

**TITLE: LUBRICANT COMPOSITION FOR PREVENTING CORROSION AND/OR
TRIBO-CORROSION OF METAL PARTS IN AN ENGINE**

5 The present invention relates to novel lubricant compositions, in particular for an engine, useful in particular for preventing corrosion and/or tribocorrosion of metal parts in an engine, in particular in a two-stroke engine such as a marine two-stroke engine. The present invention also concerns a method for passivating metal parts of an engine, in particular a two-stroke engine such as a marine two-stroke engine.

10 Since 2011, the presence of excessive even uncontrolled corrosion has become predominant when engines are operated at very low load (25 % and less of the maximum load). This excessive corrosion is also found in the latest designs of existing engines which adhere to increasingly stricter constraints. Even if in a near future (2020), the sulfur levels of marine engine fuels will be lowered to heed regulations (SOx emissions), the issue of corrosion still fully remains for many engine operators and more particularly for two-stroke engines.

15 Fuel combustion generates the formation of acid gases, in particular sulfur oxides (SO_3 , formed by oxidation of SO_2), which are in contact with the metal parts of an engine. In the presence of water, SO_3 hydrolyses to sulfuric acid H_2SO_4 , responsible for the corrosion of engine parts. Other acids, such as nitric acid, compounds carrying one or more carboxylic acid functions, or combinations of these acids, can also be responsible for corrosion and/or tribo-corrosion of engine parts.

20 Acid corrosion takes place in the tribological system, in the piston ring-cylinder liner assembly. In this zone, in a lubricated engine, the friction observed is of reciprocating sliding type.

25 For marine engines, in particular two-stroke marine engines, lubricant compositions are classified into two categories: cylinder oils ensuring lubrication of the piston-cylinder assembly, and system oils ensuring lubrication of all moving parts other than those of the piston-cylinder assembly.

30 When the engine is in operation, cylinder oil spreads over the cylinder forming a thin oily film between the piston and the cylinder wall. This film plays three roles:

- ensuring separation between the two surfaces to prevent adhesive wear;
- neutralising drops of sulfuric acids formed in the combustion chamber before they reach the cylinder and cause wear thereof via corrosion and/or la tribocorrosion; and

35 - dispersing any deposit which may form on each surface to maintain cleanliness thereof.

Lubricant compositions for engines and in particular for marine engines currently in use comprise a base oil to which dispersants and overbased detergents are added. These overbased detergents generally comprise a core of calcium carbonate CaCO_3 with a surfactant outer shell. Calcium carbonate reacts with sulfuric acid to form calcium sulfate (CaSO_4) in particular. The lowering of sulfuric acid in the medium provides protection to parts against corrosion and/or tribocorrosion.

To ensure this protection, the lubricant compositions used must be sufficiently basic (in particular to neutralise the acid) which entails increasing the quantity of detergents contained in these compositions.

Therefore, the lubricant compositions currently on the market have a Base Number (BN) higher than 70.

However, an increase in the quantity of detergents in these lubricant compositions leads to an increase in the number of CaCO_3 and CaSO_4 particles responsible for wear of surfaces via polishing (or abrasive wear) of engine metal parts, and in particular of the cylinders of two-stroke engines such as marine two-stroke engines. In addition, the use of currently available lubricant compositions does not provide full protection to engine metal parts against corrosion and/or tribocorrosion, and in particular the metal parts of two-stroke engines against tribocorrosion when friction is of reciprocating sliding type.

There is therefore an advantage in providing lubricant compositions allowing improved protection of engine metal parts, in a particular of a two-stroke engine such as a marine two-stroke engine, against corrosion and/or tribocorrosion.

There is also an advantage in providing lubricant compositions allowing a reduction in the Base Number thereof.

It is one objective of the present invention to provide lubricant compositions allowing improved protection for the metal parts of an engine, typically a two-stroke engine, in particular a marine two-stroke engine, against corrosion and/or tribocorrosion.

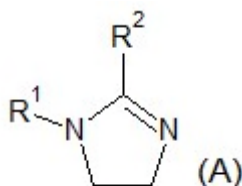
The present invention more particularly targets the providing of cylinder oils for two-stroke engines, in particular for marine two-stroke engines.

A further objective of the present invention is to provide lubricant compositions having a lowered Base Number.

Other objectives will become apparent on reading the following description of the invention.

These objectives are met with the present invention concerning a lubricant composition comprising:

- at least one base oil; and
- 0.1 to 30 %, preferably 0.5 % to 20 %, advantageously 1 % to 10 % by weight of an imidazoline compound of formula (A):



where:

- R¹ represents a linear or branched alkyl group comprising 1 to 16 carbon atoms, preferably 1 to 12 carbon atoms, advantageously 2 to 8 carbon atoms, optionally substituted at the end of the chain by a group selected from among NH₂, OH or SH, or R¹ is a linear or branched alkenyl group having 2 to 16 carbon atoms, preferably 2 to 12 carbon atoms, advantageously 2 to 8 carbon atoms, optionally substituted at the end of the chain by a group selected from among NH₂, OH or SH. Preferably, R¹ is a linear or branched alkyl or alkenyl group having 2 to 8 carbon atoms, preferably 2 to 6 carbon atoms, advantageously 2 to 4 carbon atoms and being substituted at the end of the chain by the -NH₂ group

- R² represents a linear or branched alkyl group comprising 1 to 36 carbon atoms, preferably 4 to 28 carbon atoms, advantageously 8 to 24 carbon atoms, or R² is a linear or branched alkenyl group comprising 2 to 36 carbon atoms, preferably 4 to 28 carbon atoms, advantageously 8 to 24 carbon atoms.

In one embodiment, R¹ is a linear or branched alkyl group comprising 1 to 12 carbon atoms, preferably 2 to 8 carbon atoms, more preferably 2 to 6 carbon atoms even 2 to 4 carbon atoms, said group R¹ preferably being substituted at the end of the alkyl chain by a -NH₂ group; and/or

In one embodiment, R² is a linear or branched alkyl or alkenyl group comprising 4 to 28 carbon atoms, preferably 8 to 24 carbon atoms. Preferably R² is a linear or branched alkenyl group comprising 4 to 28 carbon atoms, preferably 8 to 24 carbon atoms.

Preferably, the R² group is an alkenyl group comprising at least one double bond. Preferably said double bond is located at C-8, C-9 of the alkenyl group relative to the imidazoline function.

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In one particular embodiment of the invention, the base oil included in the lubricant composition is selected from among oils of mineral, synthetic or vegetable origin, and mixtures thereof.

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The mineral or synthetic oils generally used in the application belong to one of the classes defined under the API classification such as summarized in the Table below.

[Table 1]

	Saturates content	Sulfur content	Viscosity Index
Group 1 Mineral oils	< 90 %	> 0.03 %	80 ≤ VI < 120
Group 2 Hydrocracked oils	≥ 90 %	≤ 0.03 %	80 ≤ VI < 120
Group 3 Hydro-isomerized oils	≥ 90 %	≤ 0.03 %	≥ 120
Group 4	Polyalphaolefins (PAOs)		
Group 5	Other bases not included in the bases of Groups 1 to 4		

Table 1: API classification of base oils

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Group 1 mineral oils can be obtained by distilling selected naphthenic or paraffinic crudes followed by purification of these distillates by processes such as solvent extraction, solvent or catalytic dewaxing, hydrotreatment or hydrogenation.

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Group 2 and 3 oils are obtained by more severe purification processes e.g. a combination from among hydrotreatment, hydrocracking, hydrogenation and catalytic dewaxing.

Examples of Group 4 and 5 synthetic bases include polyalphaolefins, polybutenes, polyisobutenes, alkylbenzenes.

These base oils can be used alone or in a mixture. A mineral oil can be combined with a synthetic oil.

Cylinder oils for marine 2-stroke engines have a viscosity grade of SAE-40 to SAE-60, generally SAE-50 equivalent to kinematic viscosity at 100 °C of between 16.3 and 21.9 mm²/s.

Grade 40 oils have kinematic viscosity at 100 °C of between 12.5 and 16.3 mm²/s.

Grade 50 oils have kinematic viscosity at 100 °C of between 16.3 and 21.9 mm²/s.

Grade 60 oils have kinematic viscosity at 100 °C of between 21.9 and 26.1 mm²/s.

According to practice in the profession, it is preferred to formulate cylinder oils for marine two-stroke engines having kinematic viscosity at 100 °C of between 18 and 21.5, preferably between 19 and 21.5 mm²/s.

This viscosity can be obtained by mixing additives and base oils, for example containing Group I mineral base oils such as Solvent Neutral bases (e.g. 500 SN or 600 SN) and Bright Stock. Any other combination of bases of mineral, synthetic or vegetable origin having viscosity, in a mixture with the additives, compatible with Grade SAE-50 can be used.

Typically, a conventional formulation of cylinder lubricant for marine slow-speed 2-stroke diesel engines is of Grade SAE-40 to SAE-60, preferably SAE-50 (according to SAE J300 standard) and comprises at least 50 weight % of lubricant base oil of mineral and/or synthetic origin, adapted for use in a marine engine, e.g. belonging to Group 1 of the API classification i.e. obtained by distillation of selected crudes followed by purification of these distillates by processes such as solvent extraction, solvent or catalytic dewaxing, hydrotreatment or hydrogenation. Their Viscosity Index (VI) is between 80 and 120; the sulfur content thereof is higher than 0.03 % and saturates content lower than 90 %.

Advantageously, the lubricant composition of the invention comprises at least 50 weight % of base oil(s) relative to the total weight of the composition.

More advantageously, the lubricant composition of the invention comprises at least 60 weight %, even at least 70 weight % of base oil(s) relative to the total weight of the composition.

In particularly advantageous manner, the lubricant composition of the invention comprises from 60 to 99.9 weight % of base oils, preferably 70 to 98 weight % of base oils relative to the total weight of the composition.

Preferably, the lubricant composition of the invention also comprises at least one additive selected from among detergents, dispersants and mixtures thereof.

The detergents used in the lubricant compositions of the present invention are well known to persons skilled in the art.

5 Within the framework of the present invention, the detergents commonly used for the formulation of lubricant compositions are anionic compounds comprising a long lipophilic hydrocarbon chain and hydrophilic head. The associated cation is a metal cation of an alkali or alkaline-earth metal.

10 The detergents are preferably selected from among alkali or alkaline-earth metal salts of carboxylic acids, sulfonates, salicylates, naphthenates, and phenate salts.

 The alkali or alkaline-earth metals are preferably calcium, magnesium, sodium or barium.

15 These metal salts can contain the metal in approximately stoichiometric amount. In this case, the term non-overbased or « neutral » detergents is used, although they also contribute some basicity. These « neutral » detergents typically have a BN, measured according to ASTM D2896, of less than 150 mg KOH/g, or less than 100, or even less than 80 mg KOH/g.

20 These types of so-called neutral detergents can partly contribute to the BN of the lubricants of the present invention. For example, neutral detergents are employed of carboxylate, sulfonate, salicylate, phenate, naphthenate type of alkali and alkaline-earth metals e.g. calcium, sodium, magnesium, barium.

25 When the metal is in excess (quantity higher than the stoichiometric amount) the detergents are said to be overbased. They have a high BN e.g. higher than 150 mg KOH/g, typically between 200 and 700 mg KOH/g, generally between 250 and 450 mg KOH/g.

 The excess metal imparting the overbased nature to the detergent is in the form of an oil-insoluble metal salt e.g. carbonate, hydroxide, oxalate, acetate, glutamate, preferably carbonate.

30 In one same overbased detergent, the metals of these insoluble salts can be the same as those of oil-soluble detergents or they can differ. Preferably they are selected from among calcium, magnesium, sodium or barium.

35 Overbased detergents are therefore in the form of micelles composed of insoluble metal salts held in suspension in the lubricant composition by detergents in the form of oil-soluble metal salts.

Overbased detergents comprising a single type of soluble metal salt detergent are generally named according to the nature of the hydrophobic chain of this latter detergent.

They are therefore said to be of carboxylate, phenate, salicylate, sulfonate, naphthenate type depending on whether this detergent is respectively a carboxylate, phenate, salicylate, sulfonate, or naphthenate.

Overbased detergents are said to be of mixed type if the micelles comprise several types of detergents differing from each other through the nature of their hydrophobic chain.

For use in the lubricant compositions of the present invention, the oil-soluble metal salts are preferably carboxylates, phenates, sulfonates, salicylates, and mixed phenate, sulfonate and/or salicylate detergents of calcium, magnesium, sodium or barium,

The salts of insoluble metals imparting the overbased nature are carbonates of alkali or alkaline-earth metals, preferably calcium carbonate.

Preferably, the detergents used in the lubricant compositions of the present invention are calcium carbonate overbased detergents selected from among carboxylates, phenates, sulfonates, salicylates, and mixed phenate-sulfonate-salicylate detergents.

Advantageously, the lubricant composition of the invention may comprise from 3 % to 40 %, preferably from 5 % to 30 %, advantageously from 10 % to 25 % by weight of detergent(s) relative to the total weight of the lubricant composition.

Dispersants are additives well known for their use in the formulation of lubricant compositions, in particular for application in the marine sector. Their primary role is to hold in suspension particles that are initially present or which occur in the composition throughout use thereof in an engine. They prevent agglomeration of the latter by acting on steric hindrance. They may also have a synergic effect on neutralisation.

In the present invention, the dispersants used as lubricant additives contain a polar group associated with a relatively long hydrocarbon chain generally having 50 to 400 carbon atoms. The polar group typically contains at least one nitrogen or oxygen element.

Compounds derived from succinic acid are dispersants particularly used as lubricant additives. Particular use is made of succinimides, obtained by condensation of succinic anhydrides and amines, succinic esters obtained by condensation of succinic anhydrides and alcohols or polyols.

These compounds can then be treated with various compounds, particularly sulfur, oxygen, formaldehyde, carboxylic acids and compounds containing boron or zinc to produce borated succinimides for example or zinc-blocked succinimides.

Mannich bases, obtained by polycondensation of phenols substituted by alkyl, formaldehyde and primary or secondary amino groups, are also compounds used as dispersants in lubricants.

Preferably, the dispersants of the invention are selected from among succinimides such as polyisobutylene bis-succinimides, optionally borated or zinc-blocked.

Advantageously, the lubricant composition of the invention may comprise from 0.01 to 10 %, preferably from 0.1 % to 5 %, advantageously from 0.5 % to 3 % by weight of dispersant(s) relative to the total weight of the lubricant composition.

The lubricant composition may further comprise at least one anti-wear additive.

Preferably, the anti-wear additive is zinc dithiophosphate or ZDDP. In this category, various phosphorus-, sulfur-, nitrogen-, chlorine- and boron-containing compounds are also found.

There exists a wide variety of anti-wear additives, but the category given most use is that of phosphorus-sulfur additives such as metal alkylthiophosphates, in particular zinc alkylthiophosphates and more specifically zinc dialkyldithiophosphates or ZDDP.

Amine phosphates, polysulfides in particular sulfur-containing olefins are also routinely employed as anti-wear additives.

The anti-wear and extreme pressure additives usually found in lubricant compositions are also of nitrogen- or sulfur-containing type, such as metal dithiocarbamates in particular molybdenum dithiocarbamate. Glycerol esters are also anti-wear additives. Mention can be made of mono, di- and tri-oleates, monopalmitates and monomyristates.

In one particular embodiment the lubricant composition, relative to the total weight of the lubricant composition, comprises:

- 50 to 96.9 weight %, preferably 60 to 95 weight %, more preferably 70 to 90 weight % of base oil(s);
- 0.1 to 30 weight %, preferably 0.5 to 20 weight %, more preferably 1 to 10 weight % of one or more imidazoline compounds of formula (A); and

- 3 to 40 weight %, preferably 5 to 30 weight %, more preferably 10 to 25 weight % of detergent(s); and
- optionally 0.01 to 10 weight %, preferably 0.1 to 5 weight %, more preferably 0.5 to 3 weight % of dispersant(s).

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In one particular embodiment the lubricant composition, relative to the total weight of the lubricant composition, comprises:

- 60 to 99 weight %, preferably 60 to 95 weight %, more preferably 70 to 90 weight % of base oil(s);
- 0.1 to 30 weight %, preferably 0.5 to 20 weight %, more preferably 1 to 10 weight % of one or more imidazoline compounds of formula (A); and
- 0.01 to 10 weight %, preferably 0.1 to 5 weight %, more preferably 0.5 to 3 weight % of dispersant(s); and
- optionally 3 to 40 weight %, preferably 5 to 30 weight %, more preferably 10 to 25 weight % of detergents(s).

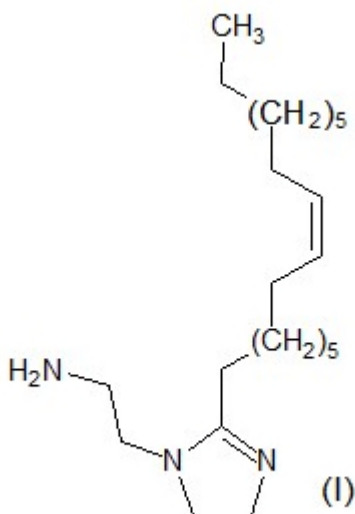
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The lubricant composition may also comprise all types of functional additives adapted for use thereof e.g. antifoaming additives which can be polar polymers for example such as polymethylsiloxanes, polyacrylates, antioxidants e.g. of phenolic or amine type and/or rust inhibitors e.g. organic-metal compounds or thiadiazoles. These are known to persons skilled in the art.

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In one preferred embodiment of the invention, the formula (A) compound is the following compound (I):



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In one particular embodiment the lubricant composition, relative to the total weight of the lubricant composition, comprises:

- 50 to 96.9 weight %, preferably 60 to 95 weight %, more preferably 70 to 90 weight % of base oil(s);
- 0.1 to 30 weight %, preferably 0.5 to 20 weight %, more preferably 1 to 10 weight % of one or more imidazoline compounds including at least one formula (I) compound defined above; and
- 3 to 40 weight %, preferably 5 to 30 weight %, more preferably 10 to 25 weight % of detergents(s) comprising at least one overbased detergent of phenate or sulfonate type; and
- optionally 0.01 to 10 weight %, preferably 0.1 to 5 weight %, more preferably 0.5 to 3 weight % dispersant(s).

In one particular embodiment the lubricant composition, relative to the total weight of the lubricant composition, comprises:

- 60 to 99 weight %, preferably 60 to 95 weight %, more preferably 70 to 90 weight % of base oil(s);
- 0.1 to 30 weight %, preferably 0.5 to 20 weight %, more preferably 1 to 10 weight % of one or more imidazoline compounds including at least one formula (I) compound defined above; and
- 0.01 to 10 weight %, preferably 0.1 to 5 weight %, more preferably 0.5 to 3 weight % of dispersant(s) selected from among succinimides; and
- optionally 3 to 40 weight %, preferably 5 to 30 weight %, more preferably 10 to 25 weight % of detergent(s).

The present invention also concerns the use of the lubricant composition of the invention to lubricate at least one metal part of an engine such as a two-stroke engine and in particular a marine two-stroke engine.

Preferably, the use of the lubricant composition of the invention allows the preventing and/or reducing of corrosion and/or tribocorrosion of said metal part of said engine.

The present invention also concerns a method for lubricating at least one metal part of an engine such as a two-stroke engine and in particular a marine two-stroke engine, comprising the contacting of said engine part with the lubricant composition of the invention.

The present invention also concerns the use of a formula (A) compound of the invention in a lubricant composition comprising at least one base oil to prevent and/or reduce corrosion and/or tribocorrosion of at least one metal part of an engine such as a two-stroke engine and in particular a marine two-stroke engine.

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The present also concerns a method for preventing and/or reducing corrosion and/or tribocorrosion of at least one metal part of an engine, such as a two-stroke engine and in particular a marine two-stroke engine, comprising the lubrication of said metal part with a lubricant composition of the invention.

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The present invention also concerns the use of the lubricant composition of the invention for passivating at least one metal part of an engine such as a two-stroke engine and in particular a marine two-stroke engine.

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The present invention also concerns a method for passivating at least one metal part of an engine, comprising at least one step to place said metal part in contact with the lubricant composition of the invention.

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The present invention also concerns the use of a formula (A) compound of the invention in a lubricant composition comprising at least one base oil for passivating at least one metal part of an engine such as a two-stroke engine and in particular a marine two-stroke engine.

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Preferably the metal part of the invention is a cylinder or piston.

Advantageously the metal part is in cast iron.

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Preferably, the engine of the invention is a two-stroke engine. Preferably the engine is a marine two-stroke engine.

Preferably, the engine is an engine consuming heavy fuel oil. By « heavy fuel oil » in the meaning of the present invention, it is meant heavy fractions derived from distillation of petroleum, optionally containing additives.

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In the meaning of the present invention, by « corrosion » it is meant deterioration of a material preferably a metal material via chemical reaction with an oxidant. Preferably this oxidant is an acid. More preferably this acid is sulfuric acid H_2SO_4 .

In the meaning of the present invention, by « tribocorrosion » it is meant a process leading to degradation and wear of a metal material under the combined action of friction and corrosion such as defined above.

Advantageously, the formula (A) compound defined in the present invention is used in a cylinder lubricant composition to reduce acid tribocorrosion on cylinders and pistons of a two-stroke engine such as a marine two-stroke engine.

FIGURES

[Fig 1] Figure 1 illustrates the depth profiles of cast iron plates obtained after a tribological test conducted in the presence of the composition of the invention CL and a comparative composition CC.

The present invention will now be described with the support of nonlimiting examples.

Example 1: Lubricant compositions

The compositions in Table 2 (CL: lubricant composition of the invention; CC: comparative lubricant composition) were prepared by mixing the dispersant and/or detergents and the additive in a base oil at 60 °C.

[Table 2]

Lubricant composition	Base oil (wt. %)	Dispersant (wt. %)	Detergent of phenate type (wt. %)	Detergent of sulfonate type (wt. %)	Additive (wt. %)
CL	Mixture of two Group 1 base oils (75.3%)	Polyisobutylene succinimide (1.1%)	Phenate having a BN of 250 (13.6%)	Sulfonate having a BN of 400 (5%)	Formula (I) compound (5%)
CC	Mixture of two Group 1 base oils (79.2%)	Polyisobutylene succinimide (1.2%)	Phenate having a BN of 250 (14.3%)	Sulfonate having a BN of 400 (5,3%)	-

Table 2: Lubricant composition of the invention and comparative lubricant composition.

Example 2: Results of wear depth tests

Tribological tests were conducted on a reciprocating Biceri tribometer using steel pins (EN31) 6 mm in diameter with a radius of curvature of 50 mm, and cast iron plates (FT 25) polished with SiC grinding paper, Grit 800. The steel pins were also polished to obtain roughness Ra of between 50 and 100 nm. In addition, the zones of the cast iron plates outside the friction zone were coated with a resin. This resin was removed after the tests. The zones coated with resin were therefore not corroded during the tests and could be used as calibration to measure the depth of the wear marks due to corrosion phenomena.

Before each test, the lubricant composition was heated to 100 °C and placed in contact with 5 M sulfuric acid solution (27 weight %) at ambient temperature by means of a « T » assembly. The lubricant composition was conveyed via the main channel and the acid solution fed by a channel perpendicular to the main channel.

The conditions for these tests were as follows:

- Temperature: 100 °C
- Pressure: 0.67 GPa
- Speed: 0.02 m/s
- Track length: 5 mm
- Duration: 6 h.

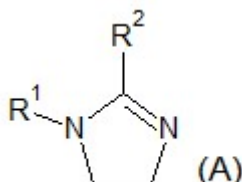
At the end of each test, the corrosion products were removed with a solution of ethylenediaminetetraacetic acid (EDTA), and wear of the cast iron plates was analysed by white light interferometry, allowing a 3D profile to be obtained of the wear mark produced by corrosion and/or tribocorrosion.

These 3D profiles allow depth profiles to be obtained of the wear mark. Figure 1 shows the depth profiles of the cast iron plates obtained after a tribological test such as described above and conducted in the presence of the lubricant composition of the invention CL, and the comparative composition CC.

The results of these tests show that in the absence of the formula (I) compound, the cast iron plate is corroded at the zones which are not in contact with the steel pin (contact-free zones) and wear due to tribocorrosion can also be seen at the zone in contact with the pin. The presence of the formula (I) compound improves protection against corrosion and tribocorrosion. Without wishing to be bound by any theory, the additives allow a second protection layer to be created, adding to neutralisation of acid drops by the detergent, by forming a physical barrier between the surface of the metal part and the oil of the lubricant composition, thereby preventing corrosion phenomena.

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CLAIMS

1. A lubricant composition comprising:
- at least 50 weight % of one base oil, relative to the total weight of the composition; and
 - 0.1 to 30 % by weight of an imidazoline compound of formula (A):



defined such that:

- R¹ represents a linear or branched alkyl group comprising 2 to 8 carbon atoms, substituted at the end of the chain by a NH₂ group; and
- R² represents a linear or branched alkenyl group comprising 8 to 24 carbon atoms.

2. The composition according to claim 1, further comprising at least one additive selected from among detergents, dispersants and mixtures thereof.

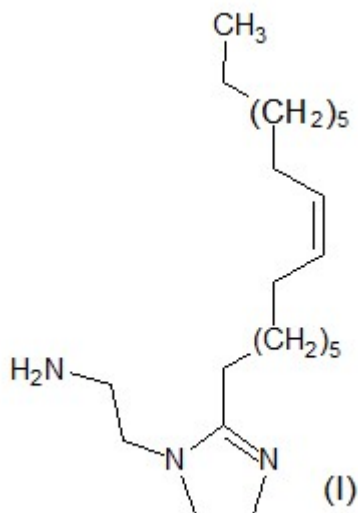
3. The composition according to claim 2, wherein:

- the amount of detergent varies from 3 to 40 %, preferably from 5 % to 30 %, advantageously from 10 % to 25 % by weight, relative to the total weight of the lubricant composition; and/or
- the amount of dispersant varies from 0.01 % to 10 %, preferably from 0.1 % to 5 %, advantageously from 0.5 % to 3 % by weight, relative to the total weight of the lubricant composition.

4. The composition according to claim 2 or 3, wherein the dispersants are selected from among succinimides, such as polyisobutylene bis-succinimides, optionally borated or zinc-blocked.

5. The composition according to any of claims 2 to 4, wherein the detergents are calcium carbonate overbased detergents selected from among carboxylates, phenates, sulfonates, salicylates, and mixed phenate-sulfonate-salicylate detergents.

6. The composition according to any of the preceding claims, wherein the compound of formula (A) corresponds to the compound of formula (I) defined by the following formula:



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7. Use of a compound of formula (A) such as defined in claims 1 to 6 in a lubricant composition comprising at least one base oil to prevent and/or reduce corrosion and/or tribocorrosion of at least one metal part in an engine, in particular a two-stroke engine for example a marine two-stroke engine.

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8. Use of the composition according to any of claims 1 to 6 to prevent and/or reduce corrosion and/or tribocorrosion of at least one metal part in an engine, in particular a two-stroke engine for example a marine two-stroke engine.

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9. The use according to claim 8 wherein the metal part is a cylinder, preferably a cast iron cylinder.

10. A method for passivating at least one metal part of an engine, in particular a two-stroke engine for example a marine two-stroke engine, comprising at least one step to place said metal part in contact with a lubricant composition defined according to any of claims 1 to 6.

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