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(54) Title: CORROSION INHIBITING COMPOSITION FOR NON-FERROUS METALS

(57) Abstract: The invention relates an additive composition for use as a metal working fluid and a process for protection of metals, particularly zinc or aluminum, against corrosion or oxidative degradation. The composition comprises an additive mixture of an alkenyl succinic half ester, a substituted imidazoline compound and amine phosphate partial ester in a functional fluid.

CORROSION INHIBITING COMPOSITION FOR NON-FERROUS METALS

The invention relates to an additive composition for use as a metal working fluid or corrosion protection oil and a process for the protection of metals, particularly zinc or aluminium alloys, against corrosion or oxidative degradation.

5 Additives, which have the purpose to protect metals against corrosion are commonly divided in to two classes:

Metal deactivators are used to protect yellow metals or alloys, such as copper or brass, and display their protective action in functional liquids, such as mineral oil or fuels, by deactivating the metal ions contained therein. These metal ions can have catalytic effects in undesired

10 oxidative decomposition processes of mineral oil or fuels. The protective action is explained by the formation of film-like layers on the surface of metals or by complex formation with metal ions.

Corrosion inhibitors are primary used to protect ferrous metals such as iron or steel. Analogue to metal deactivators, corrosion inhibitors, are forming also film-like layers on the sur-

15 face of metals. In addition some corrosion inhibitors can prevent the corrosion, by emulsifying water and minimizing therefore the direct contact of water with the metal surface.

Presently metal protection methods focus primarily on iron and copper surfaces. However, other metals, such as zinc and aluminium and their related alloys, have become very important in many technical applications. Zinc and aluminium are, for example, widely used in the

20 manufacture of automobiles. Zinc is widely used as corrosion protection coating of steels, e.g. zinc coated steel coils. Corrosion problems often occur during transport, handling and working of semi-finished metal products. Unfortunately, presently used metal deactivator compositions are less satisfactory or even unsatisfactory to protect these metal surfaces. Therefore, there is a clear need for improved metal working fluids to prevent corrosion of

25 these metals

British Patent Specification No. 795,491 discloses the preparation of alkenyl succinic half esters and their applicability as steam turbine lubricant additives.

British Patent Specification No. 1,043,488 lubricating oil compositions comprising substituted imidazoline compounds and phosphate partial esters.

30 *U.S. Patent Application Publication No. 2005/0272614 discloses corrosion inhibiting compositions, wherein substituted imidazolines and neutral metal sulfonate corrosion inhibitors are present.*

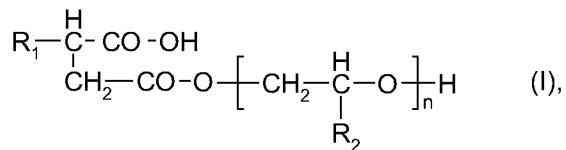
It has surprisingly been found that mixtures of alkenyl succinic half esters, substituted imidazoline compounds and amine phosphate partial esters in functional fluids, such as oils, prevent the corrosion of zinc, zinc coated steel and aluminum metal samples. This anticorrosive effect can be increased by the further admixture of additional anti-corrosive agents, such as

5 substituted imidazolines and amine phosphate partial esters.

The present invention relates to a composition, which comprises

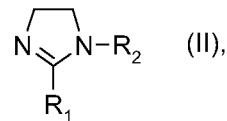
A) An additive mixture that essentially consists of

a) At least one alkenyl succinic half ester of the formula



10 Wherein R_1 represents $\text{C}_6\text{-C}_{18}$ alkenyl, R_2 represents hydrogen or methyl and n is a numeral from 1 to 100;

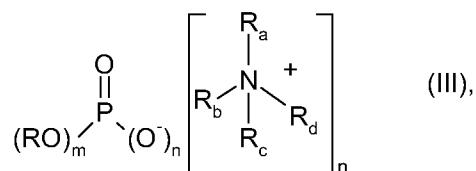
b) At least one imidazoline compound of the formula



15 Wherein one of R_1 and R_2 represents hydrogen and the other one represents a substituent selected from the group consisting of $\text{C}_1\text{-C}_{12}$ alkyl, hydroxy- $\text{C}_2\text{-C}_{12}$ alkyl, amino- $\text{C}_2\text{-C}_{12}$ alkyl, $\text{C}_2\text{-C}_{20}$ alkenyl, phenyl, phenyl- $\text{C}_1\text{-C}_4$ alkyl, $\text{C}_1\text{-C}_4$ alkylphenyl and $\text{C}_1\text{-C}_4$ alkylphenyl- $\text{C}_1\text{-C}_4$ alkyl; or

20 Wherein both of R_1 and R_2 represent substituents selected from the group consisting of $\text{C}_1\text{-C}_{12}$ alkyl, hydroxy- $\text{C}_2\text{-C}_{12}$ alkyl, amino- $\text{C}_2\text{-C}_{12}$ alkyl, $\text{C}_2\text{-C}_{20}$ alkenyl, phenyl, phenyl- $\text{C}_1\text{-C}_4$ alkyl, $\text{C}_1\text{-C}_4$ alkylphenyl and $\text{C}_1\text{-C}_4$ alkylphenyl- $\text{C}_1\text{-C}_4$ alkyl; and

c) At least one amine phosphate partial ester of the formula



Wherein m represents 1 or 2;

n represents 2, if m represents 1, or represents 1, if m represents 2;

R represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cyclo-alkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cyclo-alkyl-C₁-C₄alkyl; and

5 R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl; and

10 B) A functional fluid.

A preferred embodiment of the invention relates to a composition, which comprises

A) An additive mixture that essentially consists of

a) At least one alkenyl succinic half ester (I), wherein

15 R₁ represents C₁₀-C₁₆alkenyl, R₂ represents methyl and n is a numeral from 1 to 20;

b) At least one imidazoline compound (II),

Wherein one of R₁ and R₂ represents hydrogen and the other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl and C₁₂-C₁₈alkenyl; or

20 Wherein both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl and C₁₂-C₁₈alkenyl; and

c) At least one amine phosphate partial ester (III),

Wherein m represents 1 or 2;

n represents 2, if m represents 1, or represents 1, if m represents 2;

25 R represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl and amino-C₂-C₁₂alkyl; and

R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl and hydroxy-C₂-C₁₂alkyl; and

B) A functional fluid.

30 A particularly preferred embodiment of the invention relates to composition, which comprises

A) An additive mixture that essentially consists of

a) At least one alkenyl succinic half ester (I), wherein

R₁ represents C₁₂-C₁₆alkenyl, R₂ represents methyl and n is a numeral from 1 to 20;

5 b) At least one imidazoline compound (II),

Wherein one of R₁ and R₂ represents hydrogen and the other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl and C₁₂-C₁₈alkenyl; or

10 Wherein both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl and C₁₂-C₁₈alkenyl; and

c) At least one amine phosphate partial ester (III),

Wherein m represents 1 or 2;

n represents 2, if m represents 1, or represents 1, if m represents 2;

15 R represents a substituent selected from the group consisting of C₁-C₁₂alkyl and hydroxy-C₂-C₁₂alkyl; and

R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl and hydroxy-C₂-C₁₂alkyl; and

B) A functional fluid.

20 A highly preferred embodiment of the invention relates to a composition, which comprises

a) At least one alkenyl succinic half ester (I),

Wherein R₁ represents C₆-C₁₈alkenyl, R₂ represents methyl and n is a numeral from 1 to 100;

b) At least one imidazoline compound (II),

25 Wherein one of R₁ and R₂ represents hydrogen and the other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl; or

30 Wherein both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl,

C_2 - C_{20} alkenyl, phenyl, phenyl- C_1 - C_4 alkyl, C_1 - C_4 alkylphenyl and C_1 - C_4 alkylphenyl- C_1 - C_4 alkyl;

5 c) At least one amine phosphate partial ester (III),

Wherein m represents 1 or 2;

n represents 2 if m represents 1; or

represents 1 if m represents 2; and

10 R represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, hydroxy- C_2 - C_{12} alkyl, amino- C_2 - C_{12} alkyl, phenyl, phenyl- C_1 - C_4 alkyl, C_1 - C_4 alkylphenyl, C_1 - C_4 alkylphenyl- C_1 - C_4 alkyl,

15 C_4 - C_8 cycloalkyl, C_4 - C_8 cycloalkyl- C_1 - C_4 alkyl, C_1 - C_4 alkyl- C_4 - C_8 cycloalkyl and C_1 - C_4 alkyl- C_4 - C_8 cycloalkyl- C_1 - C_4 alkyl; and

R_a , R_b , R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C_1 - C_{12} alkyl, hydroxy- C_2 - C_{12} alkyl, amino- C_2 - C_{12} alkyl, phenyl, phenyl- C_1 - C_4 alkyl,

15 C_1 - C_4 alkylphenyl, C_1 - C_4 alkylphenyl- C_1 - C_4 alkyl, C_4 - C_8 cycloalkyl, C_4 - C_8 cycloalkyl- C_1 - C_4 alkyl, C_1 - C_4 alkyl- C_4 - C_8 cycloalkyl and C_1 - C_4 alkyl- C_4 - C_8 cycloalkyl- C_1 - C_4 alkyl; and

d) Additional customary additives.

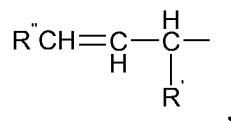
The compositions as described above are suitable as corrosion inhibitor in non-aqueous,

20 partially aqueous or aqueous functional fluids or liquids.

The expressions and terms used above and below are preferably defined as follows in the description of the present invention:

In a compound (I) R_1 defined C_6 - C_{18} alkenyl is preferably straight chain or, where possible, branched radical, for example n-2-octenyl, n-2-dodecenyl, iso-dodecenyl, or is preferably a

25 group of the partial formula



Wherein R' and R'' are independently of one another hydrogen or substantially straight chain hydrocarbyl groups, with the proviso that the total number of carbon atoms in R is within the indicated ranges. Preferably R' and R'' are C_3 - C_{15} alkyl or C_3 - C_{15} alkenyl groups. In a particu-

larly advantageous embodiment, R has from about 16 to about 18 C-atoms, R' is hydrogen or C₁-C₇alkyl or C₂-C₇alkenyl and R" is C₅-C₁₅alkyl or C₅-C₁₅alkenyl.

R₂ is hydrogen or preferably methyl.

In a compound (I) the index n represents a numeral from 1 to about 100. According to pre-

5 ferred embodiments n represents a numeral from 1 to about 20. Compounds (I) are obtainable by reacting the R-substituted succinic acid with ethylene oxide or ethylene glycol of desired chain length, if R₂ represents hydrogen, or with propylene oxide or polypropylene glycol of desired chain length, if R₂ represents methyl.

Compounds (I) are known and at least some of them are commercially available. The prepara-

10 tion of compounds (I) is described in *British Patent Specification No. 795,491*.

Compounds (I) are known oil soluble corrosion inhibitors, which are commercially available as solution in mineral oil, such as the product Ciba® Irgacor® L 12. Other products are Hitec® 536 commercially available from Ethyl Corp. Richmond VA, USA.

In a compound (II) one of R₁ and R₂ represents hydrogen and the other one represents a

15 substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl; or

Both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl,

hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl,

20 C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl.

R₁ and R₂ defined as C₁-C₁₂alkyl is, for example, C₁-C₆alkyl, e.g. methyl, ethyl, n-propyl or isopropyl or n-butyl, sec-butyl or tert-butyl or straight-chain or branched pentyl or hexyl, and C₇-C₁₂alkyl, e.g. straight-chain or branched heptyl, octyl, isoctyl, nonyl, tert-nonyl, decyl, undecyl or dodecyl.

25 R₁ and R₂ defined as hydroxy-C₂-C₁₂alkyl, is e.g. 2-hydroxyethyl, dihydroxyethyl, 2- or 3-hydroxypropyl, 2-, 3-dihydroxypropyl, glyceryl or any of the above-mentioned C₄-C₁₂alkyl groups substituted by 1-3 hydroxy groups.

R₁ and R₂ defined as amino-C₂-C₁₂alkyl is e.g. 2-aminoethyl, diaminoethyl or 2- or

3-aminopropyl or any of the above-mentioned C₄-C₁₂alkyl groups substituted by 1-3 amino groups.

R₁ and R₂ defined as C₂-C₂₀alkenyl is a straight chain or, where possible, branched radical, for example vinyl, allyl, 2-butenyl, 3-butenyl, isobut enyl, n-2,4-pentadienyl, 3-methyl-2-butenyl, n-2-octenyl, n-2-dodecenyl or iso-dodecenyl.

R_1 and R_2 defined as phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl radicals are, for example, benzyl, 1- or 2-phenethyl, 4-methyl- or 4-ethylphenyl, cumyl or 4-methylbenzyl.

According to preferred embodiments one of R_1 and R_2 represents hydrogen and the other

5 one represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl and C₁₂-C₁₈alkenyl; or

Both of R_1 and R_2 represent substituents selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl and C₁₂-C₁₈alkenyl.

According to another preferred embodiment one of R_1 and R_2 represents hydrogen and the

10 other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl and C₁₂-C₁₈alkenyl; or

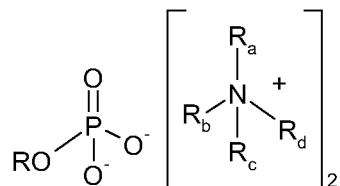
Both of R_1 and R_2 represent substituents selected from the group consisting of C₁-C₁₂alkyl and C₁₂-C₁₈alkenyl.

Compounds (II) are known compounds and applicable oil soluble corrosion inhibitors, which

15 are commercially available as solution in mineral oil, such as the product Ciba® Amine 0.

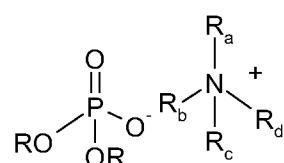
In a compound (III) m represents 1 or 2. In the event that m represents 1, n represents 2.

Such compounds are represented by the formula



In the event that m represents 2, n represents 1. Such compounds are represented by the

20 formula



In a compound (III) R represents a substituent selected from the group consisting of

C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, phenyl, phenyl-C₁-C₄alkyl,

C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl,

25 C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl; and

R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cyclo-

5 alkyl-C₁-C₄alkyl.

The definitions of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl correspond to the definitions given above with regard to compounds (I) and (II).

R as well as R_a, R_b, R_c and R_d defined as C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl,
10 C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl are, for example, cyclopentyl, cyclohexyl, cyclopentylmethyl or cyclohexylmethyl, cyclopentyl-1,1-ethyl, cyclohexyl-1,1-ethyl, cyclopentyl-1,2-ethyl, cyclohexyl-1,2-ethyl, cyclopentyl-1,2-propyl or cyclohexyl-1,2-propyl, which can be substituted on the C₄-C₈cycloalkyl groups by C₁-C₄alkyl, e.g. methyl, ethyl, n- propyl or isopropyl.

15 According to preferred embodiments R represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl and amino-C₂-C₁₂alkyl; and

R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl and hydroxy-C₂-C₁₂alkyl.

20 Amine phosphate partial ester as represented by the formula III are known compounds that can be prepared by known methods. Compounds (III) are applicable as oil soluble corrosion inhibitors and commercially available, such as the product Ciba® Irgalube® 349.

25 Other amine phosphate partial ester as represented by the formula III are commercially available from Rheinchemie Rheinau GmbH, Mannheim Germany, such as the products Additin® RC 3740, RC 3741 or RC 3760 (amine neutralized phosphoric acid ester of aliphatic alcohols).

The term functional liquid includes non-aqueous, partially aqueous and aqueous liquids which are in contact with metals to be protected, in particular aluminium and zinc.

30 Examples of non-aqueous functional liquids are fuels, e.g. hydrocarbon mixtures comprising mineral oil fractions which are liquid at room temperature and are suitable for use in internal combustion engines, e.g. internal combustion engines with external (petrol engines) or internal ignition (diesel engines), e.g. petrol having different octane contents (regular grade or premium grade petrol) or diesel fuels, and lubricants, hydraulic fluids, metal working fluids,

such as drawing oil, cutting oils, forming oils, drilling oils etc, engine coolants, transformer oils and switchgear oils.

Examples of suitable partially aqueous functional liquids are water-in-oil or oil-in-water metal working fluids, hydraulic fluids based on aqueous polyglycol/ polyglycol ether mixtures or glycol systems, and engine cooling systems based on aqueous glycol.

Examples of aqueous functional liquids are industrial cooling water, filling compositions of a water conditioning plant, steam generation systems, sea water evaporation systems, sugar evaporation systems, irrigation systems, hydrostatic boilers and heating systems or cooling systems having a closed circulation.

10 The composition according to the invention preferably comprise 0.01 to 10.0% by weight, in particular 0.02 to 3.0 % by weight, of the additive mixture, as defined above, based on the weight of the functional liquid.

15 Non-aqueous functional liquids are preferred, in particular base oils of lubricating viscosity, which can be used for the preparation of greases, metal working fluids, gear fluids and hydraulic fluids.

20 Suitable greases, metal working fluids, gear fluids and hydraulic fluids are based, for example, on mineral or synthetic oils or mixtures thereof. The lubricants are familiar to a person skilled in the art and are described in the relevant literature, such as, for example, in *Chemistry and Technology of Lubricants*; Mortier, R.M. and Orszulik, S.T. (Editors); 1992 Blackie and Son Ltd. for GB, VCH-Publishers N.Y. for U.S., ISBN 0-216-92921-0, cf. pages 208 et seq. and 269 et seq.; in *Kirk-Othmer Encyclopedia of Chemical Technology*, Fourth Edition 1969, J. Wiley & Sons, New York, Vol. 13, page 533 et seq. (Hydraulic Fluids); *Performance Testing of Hydraulic Fluids*; R. Tourret and E.P. Wright, Hyden & Son Ltd. GB, on behalf of The Institute of Petroleum London, ISBN 0 85501 317 6; *Ullmann's Encyclopedia of Ind.*

25 *Chem.*, Fifth Completely Revised Edition, Verlag Chemie, DE-Weinheim, VCH-Publishers for U.S., Vol. A 15, page 423 et seq. (Lubricants), Vol. A 13, page 165 et seq. (Hydraulic Fluids).

30 The lubricants are in particular oils and greases, for example based on mineral oil, synthetic oils, or vegetable and animal oils, fats, tallow and wax or mixtures thereof. Vegetable and animal oils, fats, tallow and wax are, for example, palm kernel oil, palm oil, olive oil, colza oil, rapeseed oil, linseed oil, soy bean oil, cotton wool oil, sunflower oil, coconut oil, maize oil, castor oil, walnut oil and mixtures thereof, fish oils, and chemically modified, e.g. epoxidised or sulphoxidised or alkylated or hydrogenated, forms or forms prepared by genetic engineering, for example soy bean oil prepared by genetic engineering.

Examples of synthetic lubricants include lubricants based on aliphatic or aromatic carboxylic esters, polymeric esters, polyalkylene oxides, phosphoric acid esters, poly- α -olefins or silicones of the diester of a dibasic acid with a monohydric alcohol, e.g. dioctyl sebacate or dinonyl adipate, of a triester of trimethylolpropane with a monobasic acid or with a mixture of 5 such acids, e.g. trimethylolpropane tripelargonate, trimethylolpropane tricaprylate or mixtures thereof, of a tetra ester of pentaerythritol with a monobasic acid or with a mixture of such acids, e.g. pentaerythrityl tetracaprylate, or of a complex ester of monobasic and dibasic acids with polyhydric alcohols, e.g. a complex ester of trimethylolpropane with caprylic and sebacic acid or of a mixture thereof. Particularly suitable in addition to mineral oils are, for example, 10 poly- α -olefins, ester-based lubricants, phosphates, glycols, polyglycols and polyalkylene glycols and mixtures thereof with water.

Said lubricants or mixtures thereof can also be mixed with an organic or inorganic thickener (base fat). Metal working fluids and hydraulic fluids can be prepared on the basis of the same substances as described above for the lubricants. These are frequently also emulsions of 15 such substances in water or other liquids.

Said lubricant compositions, e.g. greases, gear fluids, metal working fluids and hydraulic fluids, may additionally contain further additives which are added in order further to improve their fundamental properties. These include: antioxidants, metal deactivators, rust inhibitors, viscosity index improvers, pour point depressants, dispersants, detergents, tackifiers, 20 thixotropic builders, dewatering agents, antifoam agents, demulsifiers, high pressure additives and antiwear additives. Such additives are added in the amounts customary in each case for the purpose, each in the range from 0.01 to 10.0% by weight. Examples of further additives follow:

1. Phenolic antioxidants

25 1.1. Alkylated monophenols: 2,6-di-tert-butyl-4-methylphenol, 2-butyl-4,6-dimethylphenol, 2,6-di-tert-butyl-4-ethylphenol, 2,6-di-tert-butyl-4-n-butylphenol, 2,6-di-tert-butyl-4-isobutylphenol, 2,6-dicyclopentyl-4-methylphenol, 2-(α -methylcyclohexyl)-4,6-dimethylphenol, 2,6-dioctadecyl-4-methylphenol, 2,4,6-tricyclohexylphenol, 2,6-di-tert-butyl-4-methoxymethylphenol, linear nonylphenols or nonylphenols which are branched in 30 the side chain, e.g. 2,6-dinonyl-4-methylphenol, 2,4-dimethyl-6-(1'-methyl-undec-1'-yl)-phenol, 2,4-dimethyl-6-(1'-methylheptadec-1'-yl)-phenol, 2,4-dimethyl-6-(1'-methyltridec-1'-yl)-phenol and mixtures thereof

1.2. Alkylthiomethylphenols: 2,4-dioctylthiomethyl-6-tert-butylphenol, 2,4-dioctylthiomethyl-6-methylphenol, 2,4-dioctylthiomethyl-6-ethylphenol, 2,6-didodecylthiomethyl-4-nonylphenol

5 1.3. Hydroquinones and alkylated hydroquinones: 2,6-di-tert-butyl-4-methoxyphenol, 2,5-di-tert-butyl-hydroquinone, 2,5-di-tert-amyl-hydroquinone, 2,6-diphenyl-4-octadecyl-oxyphenol, 2,6-di-tert-butyl-hydroquinone, 2,5-di-tert-butyl-4-hydroxyanisole, 3,5-di-tert-butyl-4-hydroxyanisole, 3,5-di-tert-butyl-4-hydroxyphenylstearate, bis(3,5-di-tert-butyl-4-hydroxyphenyl) adipate

10 1.4. Tocopherols: α -, β -, γ - or δ -tocopherols and mixtures thereof (vitamin E)

1.5. Hydroxylated thiodiphenyl ethers: 2,2'-thiobis(6-tert-butyl-4-methylphenol), 2,2'-thiobis(4-octylphenol), 4,4'-thiobis(6-tert-butyl-3-methylphenol), 4,4'-thiobis-(6-tert-butyl-2-methylphenol), 4,4'-thiobis(3,6-di-sec-amylphenol), 4,4'-bis(2,6-dimethyl-4-hydroxyphenyl) disulphide

15 1.6. Alkylidene bisphenols: 2,2'-methylenebis(6-tert-butyl-4-methylphenol), 2,2'-methylenebis(6-tert-butyl-4-ethylphenol), 2,2'-methylenebis[4-methyl-6-(α -methylcyclohexyl)-phenol], 2,2'-methylenebis(4-methyl-6-cyclohexylphenol), 2,2'-methylenebis(6-nonyl-4-methylphenol), 2,2'-methylenebis(4,6-di-tert-butylphenol), 2,2'-ethylidenebis(4,6-di-tert-butylphenol), 2,2'-ethylidenebis(6-tert-butyl-4-isobutylphenol), 2,2'-methylenebis[6-(α -methylbenzyl)-4-nonylphenol], 2,2'-methylenebis[6-(α , α -dimethylbenzyl)-4-nonylphenol], 4,4'-methylenebis(2,6-di-tert-butylphenol), 4,4'-methylenebis(6-tert-butyl-2-methylphenol), 1,1-bis(5-tert-butyl-4-hydroxy-2-methylphenyl)butane, 2,6-bis(3-tert-butyl-5-methyl-2-hydroxybenzyl)-4-methylphenol, 1,1,3-tris(5-tert-butyl-4-hydroxy-2-methylphenyl)butane, 1,1-bis(5-tert-butyl-4-hydroxy-2-methyl-phenyl)-3-n-dodecylmercaptopbutane, ethylene glycol bis[3,3-bis(3'-tert-butyl-4'-hydroxyphenyl)butyrate], bis(3-tert-butyl-4-hydroxy-5-methyl-phenyl)dicyclopentadiene, bis[2-(3'-tert-butyl-2'-hydroxy-5'-methyl-benzyl)-6-tert-butyl-4-methyl-phenyl]terephthalate, 1,1-bis(3,5-dimethyl-2-hydroxyphenyl)-butane, 2,2-bis(3,5-di-tert-butyl-4-hydroxyphenyl)propane, 2,2-bis(5-tert-butyl-4-hydroxy-2-methylphenyl)-4-n-dodecylmercaptopbutane, 1,1,5,5-tetra(5-tert-butyl-4-hydroxy-2-methylphenyl)pentane

20 1.7. O-, N- and S-benzyl compounds: 3,5,3',5'-tetra-tert-butyl-4,4'-dihydroxydibenzyl ether, octadecyl 4-hydroxy-3,5-dimethylbenzylmercaptoacetate, tridecyl-4-hydroxy-3,5-di-tert-butylbenzylmercaptoacetate, tris(3,5-di-tert-butyl-4-hydroxybenzyl)amine, bis(4-

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tert-butyl-3-hydroxy-2,6-dimethylbenzyl) dithiophthalate, bis(3,5-di-tert-butyl-4-hydroxybenzyl) sulphide, isooctyl 3,5-di-tert-butyl-4-hydroxybenzylmercaptoacetate

1.8. Hydroxybenzylated malonates: dioctadecyl 2,2-bis(3,5-di-tert-butyl-2-hydroxybenzyl)-malonate, dioctadecyl 2-(3-tert-butyl-4-hydroxy-5-methylbenzyl)malonate, didodecyl 5 mercaptoethyl-2,2-bis(3,5-di-tert-butyl-4-hydroxybenzyl)malonate, di-[4-(1,1,3,3-tetramethylbutyl)-phenyl]-2,2-bis(3,5-di-tert-butyl-4-hydroxybenzyl)malonate

1.9. Hydroxybenzyl aromatics: 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-2,4,6-trimethylbenzene, 1,4-bis(3,5-di-tert-butyl-4-hydroxybenzyl)-2,3,5,6-tetramethylbenzene, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl)phenol

10 1.10. Triazine compounds: 2,4-bisoctylmercapto-6-(3,5-di-tert-butyl-4-hydroxyanilino)-1,3,5-triazine, 2-octylmercapto-4,6-bis(3,5-di-tert-butyl-4-hydroxyanilino)-1,3,5-triazine, 2-octylmercapto-4,6-bis(3,5-di-tert-butyl-4-hydroxyphenoxy)-1,3,5-triazine, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxyphenoxy)-1,2,3-triazine, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl) isocyanurate, 1,3,5-tris(4-tert-butyl-3-hydroxy-2,6-dimethylbenzyl) isocyanurate, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxyphenylethyl)-1,3,5-triazine, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)-hexahydro-1,3,5-triazine, 1,3,5-tris(3,5-dicyclohexyl-4-hydroxybenzyl) isocyanurate

15 1.11. Acylaminophenols: 4-hydroxylauranilide, 4-hydroxystearanilide, octyl N-(3,5-di-tert-butyl-4-hydroxyphenyl) carbamate

20 1.12. Esters of beta-(3,5-di-tert-butyl-4-hydroxyphenyl)-propionic acid with monohydric or polyhydric alcohols, e.g. with methanol, ethanol, n-octanol, isooctanol, octadecanol, 1,6-hexanediol, 1,9-nanediol, ethylene glycol, 1,2-propanediol, neopentylglycol, thiidiethylene glycol, diethylene glycol, triethylene glycol, pentaerythritol, tris(hydroxyethyl) isocyanurate, N,N'-bis(hydroxyethyl)oxalamide, 3-thiaundecanol, 25 3-thiapentadecanol, trimethylhexanediol, trimethylolpropane, 4-hydroxymethyl-1-phospho-2,6,7-trioxabicyclo[2.2.2]octane

30 1.13. Esters of beta-(5-tert-butyl-4-hydroxy-3-methylphenyl)propionic acid (with monohydric or polyhydric alcohols), e.g. the alcohols with methanol, ethanol, n-octanol, isooctanol, octadecanol, 1,6-hexanediol, 1,9-nanediol, ethylene glycol, 1,2-propanediol, neopentylglycol, thiidiethylene glycol, diethylene glycol, triethylene glycol, pentaerythritol, tris(hydroxyethyl) isocyanurate, N,N'-bis(hydroxyethyl)-oxalamide, 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylolpropane, 4-hydroxymethyl-1-phospho-2,6,7-trioxabicyclo[2.2.2]octane

1.14. Esters of beta-(3,5-dicyclohexyl-4-hydroxyphenyl)propionic acid with monohydric or polyhydric alcohols, e.g. the alcohols stated under 13.

1.15. Ester of 3,5-di-tert-butyl-4-hydroxyphenylacetic acid with monohydric or polyhydric alcohols, e.g. the alcohols stated under 13.

5 1.16. Amides of beta-(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid, e.g. N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hexamethylenediamine, N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)trimethylenediamine, N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hydrazine

1.17. Ascorbic acid (vitamin C)

10 1.18. Amine antioxidants: N,N'-diisopropyl-p-phenylenediamine, N,N'-di-sec-butyl-p-phenylenediamine, N,N'-bis(1,4-dimethylpentyl)-p-phenylenediamine, N,N'-bis(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis(1-methyl-heptyl)-p-phenylenediamine, N,N'-dicyclohexyl-p-phenylenediamine, N,N'-diphenyl-p-phenylenediamine, N,N'-di-(naphth-2-yl)-p-phenylenediamine, N-isopropyl-N'-phenyl-p-phenylenediamine, N-(1,3-dimethyl-butyl)-N'-phenyl-p-phenylenediamine, N-(1-methylheptyl)-N'-phenyl-p-phenylenediamine, N-cyclohexyl-N'-phenyl-p-phenylenediamine, 4-(p-toluenesulphonamido)diphenylamine, N,N'-dimethyl-N,N'-di-sec-butyl-p-phenylenediamine, diphenylamine, N-allyldiphenylamine, 4-isopropoxy-diphenylamine, N-phenyl-1-naphthylamine, N-(4-tert-octylphenyl)-1-naphthylamine, N-phenyl-2-naphthylamine, octylated diphenylamine, e.g. p,p'-di-tert-octyldiphenylamine, 4-n-butylaminophenol, 4-butyrylaminophenol, 4-nanoylaminophenol, 4-decanoylaminophenol, 4-octadecanoylaminophenol, di-(4-methoxyphenyl)amine, 2,6-di-tert-butyl-4-dimethylaminomethylphenol, 2,4'-diaminodiphenylmethane, 4,4'-diaminodiphenylmethane, N,N,N',N'-tetramethyl-4,4'-diaminodiphenylmethane, 1,2-di-[(2-methyl-phenyl)-amino]ethane, 1,2-di-(phenylamino)-propane, (o-tolyl)biguanide, di-[4-(1',3'-dimethyl-butyl)phenyl]amine, tert-octylated N-phenyl-1-naphthylamine, mixture of mono- and dialkylated tert-butyl/tert-octyldiphenylamines, mixture of mono- and dialkylated nonyldiphenylamines, mixture of mono- and dialkylated dodecyldiphenylamines, mixture of mono- and dialkylated isopropyl/isohexyldiphenylamines, mixtures of mono- and dialkylated tert-butyldiphenylamines, 2,3-dihydro-3,3-dimethyl-4H-1,4-benzothiazine, phenothiazine, mixture of mono- and dialkylated tert-butyl tert-octylphenothiazines, mixture of mono- and dialkylated tert-octylphenothiazines, N-allyl-phenothiazine, N,N,N',N'-tetraphenyl-1,4-diaminobut-2-ene, N,N-bis-(2,2,6,6-tetrame-

thylpiperidin-4-yl)-hexamethylenediamine, bis-(2,2,6,6-tetramethylpiperidin-4-yl) sebacate, 2,2,6,6-tetramethylpiperidin-4-one, 2,2,6,6-tetramethylpiperidin-4-ol

2. Further antioxidants: aliphatic or aromatic phosphites, esters of thiadipropionic acid or thiodiacetic acid or salts of dithiocarbamic or dithiophosphoric acid, 2,2,12,12-tetra-5-methyl-5,9-dihydroxy-3,7,11-trithiatridecane and 2,2,15,15-tetramethyl-5,12-dihydroxy-3,7,10,14-tetrathiahexadecane

3. Further metal deactivators:

3.1. Benzotriazoles and derivatives thereof: 2-mercaptopbenzotriazole, 2,5-dimercaptobenzotriazole, 4- or 5-alkylbenzotriazoles (e.g. tolutriazole) and derivatives thereof, 4,5,6,7-tetrahydrobenzotriazole, 5,5'-methylenebisbenzotriazole; Mannich bases of benzotriazole or tolutriazole, such as 1-[di(2-ethylhexylaminomethyl)]tolutriazole and 1-[di(2-ethylhexylaminomethyl)]benzotriazole; alkoxyalkylbenzotriazoles, such as 1-(nonyloxymethyl)-benzotriazole, 1-(1-butoxyethyl)benzotriazole and 1-(1-cyclohexyloxybutyl)tolutriazole

15 3.2. 1,2,4-Triazoles and derivatives thereof: 3-alkyl (or aryl)-1,2,4-triazoles, Mannich bases of 1,2,4-triazoles, such as 1-[di(2-ethylhexyl)aminomethyl]-1,2,4-triazole; alkoxyalkyl-1,2,4-triazoles, such as 1-(1-butoxyethyl)-1,2,4-triazole; acylated 3-amino-1,2,4-triazoles

20 3.3. Imidazole derivatives: 4,4'-methylenebis(2-undecyl-5-methylimidazole), bis[(N-methyl)imidazol-2-yl]carbinol octyl ether

3.4. Sulphur-containing heterocyclic compounds: 2-mercaptopbenzothiazole, 2,5-dimercapto-1,3,4-thiadiazole, 2,5-dimercaptobenzothiadiazole and derivatives thereof; 3,5-bis[di-(2-ethylhexyl)aminomethyl]-1,3,4-thiadiazolin-2-one

25 3.5. Amino compounds: salicylidenepropylenediamine, salicylaminoguanidine and salts thereof

4. Corrosion inhibitors:

4.1. Organic acids, their esters, metal salts, amine salts and anhydrides: alkyl- and alkenylsuccinic acids and partial esters thereof with alcohols, diols or hydroxycarboxylic acids, partial amides of alkyl- and alkenylsuccinic acids, 4-nonylphenoxyacetic acid, alkoxy- and alkoxyethoxycarboxylic acids, such as dodecyloxyacetic acid, dodecyloxy(ethoxy)acetic acid and amine salts thereof, and furthermore N-oleoylsarcosine, sorbitan monooleate, lead naphthenate, alkenylsuccinic anhydrides, e.g. dodecenylsuccinic anhydride, 2-(2-carboxyethyl)-1-dodecyl-3-methylglycerol and salts thereof, in particular sodium salts and triethanolamine salts

5 4.2. Nitrogen-containing compounds:

10 4.2.1 Tertiary aliphatic and cycloaliphatic amines and amine salts of organic and inorganic acids, e.g. oil-soluble alkylammonium carboxylates, and furthermore 1-[N,N-bis-(2-hydroxyethyl)amino]-3-(4-nonylphenoxy)propan-2-ol

4.2.2 Heterocyclic compounds, e.g. substituted imidazolines and oxazolines, e.g. 2-heptadecenyl-1-(2-hydroxyethyl)-imidazoline

15 5. Sulphur-containing compounds: barium dinonylnaphthalenesulphonates, calcium petroleum sulphonates, alkylthio-substituted aliphatic carboxylic acids, esters of aliphatic 2-sulphocarboxylic acids and salts thereof

6. Viscosity index improvers: polyacrylates, polymethacrylates, vinylpyrrolidone/methacrylate copolymers, polyvinylpyrrolidones, polybutenes, olefin copolymers, styrene/acrylate copolymers, polyethers

20 7. Pour point depressants: poly(meth)acrylates, ethylene-vinyl acetate copolymers, alkyl polystyrenes, fumarate copolymers, alkylated naphthalene derivatives

8. Dispersants/Surfactants: polybutenylsuccinamides or polybutenylsuccinimides, polybutenylphosphonic acid derivatives, basic magnesium, calcium and barium sulphonates and phenolates

25 9. High pressure and antiwear additives: sulphur- and halogen-containing compounds, e.g. chlorinated paraffins, sulphonated olefins or vegetable oils (soy bean oil, rape-seed oil), alkyl or aryl di- or trisulphides, benzotriazoles or derivatives thereof, such as

bis (2-ethylhexyl)aminomethyl tolutriazoles, dithiocarbamates, such as methylenebis-dibutyl dithiocarbamate, derivatives of 2-mercaptopbenzothiazole, such as 1-[N,N-bis(2-ethylhexyl)aminomethyl]-2-mercaptop-1H-1,3-benzothiazole, derivatives of 2,5-dimercapto-1,3,4-thiadiazole, such as 2,5-bis(tert.nonyldithio)-1,3,4-thiadiazole

5 10. Substances for reducing the coefficient of friction: lard oil, oleic acid, tallow, rapeseed oil, sulphurised fats, amines. Further examples are stated in *EP-A-0 565 487*

11. Special additives for use in water/oil metal processing and hydraulic fluids:

11.1 Emulsifiers: petroleum sulphonates, amines, such as polyoxyethylated fatty amines, non-ionic surface-active substances

10 11.2 Buffers: alkanolamines

11.3 Biocides: triazines, thiazolinones, trisnitromethane, morpholine, sodium pyridinethiol

11.4 Processing speed improvers: calcium sulphonates and barium sulphonates

11.5 Tackifiers: acrylamide copolymer, polyisobutene resins.

11.6 Thixotropic builders: microcrystalline waxes, oxidized waxes and oxidized esters

15 11.7 Dewatering agents: polyglycol ethers, butyldiglycols.

Said components can be mixed with the lubricants in a manner known per se. It is also possible to prepare a concentrate or a so-called additive package, which can be diluted to the concentrations of use for the corresponding lubricant according to the application purposes as intended.

20 The ratio of component a) to component b) to component b) present in the additive mixture A) may vary within the ranges of approximately from 10 : 10 : 80 and 80 : 10 : 10 to 10 : 80 : 10% by weight.

Although the total content of the additive mixture A) in the composition is not critical, the preferred total content of the additive mixture A) in the composition is in the range between

25 10.0 and 0.01, preferably 10.0 and 0.1 or 3.0 and 0.1% by weight, based on the total weight of the composition.

A further embodiment of the invention relates to an additive mixture that essentially consists of

a) At least one alkenyl succinic half ester (I),

Wherein R₁ represents C₆-C₁₈alkenyl, R₂ represents hydrogen or methyl and n is a numeral from 0 to 100;

b) At least one imidazoline compound (II),

Wherein one of R₁ and R₂ represents hydrogen and the other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl; or

Wherein both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl; and

c) At least one amine phosphate partial ester (III),

Wherein m represents 1 or 2, n represents 2, if m represents 1; or represents 1, if m represents 2;

R represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl; and

R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl.

The definitions of components a), b) and c) present in the additive mixture corresponds to the definitions of components a), b) and c) present in the compositions as defined above.

According to a preferred embodiment, the invention relates to the additive mixture, as defined above, used as additives in a metal working fluid.

The invention also relates to the process for protection against corrosion or oxidative degradation of metals, wherein the metal is exposed to a functional fluid comprising the additive mixture as defined above.

According to a preferred embodiment, the invention relates to the process for protection
5 against corrosion or oxidative degradation of zinc, aluminum or alloys thereof, wherein zinc, aluminum or alloys thereof are exposed to a functional fluid comprising the additive mixture as defined above.

A further embodiment of the invention relates to a process for protection against corrosion or oxidative degradation of zinc, aluminum or alloys thereof, wherein zinc, aluminum or alloys
10 thereof are exposed to a functional fluid comprising at least one alkenyl succinic half ester of the formula I as defined above, wherein R₁ represents C₆-C₁₈alkenyl, R₂ represents hydrogen or methyl and n is a numeral from 1 to 100.

The following **Examples** illustrate the invention:

Application Examples

15 A typical test procedure to test the corrosion inhibition is the climate chamber test according to DIN EN ISO 6270-2. This test is slightly modified by using several different metal samples and more severe conditions. Each sample is treated in the following test cycle:
Exposure for 8 hours in a closed climate chamber at 50 ± 3 °C, humidity ca. 100%, followed by 16 hours in an open climate chamber, cooling at 21 ± 3°C and humidity approaching ambient. The test cycles are repeated until 100% corrosion is detected visually. In the event that
20 the test sample is not corroded, the test procedure is stopped after 24 cycles.

Corrosion Inhibitor	Test Specimen	Passed test cycles	Additive treat rate
Reference oil	Zinc	19	app. 15-20%
Mixture A	Zinc	> 24	3%
Mixture B	Zinc	> 24	5%
Mixture C	Zinc	> 24	3%
Mixture D	Zinc	20	3%
Reference oil	Aluminum	0	app. 15-20%
Mixture A	Aluminum	> 15	3%
Mixture B	Aluminum	> 15	5%
Mixture C	Aluminum	> 15	3%
Mixture D	Aluminum	> 15	3%

Reference oil: As mentioned in "VDA-Prüfblatt" from May 2003; VDA 230- 201:

Mixture A = 3% Irgacor® L12 in a paraffinic base oil

5 Mixture B = 5% Irgalube® 349 in a paraffinic base oil

Mixture C = 0.9% IRGACOR L12; 1.5% Amine O; 0.6% IRGALUBE 349 in an naphthenic base oil

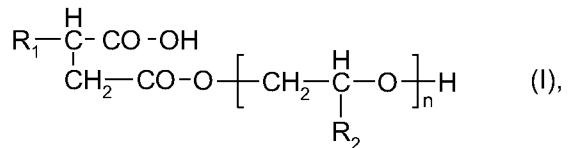
Mixture D = 0.6% IRGACOR L12; 0.9% Amine O; 1.5% IRGALUBE 349 in a paraffinic base oil.

Claims

1. A composition, which comprises

A) An additive mixture that essentially consists of

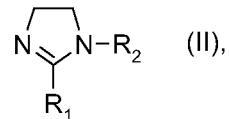
a) At least one alkenyl succinic half ester of the formula



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Wherein R_1 represents $\text{C}_6\text{-C}_{18}$ Alkenyl, R_2 represents hydrogen or methyl and n is a numeral from 1 to 100;

b) At least one imidazoline compound of the formula



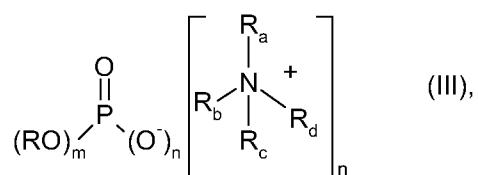
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Wherein one of R_1 and R_2 represents hydrogen and the other one represents a substituent selected from the group consisting of $\text{C}_1\text{-C}_{12}$ alkyl, hydroxy- $\text{C}_2\text{-C}_{12}$ alkyl, amino- $\text{C}_2\text{-C}_{12}$ alkyl, $\text{C}_2\text{-C}_{20}$ alkenyl, phenyl, phenyl- $\text{C}_1\text{-C}_4$ alkyl, $\text{C}_1\text{-C}_4$ alkylphenyl and $\text{C}_1\text{-C}_4$ alkylphenyl- $\text{C}_1\text{-C}_4$ alkyl; or

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Wherein both of R_1 and R_2 represent substituents selected from the group consisting of $\text{C}_1\text{-C}_{12}$ alkyl, hydroxy- $\text{C}_2\text{-C}_{12}$ alkyl, amino- $\text{C}_2\text{-C}_{12}$ alkyl, $\text{C}_2\text{-C}_{20}$ alkenyl, phenyl, phenyl- $\text{C}_1\text{-C}_4$ alkyl, $\text{C}_1\text{-C}_4$ alkylphenyl and $\text{C}_1\text{-C}_4$ alkylphenyl- $\text{C}_1\text{-C}_4$ alkyl; and

c) At least one amine phosphate partial ester of the formula



Wherein m represents 1 or 2;

20

n represents 2, if m represents 1, or represents 1, if m represents 2;

R represents a substituent selected from the group consisting of $\text{C}_1\text{-C}_{12}$ alkyl, hydroxy- $\text{C}_2\text{-C}_{12}$ alkyl, amino- $\text{C}_2\text{-C}_{12}$ alkyl, phenyl, phenyl- $\text{C}_1\text{-C}_4$ alkyl, $\text{C}_1\text{-C}_4$ alkylphenyl, $\text{C}_1\text{-C}_4$ alkylphenyl- $\text{C}_1\text{-C}_4$ alkyl, $\text{C}_4\text{-C}_8$ cycloalkyl, $\text{C}_4\text{-C}_8$ cyclo-

alkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cyclo-alkyl-C₁-C₄alkyl; and

R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl; and

5 B) A functional fluid.

2. A composition according to claim 1, which comprises

10 A) An additive mixture that essentially consists of

a) At least one alkenyl succinic half ester (I), wherein

R₁ represents C₁₀-C₁₆alkenyl, R₂ represents methyl and n is a numeral from 1 to 20;

b) At least one imidazoline compound (II),

15 Wherein one of R₁ and R₂ represents hydrogen and the other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl and C₁₂-C₁₈alkenyl; or

Wherein both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl and C₁₂-C₁₈alkenyl; and

c) At least one amine phosphate partial ester (III),

20 Wherein m represents 1 or 2;

n represents 2, if m represents 1, or represents 1, if m represents 2;

R represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl and amino-C₂-C₁₂alkyl; and

25 R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl and hydroxy-C₂-C₁₂alkyl; and

B) A functional fluid.

3. A composition according to claim 1, which comprises

A) An additive mixture that essentially consists of

a) At least one alkenyl succinic half ester (I), wherein

R₁ represents C₁₂-C₁₆alkenyl, R₂ represents methyl and n is a numeral from 1 to 20;

b) At least one imidazoline compound (II),

Wherein one of R₁ and R₂ represents hydrogen and the other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl and C₁₂-C₁₈alkenyl; or

Wherein both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl and C₁₂-C₁₈alkenyl; and

c) At least one amine phosphate partial ester (III),

Wherein m represents 1 or 2;

n represents 2 if m represents 1; or

represents 1 if m represents 2; and

R represents a substituent selected from the group consisting of C₁-C₁₂alkyl and hydroxy-C₂-C₁₂alkyl; and

R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl and hydroxy-C₂-C₁₂alkyl; and

B) A functional fluid.

4. A composition, which comprises

a) At least one alkenyl succinic half ester (I),

Wherein R₁ represents C₆-C₁₈alkenyl, R₂ represents methyl and n is a numeral from 1 to 100;

b) At least one imidazoline compound (II),

Wherein one of R₁ and R₂ represents hydrogen and the other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl; or

Wherein both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl;

c) At least one amine phosphate partial ester (III),
Wherein m represents 1 or 2;
n represents 2 if m represents 1; or
represents 1 if m represents 2; and
5 R represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl; and
10 R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cyclo-15 alkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl; and
d) Additional customary additives.

5. An additive mixture that essentially consists of

a) At least one alkenyl succinic half ester (I),
Wherein R₁ represents C₆-C₁₈alkenyl, R₂ represents hydrogen or methyl and n is a numeral from 0 to 100;
20 b) At least one imidazoline compound (II),
Wherein one of R₁ and R₂ represents hydrogen and the other one represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl; or
25 Wherein both of R₁ and R₂ represent substituents selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl and C₁-C₄alkylphenyl-C₁-C₄alkyl; and
30 c) At least one amine phosphate partial ester (III),
Wherein m represents 1 or 2;

n represents 2 if m represents 1; or

represents 1 if m represents 2; and

R represents a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl; and

R_a, R_b, R_c and R_d independently of one another represent hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, hydroxy-C₂-C₁₂alkyl, amino-C₂-C₁₂alkyl, C₂-C₂₀alkenyl, phenyl, phenyl-C₁-C₄alkyl, C₁-C₄alkylphenyl, C₁-C₄alkylphenyl-C₁-C₄alkyl, C₄-C₈cycloalkyl, C₄-C₈cycloalkyl-C₁-C₄alkyl, C₁-C₄alkyl-C₄-C₈cycloalkyl and C₁-C₄alkyl-C₄-C₈cycloalkyl-C₁-C₄alkyl.

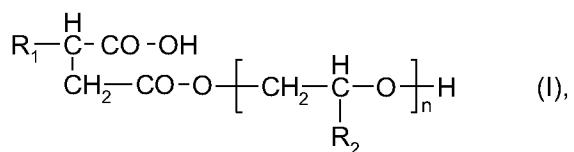
6. The additive mixture according to claim 5 for use as a metal working fluid.

15 7. A composition according to claim 1, wherein the functional fluid B) is a non-aqueous functional liquid selected from the group consisting of lubricants, hydraulic fluids, metal working fluids, engine coolants, transformer oils and switch gear oils.

8. A process for protection against corrosion or oxidative degradation of metals, wherein the metal is exposed to a functional fluid comprising the additive mixture according to claim 5.

20 9. A process for protection against corrosion or oxidative degradation of zinc, aluminum or alloys thereof, or zinc-coated steels, wherein zinc, aluminum or alloys thereof are exposed to a functional fluid comprising the additive mixture according to claim 5.

10. A process for protection against corrosion or oxidative degradation of zinc, aluminum or alloys thereof, or zinc-coated steels, wherein zinc, aluminum or alloys thereof are exposed to a functional fluid comprising at least one alkenyl succinic half ester of the formula



Wherein R₁ represents C₆-C₁₈alkenyl, R₂ represents hydrogen or methyl and n is a numeral from 1 to 100.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2007/054674

A. CLASSIFICATION OF SUBJECT MATTER
INV. C10M141/10 C10M161/00
ADD. C10N30/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C10M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 394 289 A (NIPPON MITSUBISHI OIL CORP [JP]) 3 March 2004 (2004-03-03) paragraph [0098] paragraph [0109] examples 6-8 -----	1-10
Y	GB 795 491 A (LUBRIZOL GREAT BRITAIN LTD) 21 May 1958 (1958-05-21) cited in the application the whole document -----	1-9
Y	US 2003/040444 A1 (GARMIER WILLIAM W [US]) 27 February 2003 (2003-02-27) paragraphs [0062] - [0079]; claims; examples -----	1-9

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

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- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2007/054674

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