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CORROSION INHIBITED LUBRICATING COMPOSITION

Richard A. Butcosk, Westmont, N.J., assignor to Mobil Oil Corporation, a corporation of New York

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This invention relates to lubricating compositions suitable for use over a wide range of operating conditions. In one of its aspects, the invention relates to lubricating compositions containing certain materials which exhibit corrosion or rust-inhibiting characteristics when incorporated in these compositions. Still more particularly, in this aspect, the invention relates to lubricating grease compositions exhibiting the aforementioned corrosion-inhibiting characteristics, and to a method for their preparation.

In the preparation of lubricating compositions, as for example, greases and other lubricants of varying viscosities, it has been the practice to incorporate in these compositions various corrosion or rust-inhibiting materials to avoid the deleterious effect upon metal surfaces being lubricated, when such surfaces are continuously or intermittently subjected to humid or wet environmental conditions. Among the corrosion-inhibiting materials that have been suggested for this purpose are the alkali metal nitrites, which are well known for their corrosion-inhibiting properties. Of particular importance, in this respect, is sodium nitrite. In general, it has been found that in order to achieve a fairly adequate degree of corrosion-inhibiting effect in the aforementioned lubricating compositions, the alkali metal nitrite should be employed in the lubricant in an amount equal to at least about 2 percent, by weight, of the total lubricating composition. In this respect, however, it has also been found that the presence of even such low concentrations of alkali metal nitrite results in the abrasion and deterioration of the metal surfaces being lubricated by the grease or other lubricating composition. On the other hand, the use of lower concentrations of the alkali metal nitrite in the lubricant, does not result in imparting sufficient corrosion-resistant properties to the latter. Thus, prior to the present invention no effective and relatively simple method has been proposed for the incorporation of alkali metal nitrites in lubricating compositions in relatively small concentrations and which, nevertheless, still impart adequate corrosion-resistant properties to the lubricant.

It is, therefore, an object of the present invention to provide improved corrosion-inhibiting materials for lubricating compositions.

Another object of the invention is to provide improved corrosion-inhibiting materials, comprising alkali metal nitrites, for lubricating compositions.

Still another object of the invention is to provide lubricating compositions having improved corrosion-inhibiting properties, and wherein metallic surfaces being lubricated by these compositions are not significantly abraded or otherwise damaged.

A still further object of the invention is to provide a method for preparing the aforementioned lubricating compositions.

Other objects and advantages inherent in the invention will become apparent to those skilled in the art from the following description.

It has now been found that lubricating compositions having effective and useful corrosion and rust-inhibiting properties may be prepared employing relatively small amounts of alkali metal nitrites, as the inhibitors, when used in conjunction with a N-carboxymethyl-alkenyl-succinamic acid, as more fully hereinafter described. The synergistic effect of this additive combination makes it possible to employ such small quantities of the alkali metal nitrite and the N-carboxymethyl-alkenyl-succinamic acids that metallic surfaces being lubricated are not abraded or otherwise damaged by the nitrite components in the lubricating composition. Furthermore, it has also been found that this ability of the lubricating composition to exhibit effective corrosion-inhibiting properties, although employing relatively small amounts of the nitrite component, could not otherwise be achieved except for the presence, and the synergistic effect, of the N-carboxymethyl-alkenyl-succinamic acid component.

Insofar as the components comprising the corrosion inhibitor are concerned, the alkali metal nitrites which may be employed include sodium nitrite, potassium nitrite and lithium nitrite. Of these, sodium nitrite is preferred. The alkali metal nitrite is generally employed in the inhibitor composition in an amount from about 40 to about 70 percent, by weight, and preferably in an amount from about 45 to about 65 percent, by weight, of the total inhibitor composition.

As indicated above, a N-carboxymethyl-alkenyl-succinamic acid is employed in conjunction with the alkali metal nitrite in the inhibitor composition for its synergistic effect. These succinamic acids can be prepared by several methods known to those skilled in the art. In general, they can be prepared by reacting an alkenyl succinic acid anhydride or an alkenyl succinic acid with glycine (aminoacetic acid), in equimolar amounts and with the elimination of water of condensation, when the acid is employed. Accordingly, the reaction will be carried out at temperatures of between about 90° C. and about 120° C. The time of reaction will be dependent, of course, upon the reaction temperature employed. Reaction will take place readily when the acid anhydride is employed. When the acid is employed, reaction will continue until the required amount of water of condensation has evolved. Generally, the time will vary between about 6 to about 10 hours, and shorter reaction times are required if water is removed by azeotropic distillation. Suitable liquids which form azeotropes with water are non-polar solvents, such as benzene, toluene, and xylene.

The alkenyl succinic acid anhydride reactant can, generally, have from about 8 to about 35 carbon atoms in the alkenyl radical, particularly when employed in grease compositions, and preferably from about 10 to about 14 carbon atoms. Non-limiting examples of the alkenyl succinic acid anhydride reactants are octenyl succinic acid anhydride, diisobutenyl succinic acid anhydride, 2-methylheptenyl succinic acid anhydride, 4-ethylhexenyl-succinic acid anhydride, nonenyl succinic acid anhydride, decenyl succinic acid anhydride, undecenyl succinic acid anhydride, dodecenyl succinic acid anhydride, triisobutenyl succinic acid anhydride, tetrapropenyl succinic acid anhydride, tetradecenyl succinic acid anhydride, hexadecenyl succinic acid anhydride, 11-tricosenyl succinic anhydride, and 17-pentatriacontenyl succinic anhydride. As mentioned hereinbefore, the alkenyl succinic acids corresponding to these alkenyl succinic acid anhydrides can also be used to prepare the succinamic acids employed in the inhibitor composition. The preparation of the aforementioned N-carboxymethyl-alkenyl-succinamic acids is more fully discussed in U.S. Patent No. 3,039,861, issued June 19, 1962. The N-carboxymethyl-alkenyl-succinamic acid is generally employed in the inhibitor composition in an amount from about 30 to about 60 percent, by weight, and preferably in an amount from about 35 to about 55 percent, by weight, of the total inhibitor composition.

The quantity of the corrosion inhibitor employed will depend upon the characteristics of the lubricating composition being treated and the nature of the environmental conditions encountered by the lubricant in per-

forming its function. In general, the more viscous types of lubricating compositions, for example, those which are normally classified as greases, may contain the aforementioned inhibitors which comprise from about 0.2 to about 3.0 percent, by weight, and, preferably, from about 0.5 to about 1.5 percent, by weight, of the total lubricant composition. The amount of alkali metal nitrite present may comprise from about 0.1 to about 2.0 percent, by weight, and, preferably, from about 0.3 to about 1.0 percent, by weight, of the total lubricant composition. The amount of N-carboxymethyl-alkenyl-succinamic acid present may comprise from about 0.1 to about 1.0 percent, by weight, and preferably, from about 0.2 to about 0.5 percent, by weight, of the total lubricant composition.

In preparing the improved lubricants containing the novel inhibitor compositions of the present invention, the manner in which the alkali metal nitrite and the N-carboxymethyl-alkenyl-succinamic acid are incorporated into the lubricant is critical with respect to the state of the individual inhibitor components employed. Thus, if the alkali metal nitrite and the N-carboxymethyl-alkenyl-succinamic acid are to be added to the lubricant under substantially anhydrous conditions, i.e. either as solids or in the presence of a non-aqueous vehicle for one or both of the components (e.g. mineral oils, alcohols, etc.), these components may be incorporated into the lubricant either separately, and in any sequence; or they may first be admixed, and thereafter, the thus-formed inhibitor composition may be incorporated therein. If, on the other hand, the aforementioned inhibitor components are added under aqueous conditions, it is essential that the aqueous nitrite component be first incorporated into the lubricant while the latter is maintained at an elevated temperature sufficient to drive off water present, and the succinamic acid is thereafter added. This sequence is necessitated because of the fact that if the succinamic acid were first incorporated into the lubricant, the succinamic acid being reactively acid would cause the nitrite to decompose and liberate nitrous oxide under the aqueous conditions present, thereby rendering the nitrite component ineffective as a corrosion inhibitor and also bring about corrosion of metal surfaces being lubricated.

The following examples will serve to illustrate the preparation of typical improved corrosion inhibitor compositions of the present invention, and their incorporation and performance in lubricant compositions. In the examples, where indicated, sodium nitrite and N-carboxymethyl-tetrapropenyl-succinamic acid (comprising the reaction product of glycine with tetrapropenyl succinic anhydride) were incorporated into a calcium lead-acetate complex grease prepared in accordance with the procedure described in U.S. Patent 2,898,297, issued August 4, 1959. In each instance aqueous solutions of sodium nitrite were employed and were added to the grease, while the latter was maintained at a temperature of about 210° F. and for a period of time sufficient to drive off the water present. The succinamic acid was thereafter added. The respective grease formulations were next subjected to the Bearing Protection Test, ASTM D–1743 rating, with the respective ratings, in each instance, being recorded, as shown.

Example	$NaNO_2$ (Wt. percent)	N-carboxymethyl tetrapropenylsuccinamic acid (Wt. percent)	Bearing Protection Test, ASTM D–1743 Rating [1]
1 (Blank)	0	0	#3, #3
2	0.1	0	#3, #3
3	0.5	0	#3, #3
4	0	0.2	#3, #3
5	0.1	0.2	#1, #1
6	0.2	0.3	#1, #1

[1] #1 rating—no spots on bearing case or on roller (excellent). #2 rating—1 to 3 very small spots (fair). #3 rating—3 or more large spots (poor).

From the above data, it will be seen, as shown in Examples 5 and 6, that a synergistic effect is obtained by the combined use of the alkali metal nitrite, as exemplified by sodium nitrite and the N-carboxymethyl-alkenyl-succinamic acid, as exemplified by N-carboxymethyl-tetrapropenyl-succinamic acid, when compared to the use of each of these components, alone, as shown in Examples 2, 3 and 4, or in their absence, as shown in Example 1. It will be understood, of course, that other alkali metal nitrites may be substituted for the sodium nitrite, and that other N-carboxymethyl-alkenyl-succinamic acids may be substituted for the N-carboxymethyl-tetrapropenyl-succinamic acid, as shown in the above examples, and that corrosion inhibitors containing these components may be incorporated in a wide variety of lubricant compositions.

While preferred embodiments of the compositions of the present invention and the process for their preparation have been described for the purpose of illustration, it should be understood that various modifications and adaptations thereof, which will be obvious to those skilled in the art, may be made without departing from the spirit of the invention.

I claim:

1. A lubricant composition containing a corrosion inhibitor, said inhibitor consisting essentially of an alkali metal nitrite and a N-carboxymethyl-alkenyl-succinamic acid containing from about 8 carbon atoms to about 35 carbon atoms in the alkenyl group thereof.

2. A grease composition containing a corrosion inhibitor, said inhibitor consisting essentially of an alkali metal nitrite and a N-carboxymethyl-alkenyl-succinamic acid containing from about 8 carbon atoms to about 35 carbon atoms in the alkenyl group thereof.

3. A grease composition containing a corrosion inhibitor, said inhibitor consisting essentially of an alkali metal nitrite and a N-carboxymethyl-alkenyl-succinamic acid containing from about 10 carbon atoms to about 14 carbon atoms in the alkenyl group thereof.

4. A grease composition containing a corrosion inhibitor, said inhibitor consisting essentially of sodium nitrite and N-carboxymethyl-tetrapropenyl-succinamic acid.

5. A grease composition containing from about 0.2 to about 3.0 percent, by weight, of the grease, of a corrosion inhibitor consisting essentially of from about 40 to about 70 percent, by weight, of an alkali metal nitrite and from about 30 to about 60 percent, by weight, of a N-carboxymethyl-alkenyl-succinamic acid containing from about 8 carbon atoms to about 35 carbon atoms in the alkenyl group thereof.

6. A grease composition containing from about 0.5 to about 1.5 percent, by weight, of the grease, of a corrosion inhibitor consisting essentially of from about 45 to about 65 percent, by weight, of an alkali metal nitrite and from about 35 to about 55 percent, by weight, of a N-carboxymethyl-alkenyl-succinamic acid containing from about 10 carbon atoms to about 14 carbon atoms in the alkenyl group thereof.

7. A composition consisting essentially of an alkali metal nitrite and a N-carboxymethyl-alkenyl-succinamic acid containing from about 8 carbon atoms to about 35 carbon atoms in the alkenyl group thereof.

8. A composition consisting essentially of an alkali metal nitrite and a N-carboxymethyl-alkenyl-succinamic acid containing from about 10 carbon atoms to about 14 carbon atoms in the alkenyl group thereof.

9. A composition consisting essentially of from about 40 to about 70 percent, by weight, of an alkali metal nitrite and from about 30 to about 60 percent, by weight, of a N-carboxymethyl-alkenyl-succinamic acid containing from about 8 carbon atoms to about 35 carbon atoms in the alkenyl group thereof.

10. A composition consisting essentially of from about 45 to about 65 percent, by weight, of an alkali metal nitrite and from about 35 to about 55 percent, by weight, of a N-carboxymethyl-alkenyl-succinamic acid containing

from about 10 carbon atoms to about 14 carbon atoms in the alkenyl group thereof.

11. A composition consisting essentially of sodium nitrite and N-carboxymethyl-tetrapropenyl-succinamic acid.

12. A composition consisting essentially of from about 40 to about 70 percent, by weight, of sodium nitrite and from about 30 to about 60 percent, by weight, of N-carboxymethyl-tetrapropenyl-succinamic acid.

13. A composition consisting essentially of from about 45 to about 65 percent, by weight, of sodium nitrite and from about 35 to about 55 percent, by weight, of N-carboxymethyl-tetrapropenyl-succinamic acid.

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DANIEL E. WYMAN, *Primary Examiner.*

P. P. GARVIN, *Assistant Examiner.*