₄ to C₁₂ dicarboxylic acid and tall oil fatty acids. Other alkali or alkaline earth metal fatty acids containing from 12 to 30 carbon atoms and no free hydroxyl may be used. These include soaps of stearic and oleic acids.

Other thickening agents include salt and salt-soap complexes as calcium stearate-acetate (U.S. Patent No. 2,197,263), barium stearate acetate (U.S. Patent No. 2,564,561), calcium, stearate-caprylate-acetate complexes (U.S. Patent No. 2,999,065), calcium caprylate-acetate (U.S. Patent No. 2,999,066), and calcium salts and soaps of low-, intermediate- and high-molecular weight acids and of nut oil acids.

Another group of thickening agents comprises substituted ureas, phthalocyanines, indanthrene, pigments such as perylimides, pyromellitimides, and ammeline, as well as certain hydrophobic clays. These thickening agents can be prepared from clays which are initially hydrophilic in character, but which have been converted into a hydrophobic condition by the introduction of long-chain hydrocarbon radicals into the surface of the clay particles prior to their use as a component of a grease composition, as, for example, by being subjected to a preliminary treatment with an organic cationic surface active agent, such as an onium compound. Typical onium compounds are tetraalkylammonium chlorides, such as dimethyl dioctadecyl ammonium chloride, dimethyl dibenzyl ammonium chloride and mixtures thereof. This method of conversion, being well known to those skilled in the art, is believed to require no further discussion.

The third member(s) of the grease composition of the instant invention are the phosphorus and sulfur moieties. Both of these can be present in the same molecule, such as in a metal or non-metal phosphorothioate or phosphorodithioate of the formula



wherein R⁵ is a hydrocarbyl group containing 3 to 18 carbon atoms, M is a metal or non-metal, n is the valence of M and X is oxygen or sulfur.

In this compound, R⁵ is preferably an alkyl group and may be a propyl, butyl, pentyl, hexyl, octyl, decyl, dodecyl, tetradecyl, octadecyl or oleyl group, including those derived from isopropanol, butanol, isobutanol, sec-butanol, 4-methyl-2-pentanol, 2-ethylhexanol, oleyl alcohol, and mixtures thereof. Further included are alkaryl groups such as butylphenyl, octylphenyl, nonylphenyl and dodecylphenyl groups.

The metals covered by M include those in Groups IA, IIA, IIB and VIII of the Periodic Table. Some that may be mentioned are lithium, sodium, calcium, zinc, cadmium, silver and gold. Non-metallic ions include organic groups derived from vinyl esters such as vinyl acetate, vinyl ethers such as butyl vinyl ether and epoxides such as propylene oxide and 1,2-epoxydodecane.

The phosphorus and sulfur can also be supplied from the combination of two separate compounds, such as the combination of (1) a dihydrocarbyl phosphite having 2 to 10 carbon atoms in each hydrocarbyl group or mixtures of phosphites and (2) a sulfide such as sulfurized isobutylene, dibenzyl disulfide, sulfurized terpenes, phosphorodithionyl disulfide and sulfurized jojoba oil. The phosphites embrace the dibutyl, dihexyl, dioctyl and didecyl phosphites and mixtures thereof. Phosphate esters containing 4 to 20 carbon atoms in each hydrocarbyl group, such as tributyl phosphate, tridecyl phosphate, tricresyl phosphate and mixtures of such phosphates, can also be used.

In summary, it is critical to the practice of this invention, in which greases having vastly improved dropping points are obtained, that all three of the above-mentioned ingredients be formulated into the composition. Thus:

first, with respect to the preparation of the grease, the thickener must have at least about 15% by weight of a metal or non-metal hydroxyl-containing soap therein;

second, there must be added to the grease from 0.01% to 10% by weight, preferably 0.1% to 2%, of a borated epoxide, in which the borated epoxide has been reacted with at least an equimolar amount of boron; and

third, the composition must have therein from 0.01% to about 10% by weight preferably, from 0.2% to 2% by weight of phosphorus- and sulfur-containing compounds or a mixture of two or more compounds which separately supply the phosphorus and sulfur moieties. If separate compounds are used, an amount of the mixture equivalent to the above concentration levels is used to supply equimolar amounts of phosphorus and sulfur.

In general, the reaction products of the present invention may be employed in any amount which is effective for imparting the desired degree of friction reduction, antiwear activity, antioxidant activity, high temperature stability or antirust activity. In many applications, however, the borated epoxide and the phosphorus- and/or sulfur-containing compound(s) are effectively employed in combined amounts from 0.02% to 20% by weight, and preferably from 0.2% to 4% of the total weight of the composition.

The greases of the present invention can be made from either a mineral oil or a synthetic oil, or

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mixtures thereof. In general, mineral oils, both paraffinic, naphthenic and mixtures thereof, may be of any suitable lubricating viscosity range, as for example, from 5.7 to 1300 mm²/s at 38°C (45 SSU at 100°F to 6000 SSU at 100°F), and preferably from 7.4 to 54 mm²/s at 99°C (50 to 250 SSU at 210°F). These oils may have viscosity indexes ranging to 100 or higher. Viscosity indexes from 70 to 95 are preferred. The average molecular weights of these oils may range from 250 to 800. In making the grease, the lubricating oil from which it is prepared is generally employed in an amount sufficient to balance the total grease composition, after accounting for the desired quantity of the thickening agent, and other additive components to be included in the grease formulation.

In instances where synthetic oils are desired, in preference to mineral oils, various compounds of this type may be successfully utilized. Typical synthetic vehicles include polyisobutylene, polybutenes, hydrogenated polydecenes, polypropylene glycol, polyethylene glycol, trimethylol propane esters, neopentyl and pentaerythritol esters, di(2-ethylhexyl) sebacate, di(2-ethylhexyl) adipate, dibutyl phthalate, fluorocarbons, silicate esters, silanes, esters of phosphorus-containing acids, liquid ureas, ferrocene derivatives, hydrogenated synthetic oils, chain-type polyphenyls, siloxanes and silicones (polysiloxanes), alkyl-substituted diphenyl ethers typified by a butyl-substituted bis(p-phenoxy phenyl) ether, phenoxy phenylethers.

Example 1

Borated 1,2-epoxyhexadecane

Approximately 1440 g of 1,2-epoxyhexadecane (obtained commercially from Union Carbide), 500 g of toluene and 500 g of boric acid were charged to a 5 liter glass reactor equipped with heater agitator and Dean-Stark tube with condenser. The contents were heated up to 144°C with agitation until water evolution stopped. This took place over a period of about 10 hours. The solvent was removed by vacuum distillation at about 160°C, and the product was filtered at about 120°C through diatomaceous earth to yield a clear amber fluid as an amber waxy fluid upon cooling.

Example 2

A lithium hydroxystearate grease thickener was prepared by saponification of 12-hydroxystearic acid (8%) and glyceride (9%) with lithium hydroxide monohydrate (2.5%) in a mineral oil vehicle (about 76%) at about 177°C and final pressure of about 860 kPa (110 psig) in a closed contactor. All percentages were percentages by weight of the total weight of the thickener.

Example 3

After dehydrating the thickener in an open kettle, 1.4% by weight of a boron ester was added to the grease concentrate. The boron-containing ester was prepared by placing 1440 g of 1,2-epoxyhexadecane, 500 g of toluene and 500 g of boric acid in a glass reactor equipped with heater, agitator and Dean-Stark tube with condenser. The reaction mixture was heated up to 144°C until water evolution as a result of azeotropic distillation ceased. The solvent was removed by vacuum distillation and the crude borate ester was filtered through diatomaceous earth to form a clear amber fluid which became waxy after cooling.

After the above boron additive was introduced into the grease concentrate thickener, moderate heat was applied and sufficient oil was then added to reduce the thickener content to about 9.0% and consequently the boron additive content to 1%. The boron content of the resulting grease was approximately 0.04% by weight. After cooling to 99°C, antioxidant, antirust, extreme pressure and antiwear additives including 1.5% zinc dialkyl phosphorodithioate, the alkyl groups being derived from a mixture of C₃ secondary and C₆ primary alcohols, were incorporated in the grease. Results obtained in the ASTM D2265-78 grease dropping point test are shown in the following table.

TABLE 1

	Sample	D2265 Dropping point, °C.
5	Base Grease — Dehydrated grease thickener	199°C
	Example 1 — Dehydrated grease thickener+1.4 wt% borated epoxide	257°C
10	Example 2 — Dehydrated grease thickener+1.0 wt.% borated epoxide +diluent mineral oil +additive package (containing amine antioxidant, phenolic antioxidant, metallic dithiophosphate, sulfur-containing metal deactivator and nitrogen-containing antirust additives)	307°C
15	Fully formulated base grease without boron additive — Dehydrated grease thickener+diluent mineral oil +normal additive package (containing amine antioxidant, phenolic antioxidant, metallic dithiophosphate, sulfur-containing metal deactivator and nitrogen-containing antirust additives)	193°C
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25 The dropping point of the dehydrated thickener without borated epoxide was 199°C. Adding 1.4 wt.% of borated epoxide to the thickener increased the dropping point to 257°C. After the normal grease additive package was added to produce a finished grease, the dropping point increased further to 307°C. The dropping point of an identical, fully formulated finished grease with metallic dithiophosphate but without the borated epoxide was 193°C.

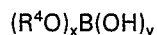
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Claims

35 1. A grease composition consisting essentially of (1) a major amount of a grease and at least about 15% by weight of a hydroxyl-containing soap thickener (2) from 0.01% to 10% by weight of a reaction product made by reacting an epoxide of the formula



45 wherein R, R¹, R² and R³ are hydrogen or a hydrocarbyl group containing from 8 to 30 carbon atoms at least 1 of which is hydrocarbyl, with at least a molar amount of a boron compound selected from boric acid, boric oxide and an alkyl borate of the formula



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wherein x is 1 to 3, y is 0 to 2, their sum being 3, and R⁴ is an alkyl group having 1 to 6 carbon atoms and (3) from about 0.01% to about 10% by weight of a phosphorus and sulfur compound or a mixture of phosphorus-containing and sulfur-containing compounds to supply a like amount of phosphorus and sulfur.

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2. The composition of Claim 1 wherein the thickener is an alkali metal or an alkaline earth metal soap of a hydroxyl-containing fatty acid, fatty glyceride or fatty ester containing 12 to 30 carbon atoms.

3. The composition of Claim 2 wherein the metal is sodium, lithium, calcium or barium.

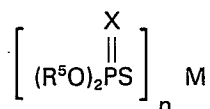
4. The composition of Claim 2 wherein the thickener is derived from 12-hydroxystearic acid.

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5. The composition of Claim 1, wherein the epoxide is 1,2-epoxyoctane, 1,2-epoxydecane, 1,2-epoxydodecane, 1,2-epoxytetradecane, 1,2-epoxypentadecane, 1,2-epoxyhexadecane, 1,2-epoxyoctadecane, 1,2-epoxyeicosane, epoxides of mixtures of C₂₂ to C₃₀ olefins, epoxides of mixtures of C₂₄ to C₂₈ olefins, epoxides from decene trimers or epoxides from: dimers of octene; dimers of decene; or dimers of mixed octene and decene.

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6. The composition of Claim 1 wherein the phosphorus and sulfur moieties are supplied by a phosphorothioate or phosphorodithioate of the formula



- 5 wherein R^5 is a hydrocarbyl group containing 3 to 18 carbon atoms, M is a metal or non-metal, n is the valence of M and X is oxygen or sulfur.
7. The composition of Claim 6 wherein R^5 is an alkyl group.
8. The composition of Claim 7 wherein R^5 is a propyl, butyl, pentyl, hexyl, octyl, decyl, dodecyl, 10 tetradecyl, octadecyl or oleyl group or mixtures thereof.
9. The composition of Claim 8 wherein R^5 is derived from isopropanol, butanol, isobutanol, sec-butanol, 4-methyl-2-pentanol, 2-ethylhexanol or mixtures thereof.
10. The composition of Claim 6 wherein M is a metal from Group IA, IIA, IIB or VIII of the Periodic Table.
11. The composition of Claim 10 wherein the metal is lithium, sodium, calcium, zinc, cadmium or gold.
- 15 12. The composition of Claim 6 wherein M is derived from vinyl acetate, butyl vinyl ether, propylene oxide or 1,2-epoxydodecane.
13. The composition of Claim 1 wherein the phosphorus and sulfur moieties are supplied by a combination of (1) a dihydrocarbyl phosphite having 2 to 10 carbon atoms in each hydrocarbyl group, mixtures of such phosphites, or a phosphate ester having 4 to 20 carbon atoms in each hydrocarbyl group 20 and (2) a sulfide selected from sulfurized isobutylene, dibenzyl disulfide, sulfurized terpenes, phosphorodithionyl disulfide and sulfurized jojoba oil.
14. The composition of Claim 13 wherein the phosphite is a dibutyl, dihexyl, dioctyl or didecyl phosphite or mixtures thereof.
15. The composition of Claim 13 wherein the phosphate ester is a tributyl, tridecyl or tricresyl 25 phosphate or mixtures thereof.
16. The composition of Claim 13 wherein the epoxide is 1,2-epoxyhexadecane, the boron compound is boric acid and the phosphorus- and sulfur-containing compound is zinc dialkyl phosphorodithioate wherein the alkyl groups are derived from mixed C_3 secondary and C_6 primary alcohols.
17. The composition of Claim 1 wherein the grease vehicle is a mineral oil, synthetic oil or mixtures 30 thereof.

Patentansprüche

- 35 1. Fettzusammensetzung bestehend im wesentlichen aus (1) einer größeren Menge eines Fetts und mindestens etwa 15 Gew.-% eines hydroxylgruppenhaltigen Seifenverdickers (2) aus 0,01 bis 10 Gew.-% eines Reaktionsproduktes, das erhalten wurde durch Reaktion eines Epoxids der Formel



- 45 in der R, R^1 , R^2 und R^3 jeweils ein Wasserstoffatom oder einen Kohlenwasserstoffrest mit 8 bis 30 Kohlenstoffatomen bedeuten, von denen mindestens einer ein Kohlenwasserstoffrest ist, mit mindestens einer molaren Menge einer Borverbindung, ausgewählt aus Borsäure, Boroxid und einem Alkylborat der Formel



- in der x eine Zahl von 1 bis 3 und y eine Zahl von 0 bis 2 bedeuten, die Summe von x und y die Zahl 3 ist und R^4 einen Alkylrest mit 1 bis 6 Kohlenstoffatomen darstellt und (3) aus ca. 0,01 bis ca. 10 Gew.-% einer Phosphor- und Schwefelverbindung oder einer Mischung phosphor- und schwefelhaltiger Verbindungen 55 zur Bereitstellung entsprechender Mengen an Phosphor und Schwefel.

2. Zusammensetzung nach Anspruch 1, worin der Verdicker eine Alkali- oder Erdalkalimetallseife einer hydroxylgruppenhaltigen Fettsäure, eines Fettsäureglycerids oder eines Fettsäureesters mit 12 bis 30 Kohlenstoffatomen ist.

3. Zusammensetzung nach Anspruch 2, worin das Metall Natrium, Lithium, Calcium oder Barium ist.

- 60 4. Zusammensetzung nach Anspruch 2, worin der Verdicker sich von 12-Hydroxystearinsäure ableitet.

5. Zusammensetzung nach Anspruch 1, worin das Epoxid 1,2-Epoxyoctan, 1,2-Epoxydecan, 1,2-Epoxydodecan, 1,2-Epoxytetradecan, 1,2-Epoxypentadecan, 1,2-Epoxyhexadecan, 1,2-Epoxyoctadecan, 1,2-Epoxyeicosan, Epoxide aus Mischungen von C_{22} - bis C_{30} -Olefinen, Epoxide aus Mischungen von C_{24} - bis C_{28} -Olefinen, Epoxide von Decentrimeren oder Epoxide von Dimeren des Octens, Dimeren des Decens 65 oder Dimeren eines Octen-Decen-Gemisches ist.

6. Zusammensetzung nach Anspruch 1, worin die Phosphor- und Schwefelgruppen durch ein Phosphorthioat oder ein Phosphorodithioat der Formel



bereitgestellt werden, in der R^5 einen Kohlenwasserstoffrest mit 3 bis 18 Kohlenstoffatomen, M ein Metall oder Nichtmetall, n die Wertigkeit von M und X Sauerstoff oder Schwefel bedeuten.

7. Zusammensetzung nach Anspruch 6, worin R^5 einen Alkylrest bedeutet.

8. Zusammensetzung nach Anspruch 7, worin R^5 eine Propyl-, Butyl-, Pentyl-, Hexyl-, Octyl-, Decyl-, Dodecyl-, Tetradecyl-, Octadecyl- oder Oleylgruppe oder Mischungen davon bedeuten.

9. Zusammensetzung nach Anspruch 8, worin R^5 von Isopropanol, Butanol, Isobutanol, sek.-Butanol, 4-Methyl-2-pentanol, 2-Ethylhexanol oder Mischungen davon abgeleitet ist.

10. Zusammensetzung nach Anspruch 6, worin M ein Metall aus der Gruppe IA, IIA, IIB oder VIII des Periodensystems bedeutet.

11. Zusammensetzung nach Anspruch 10, worin das Metall Lithium, Natrium, Calcium, Zink, Cadmium oder Gold ist.

12. Zusammensetzung nach Anspruch 6, worin M von Vinylacetat, Butylvinylether, Propylenoxid oder 1,2-Epoxydodecan abgeleitet ist.

13. Zusammensetzung nach Anspruch 1, worin die Phosphor- und Schwefelgruppen durch eine Kombination von (1) einem Dikohlenwasserstoffphosphit mit 2 bis 10 Kohlenstoffatomen in jedem Kohlenwasserstoffrest, Mischungen solcher Phosphite oder einem Phosphatester mit 4 bis 20 Kohlenstoffatomen in jedem Kohlenwasserstoffrest und (2) einem Sulfid, ausgewählt aus sulfuriertem Isobutylen, Dibenzyldisulfid, sulfurierten Terpenen, Phosphordithionylsulfid und sulfuriertem Jojobaöl, bereitgestellt werden.

14. Zusammensetzung nach Anspruch 13, worin das Phosphit Dibutyl-, Dihexyl-, Dioctyl- oder Didecylphosphit oder Mischungen davon ist.

15. Zusammensetzung nach Anspruch 13, worin der Phosphatester Tributyl-, Tridecyl- oder Tricresylphosphatester oder Mischungen davon ist.

16. Zusammensetzung nach Anspruch 13, worin das Epoxid 1,2-Epoxyhexadecan, die Borverbindung Borsäure und die phosphor- und schwefelhaltige Verbindung ein Zinkdialkylphosphordithioat, in dem die Alkylreste von sekundären C_3 - und primären C_6 -Alkoholen abgeleitet sind, darstellt.

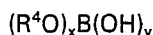
17. Zusammensetzung nach Anspruch 1, worin der Fettträger ein Mineralöl, ein synthetisches Öl oder Mischungen davon ist.

Revendications

1. Composition de graisse consistant essentiellement: en (1) une grande quantité d'une graisse et au moins environ 15% en poids d'un épaississant du type savon hydroxylé; (2) de 0,01 à 10% en poids d'un produit de réaction préparé par réaction d'un époxyde de formule



dans laquelle R, R^1 , R^2 et R^3 sont chacun l'hydrogène ou un groupe hydrocarbyle en C_8-C_{30} et dont l'un au moins est un groupe hydrocarbyle, avec au moins une quantité molaire d'un composé de bore choisi parmi l'acide borique, l'oxyde borique et un borate d'alkyle de formule



dans laquelle x est de 1 à 3, y est de 0 à 2, leur somme étant 3, et R^4 est un groupe alkyle en C_1-C_6 ; et (3) d'environ 0,01 à environ 10% en poids d'un composé de phosphore et de soufre ou d'un mélange de composés phosphorés et soufrés pour fournir une quantité semblable de phosphore et de soufre.

2. Composition selon la revendication 1, dans laquelle l'épaississant est un savon de métal alcalin ou de métal alcalino-terreux d'un acide gras hydroxylé, d'un glycéride gras ou d'un ester gras contenant 12 à 30 atomes de carbone.

3. Composition selon la revendication 2, dans laquelle le métal est le sodium, le lithium, le calcium ou le baryum.

4. Composition selon la revendication 2, dans laquelle l'épaississant dérive de l'acide 12-hydroxystéarique.

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5. Composition selon la revendication 1, dans laquelle l'époxyde est le 1,2-époxyoctane, le 1,2-époxydécane, le 1,2-époxydodécane, le 1,2-époxytétradécane, le 1,2-époxy-pentadécane, le 1,2-époxy-hexadécane, le 1,2-époxyoctadécane, le 1,2-époxyeicosane, les époxydes de mélanges d'oléfines en $C_{22}-C_{30}$, les époxydes de mélanges d'oléfines en $C_{24}-C_{28}$, les époxydes de trimères de décène ou les
5 époxydes de dimères d'octène ou de dimères de décène ou de dimères mixtes d'octène et de décène.

6. Composition selon la revendication 1, dans laquelle les restes phosphorés et soufrés sont fournis par un phosphorothioate ou un phosphorodithioate de formule



dans laquelle R^5 est un groupe hydrocarbyle en C_3-C_{18} , M est un métal ou un reste non métallique, n est la
15 valence de M et X est l'oxygène ou le soufre.

7. Composition selon la revendication 6, dans laquelle R^5 est un groupe alkyle.

8. Composition selon la revendication 7, dans laquelle R^5 est un groupe propyle, butyle, pentyle, hexyle, octyle, décyle, dodécyle, tétradécyle, octadécyle ou oléyle ou leurs mélanges.

9. Compositions selon la revendication 8, dans laquelle R^5 dérive de l'isopropanol, du butanol, de
20 l'isobutanol, du sec-butanol, du 4-méthyl-2-pentanol, du 2-éthylhexanol ou de leurs mélanges.

10. Composition selon la revendication 6, dans laquelle M est un métal du groupe IA, IIA, IIB ou VIII de la Classification Périodique.

11. Composition selon la revendication 10, dans laquelle le métal est le lithium, le sodium, calcium, le zinc, le cadmium ou l'or.

12. Composition selon la revendication 6, dans laquelle M dérive de l'acétate de vinyle, de l'éther butyl-vinyle, de l'oxyde de propylène ou du 1,2-époxydodécane.

13. Composition selon la revendication 1, dans laquelle les restes phosphorés et soufrés sont fournis par une combinaison de (1) un phosphite de dihydrocarbyle ayant de 2 à 10 atomes de carbone dans chaque groupe hydrocarbyle, des mélanges de ces phosphites ou un phosphate d'hydrocarbyle ayant de 4
30 à 20 atomes de carbone dans chaque groupe hydrocarbyle et (2) un sulfure choisi parmi l'isobutylène sulfuré, le disulfure de dibenzyle, les terpènes sulfurés, le disulfure de phosphorodithionyle et l'huile de jujube sulfurée.

14. Composition selon la revendication 13, dans laquelle le phosphite est un phosphite de dibutyle, de dihexyle, de dioctyle ou de didécyle ou leurs mélanges.

15. Composition selon la revendication 13, dans laquelle l'ester phosphorique est le phosphate de tributyle, de tridécyle ou de tricrésyle ou leurs mélanges.

16. Composition selon la revendication 13, dans laquelle l'époxyde est le 1,2-époxyhexadécane, le composé de bore est l'acide borique et le composé contenant du phosphore et du soufre est un dialkylphosphorodithioate de zinc dans lequel les groupes alkyles dérivent d'un mélange d'alcools
40 secondaire en C_3 et primaire en C_6 .

17. Composition selon la revendication 1, dans laquelle le véhicule de la graisse est une huile minérale, une huile synthétique ou leurs mélanges.