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RUST-PREVENTIVE COMPOSITIONS

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The present invention relates to novel compositions adapted for inhibiting corrosion and rusting of metal surfaces.

The compositions embodied herein find utility for many requirements wherein protection of normally corrodible metals against corrosion and rusting is desired, but, in particular, they find utility as "slushing compositions" adapted for coating of metal articles, especially those of ferrous metals, for protection thereof against corrosion- and rust-inducing atmospheres such as are often encountered during transportation, storage, etc. of such articles. In more specific illustration, compositions embodied herein find particular utility for application as a coating to metal surfaces of machined parts, engines, drums, piston rings, light arms, gears, etc., for protection thereof against corrosion and rusting upon exposure to adverse conditions for extended periods of time and which coatings may be readily removed, such as by use of suitable solvents, from the metal surfaces if removal of the coating is desired prior to placing the metal article in use. Moreover, and particularly in instances wherein compositions as embodied herein comprise a lubricating medium such, for example, as a mineral oil of lubricating grade, the compositions may be employed to serve a dual function for preventing corrosion and rusting of metal surfaces coated therewith while at the same time providing satisfactory lubricating properties.

The present invention is based on the discovery that metals having a tendency to corrode and rust upon exposure to atmospheres inducive thereof, and particularly humid atmospheres, may be effectively inhibited against such a tendency by applying to the surface of said metals a composition containing, as a rust inhibiting agent, an esterifiable alkylol-containing amine possessing an alkylol group that is esterified with a sulfonic acid. Generally speaking, the compositions embodied herein comprise a suitable substantially non-corrosive vehicle in major amount based on the weight of the composition and a minor amount, sufficient to impart rust preventive characteristics to said composition, of an ester as afore-defined, said compositions preferably being a solution of the ester in the vehicle although in certain instances the compositions may be employed in the form of a dispersion.

Although a wide variety of vehicles may be suitably employed in the compositions embodied herein, particularly preferred vehicles are hydrocarbons of the volatile and/or non-volatile type such as the non-drying substantially non-volatile type of oils derived from mineral oils and fractions thereof including lubricating oils, petrolatums, etc., mixtures thereof, and volatile substances such as hexane, petroleum ether, naphtha, other light petroleum distillates, etc. In preferred embodiment, however, the compositions embodied herein comprise mineral oils of lubricating grade as the vehicle in combination with an oil-soluble rust inhibiting agent formed by esterifying an alkylol amine with a sulfonic acid.

As aforesaid, the compositions embodied herein contain, as a rust inhibiting agent, an esterifiable alkylol-containing amine possessing an alkylol group esterified with a sulfonic acid. The amines contemplated for esterification with such acids in preparation of the rust inhibiting agent may comprise a monoalkylol-containing-, a dialkylol-containing-, and trialkylol-containing-amine, or

mixtures thereof. Specific ilustrations of such amines include trialkylol amines such as triethanol amine and tripropanol amine; alkyl alkylol amines such as ethyl diethanol amine, diethyl amino ethanol, dibutyl ethanol amine, and butyl di-ethanol amine; cycloalkyl alkylol amines such as cyclohexyl diethanol amine; and aromatic-containing alkylol amines such as phenyl alkylol amines, and the like. In preferred embodiment, the invention embodies use of tertiary alkyl alkylol-amines, such as the monoalkyloldialkyl amines and dialkylolalkyl amines, specific ilustrations of which are included in the examples set forth hereinafter. It should be understood, however, that although such specific illustrations have been set forth, the invention is not limited to the use of such amines as in broad aspect the invention contemplates use of alkylol-containing amines that are esterifiable with a sulfonic acid for preparation of rust inhibiting esters adapted for use in combination with a non-corrosive vehicle to provide rust inhibiting compositions as embodied herein.

The sulfonic acid component of the esters contemplated for use in practice of this invention may be derived from a wide variety of sulfonic acids including such acids derived from petroleum and known to the art as petroleum sulfonic acids as well as sulfonic acids synthetically prepared by other means. Thus, for example, the sulfonic acid component of esters embodied for use herein may be derived from sulfonic acids such as aliphatic, aromatic, or mixed aliphatic-aromatic sulfonic acids, illustrative examples of which include lauryl, stearyl, benzyl, and alkylbenzene sulfonic acids as well as polysulfonic acids, an illustrative example of which is the polymeric polysulfonic acid having a molecular weight of about 3300 and a neutralization equivalent of 390 and prepared from dodecyl benzene and acetaldehyde monosulfonic acid. In further illustration, highly suitable sulfonic acids for use in practice of this invention are petroleum sulfonic acids which are known to the art as mahogany acids and are generally formed when lubricating or similar petroleum fractions are treated with concentrated or fuming sulfuric acid. Such petroleum sulfonic acids are generally available in the form of their metal salts which are hydrolyzable to yield sulfonic acids suitable for use to esterify alkylol-containing amines for production of esters as contemplated for practice of this invention. Although, as aforesaid, a wide variety of sulfonic acids may be employed for esterification of alkylol amines, particularly preferred are sulfonic acids having a relatively high molecular weight, such, for example, as a molecular weight of about 200 to about 600, illustrated by sulfonic acids of the mahogany acid type, or even higher molecular weight acids, e. g., up to about 3,500 or more, such as the aforesaid polymeric polysulfonic acid prepared from said dodecyl benzene and acetaldehyde monosulfonic acid. Sulfonic acids of the relatively high molecular weight type are preferred as they generally produce esters having improved solubility characteristics, particularly when used in vehicles of the hydrocarbon type, and in many instances provide improved protection of metals against corrosion and rusting.

In order to further describe the invention, several examples are set forth hereinafter illustrating the markedly effective protection obtained against metal corrosion and rust by practice of this invention. In the examples, determination of protective ability of the compositions was made by subjecting the compositions to the severe conditions of the humidity corrosion test described in "Army-Navy Aeronautical Specification Compound; Corrosive Preventive, Aircraft Engine, AN–VV–C–576–B" of April 28, 1945. Briefly, the test comprises coating two freshly sand blasted steel panels with the test composition, draining for four hours in an atmosphere maintained at a relative humidity not exceeding 50% and a temperature of 25° plus or minus 3° C., and then subjecting the panel to a circulating atmosphere of 95 to 100% relative humidity at 120° F. for 150 hours or for a longer period to determine the corrosive inhibiting

characteristics of the test composition under extended periods of corrosion- and rust-inducing conditions. At the end of the test period, the panels are removed from the humidity cabinet, cleaned with naphtha and examined.

In the following examples and wherein reference is made to the use of a petroleum sulfonic acid in preparation of the rust inhibiting esters, the petroleum sulfonic acid was obtained by hydrolyzing (with hydrochloric acid) sodium salts of petroleum sulfonates marketed as "Petronate" and containing a concentration of about 60 to about 65% of sodium salts of petroleum sulfonic acids in a mineral oil. The specific petroleum sulfonic acids, employed in the examples and used for esterifying the designated alkylolamines with subsequent preparation of homogeneous solutions of the esterified product in a mineral oil, had a neutralization equivalent of 645/750 and an ash value of 2% by weight.

Example I

A composition was prepared comprising by weight 97% of a mineral lubricating oil and 3% of an ester prepared by esterifying diethyl amino ethanol with the aforedefined petroleum sulfonic acid. The esterified product was prepared by refluxing for 2 to 4 hours a mixture of the alkylolamine and acid, using an excess of the amine over the theoretical amount required to esterify the acid, and removal from the reacted mixture of excess amine and water formed by the esterification reaction. When the composition was subjected to the conditions of the aforesaid test, protection of the metal panel against corrosion and rusting was obtained for a period of about 500 hours. A composition identical to the aforesaid, except that it contained only 1.5% instead of 3% of the ester, showed no evidence of panel failure upon observation at 310 hours of exposure.

Example II

A composition was prepared comprising 97% by weight of a mineral lubricating oil and 3% of di-n-butyl amino ethanol esterified with a petroleum sulfonic acid as aforedefined. The esterified product was prepared by refluxing for 2 to 4 hours a mixture of the alkylolamine and acid, using an excess of the amine over the theoretical amount required to esterify the acid and removal from the reacted mixture of excess amine and water formed by the esterification reaction. When subjected to the conditions of the aforesaid test, such a composition protected the metal panel against corrosion and rusting for a period of about 288 hours. A composition, identical to the aforesaid except that it contained only 1.5% of the ester, protected the metal panel for about 230 hours.

Example III

A composition was prepared comprising 97% by weight of a mineral lubricating oil and 3% of a partially esterified product prepared by subjecting tri-ethanol amine to esterification with a petroleum sulfonic acid as aforedefined using as reactants a ratio of one mole of triethanol amine to one mole of the acid. When subjected to the conditions of the aforesaid test, such a composition protected the metal panel against rusting and corrosion for about 288 hours. A composition, identical to the aforeaid, but containing only 1.5% of the ester showed no evidence of panel failure upon observation at 310 hours of exposure.

Example IV

A composition was prepared comprising 97% by weight of a mineral lubricating oi land 3% of a di-ethyl amino ethanol esterified with a polymeric sulfonic acid prepared from dodecyl benzene and acetaldehyde monosulfonic acid. The esterified product was prepared by refluxing for 2 to 4 hours a mixture of the alkylolamine and acid, using an excess of the amine over the theoretical amount required to esterify the acid and removal from the reacted mixture of excess amine and water formed by the esterification reaction. When subjected to the conditions of the aforesaid test, such a composition protected the metal panel against corrosion and rusting for about 288 hours. A composition, identical to the aforesaid except that it contained only 1.5% of the ester, protected the panel for about 230 hours.

As will be apparent to those skilled in the art, the use of alkylol-containing amines esterified with sulfonic acids provide highly effective protection of metals against rusting and corrosion upon exposure thereof to corrosion-inducing conditions. Although, in the foregoing illustrative examples, specific concentrations of the esters have been employed, it should be understood that such concentrations has been used for illustrative purposes and are not intended as limiting the invention thereto. As will be further apparent to those skilled in the art, the concentration of ester employed may be varied over a rather wide range of concentration depending upon factors such as the degree of corrosion prevention desired, solubility characteristics of the particular ester in the vehicle employed, etc. Generally, however, the ester is employed in amounts varying from about 0.01 to about 20% by weight of the composition, the lower concentrations generally being used for conditions that are not too severe towards enhancing metal corrosion and the higher concentrations for protection against more severe conditions. For most purposes, however, highly satisfactory results are obtained by use of about 0.5 to about 10% of the esters based on the weight of the composition.

Although, and as illustratively described in the foregoing examples, the compositions comprise a suitable vehicle and an esterified alkylol amine, it is within the scope of this invention to include in the compositions embodied herein other addition agents for imparting certain desired properties to the compositions. In illustration, the compositions embodied herein may also contain substances such as anti-oxidants, pour point depressants, etc.

Although the present invention has been described in conjunction with certain preferred embodiments thereof, those skilled in the art will readily recognize that variations and modifications are to be considered within the purview of the specification and scope of the appended claims.

I claim:

1. A substantially non-aqueous composition, adapted for inhibiting rusting of metal surfaces, comprising a major amount by weight based on said composition of a substantially non-corrosive vehicle and a small amount, sufficient to impart rust-preventive characteristics to said composition, of a rust-inhibiting alkylol-containing amine having an alkylol group esterified with a sulfonic acid.

2. A composition, as defined in claim 1, wherein the vehicle is a hydrocarbon.

3. A composition, as defined in claim 1, wherein the vehicle is a mineral oil.

4. A composition, as defined in claim 1, wherein the sulfonic acid is a petroleum sulfonic acid.

5. A composition, as defined in claim 1, wherein the alkylol-containing amine is a trialkylol amine.

6. A composition, as defined in claim 1, wherein the alkylol-containing amine is a tertiary alkyl alkylolamine.

7. A substantially non-aqueous composition, adapted for inhibiting rusting of metal surfaces, comprising a major amount by weight based on said composition of a mineral oil and a small amount, sufficient to impart rust-preventive characteristics to said composition, of a rust-inhibiting oil-soluble tertiary alkylol-containing amine having an alkylol group esterified with a petroleum sulfonic acid.

8. A composition, as defined in claim 7, wherein the amine is an alkyl alkylolamine.

9. A method for inhibiting rusting of metal surfaces which comprises applying to the surface of a normally corrodible metal a substantially non-aqueous composition comprising a major amount by weight based on said composition of a substantially non-corrosive vehicle and a small amount, sufficient to impart rust-preventive characteristics to said composition, of a rust-inhibiting alkylol-containing amine having an alkylol group esterified with a sulfonic acid.

10. A method, as defined in claim 9, wherein the vehicle is a hydrocarbon.

11. A method, as defined in claim 9, wherein the vehicle is a mineral oil.

12. A method, as defined in claim 9, wherein the sulfonic acid is a petroleum sulfonic acid.

13. A method, as defined in claim 9, wherein the amine is a tertiary amine.

14. A method, as defined in claim 13, wherein the amine is an alkyl alkylolamine.

15. A composition, as defined in claim 1, which contains the esterified alkylolamine in an amount of about

0.01 to about 20% based upon the weight of the composition.

16. A composition, as defined in claim 1, wherein the vehicle is a mineral oil of lubricating grade, the alkylol-containing amine is a member from the group consisting of diethyl amino ethanol, di-n-butyl amino ethanol and triethanol amine, the sulfonic acid is a petroleum sulfonic acid, and the esterified alkylol amine is present in an amount of about 0.01 to about 20% based on the weight of the composition.

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