WHAT IS CLAIMED IS:

1. A method for improving copper corrosion performance of a lubricating oil composition comprising (a) a major amount of a base oil of lubricating viscosity; and (b) one or more dispersants containing one or more basic nitrogen atoms, the method comprising adding to the lubricating oil composition an effective amount of one or more copper corrosion performance improving agents of the general formula $Si\text{-}X_4$ or a hydrolysis product thereof, wherein each X is independently a hydroxyl-containing group, hydrocarbyloxy-containing group, acyloxy-containing group, amino-containing group, monoalkyl amino-containing group or dialkyl amino-containing group.

2. The method according to Claim 1, wherein the base oil of lubricating viscosity is selected from the group consisting of a Group I base oil, Group II base oil, Group III base oil, Group IV base oil, Group V base oil, and mixtures thereof.

3. The method according to Claim 1 or Claim 2, wherein the one or more dispersants are selected from the group consisting of a succinimide, carboxylic acid amide, hydrocarbyl monoamine, hydrocarbyl polyamine, Mannich base, phosphonamide, thiophosphonamide and phosphoramide, thiazole, triazole, a copolymer which contain a carboxylate ester with one or more additional polar functions, a borate post-treated succinimide, an ethylene carbonate post-treated succinimide, and mixtures thereof.

4. The method according to Claim 1 or Claim 2, wherein the one or more dispersants is an alkenyl succinimide.

5. The method according to Claims 1-4, wherein each X is independently selected from the group consisting of a C_1 to C_6 alkoxy group, C_6 to C_{20} aryloxy group, C_7 to C_{20} alkylaryloxy group, C_7 to C_{20} arylalkyloxy group, C_6 to C_{20} cycloalkyloxy group, C_7 to C_{20} cycloalkylalkyloxy group, and C_7 to C_{20} alkylcycloalkyloxy group.

6. The method according to Claims 1-4, wherein each X is independently selected from the group consisting of a C_1 to C_6 alkoxy, C_6 to C_{20} aryloxy, and C_1 to C_6 acyloxy.

7. The method according to Claims 1-4, wherein the one or more copper corrosion performance improving agents are one or more oil-soluble tetra-functional hydrolyzable silane compounds of formula I or a hydrolysis product thereof:

$$(RO)_a\text{—}Si\text{—}(OCR^1)_{4-a} \quad (I)$$

wherein each R is independently a substituted or unsubstituted C_1 to C_{20} hydrocarbyl group; each R^1 is independently a straight or branched chain alkyl, cycloalkyl or aryl group; and a is an integer of 0 to 4.

8. The method according to Claim 7, wherein a is an integer from 1 to 4 and each R is independently a straight or branched chain alkyl, cycloalkyl, alkcycloalkyl, aryl, alkylaryl, or arylalkyl group.

9. The method according to Claims 1-5, wherein the one or more copper corrosion performance improving agents are selected from the group consisting of tetramethoxysilane, tetraethoxysilane, tetrapropoxysilane, tetraisopropoxysilane, tetrabutoxysilane, tetraisobutoxysilane, tetrakis(methoxyethoxy)silane, tetrakis(methoxypropoxy)silane,

tetrakis(ethoxyethoxy)silane, tetrakis(methoxyethoxyethoxy)silane, trimethoxyethoxysilane, dimethoxydiethoxysilane, triethoxymethoxysilane, and mixtures thereof.

10. The method according to Claims 1-9, wherein the lubricating oil composition comprises:

about 0.05 to about 15 wt. % of the one or more dispersants; and

about 0.01 to about 5 wt. % of the one or more copper corrosion performance improving agents, based on the total weight of the lubricating oil composition.

11. The method according to Claims 1-10, wherein the lubricating oil composition further comprises one or more lubricating oil additives selected from the group consisting of an antioxidant, detergent, rust inhibitor, dehazing agent, demulsifying agent, metal deactivating agent, friction modifier, antiwear agent, pour point depressant, antifoaming agent, co-solvent, package compatibiliser, corrosion-inhibitor, dye, extreme pressure agent and mixtures thereof.

12. The method according to Claims 1-11, wherein the lubricating oil composition is a crankcase lubricating oil composition for use in an internal combustion engine.

13. The method according to Claims 1-11, wherein the lubricating oil composition is a crankcase lubricating oil composition for use in a compression-ignited diesel engine.

14. The method according to Claims 1-11, wherein the lubricating oil composition is a crankcase lubricating oil composition for use in an internal combustion heavy duty diesel engine.

15. The use of one or more copper corrosion performance improving agents of the general formula $Si\text{-}X_4$ or a hydrolysis product thereof, wherein each X is independently a hydroxyl-containing group, hydrocarbyloxy-containing group, acyloxy-containing group, amino-containing group, monoalkyl amino-containing group or dialkyl amino-containing group in a lubricating oil composition comprising (a) a major amount of a base oil of lubricating viscosity; and (b) one or more dispersants containing one or more basic nitrogen atoms, for the purpose of improving copper corrosion performance of the lubricating oil composition in an internal combustion engine.

WHAT IS CLAIMED IS:

1. A method for improving copper corrosion performance of a lubricating oil composition comprising (a) a major amount of a base oil of lubricating viscosity; and (b) one or more dispersants containing one or more basic nitrogen atoms, the method comprising adding to the lubricating oil composition an effective amount of one or more copper corrosion performance improving agents of the general formula $Si\text{-}X_4$ or a hydrolysis product thereof, wherein each X is independently a hydroxyl-containing group, hydrocarbyloxy-containing group, acyloxy-containing group, amino-containing group, monoalkyl amino-containing group or dialkyl amino-containing group.

2. The method according to Claim 1, wherein the base oil of lubricating viscosity is selected from the group consisting of a Group I base oil, Group II base oil, Group III base oil, Group IV base oil, Group V base oil, and mixtures thereof.

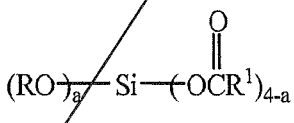
3. The method according to Claim 1 or Claim 2, wherein the one or more dispersants are selected from the group consisting of a succinimide, carboxylic acid amide, hydrocarbyl monoamine, hydrocarbyl polyamine, Mannich base, phosphonamide, thiophosphonamide and phosphoramide, thiazole, triazole, a copolymer which contain a carboxylate ester with one or more additional polar functions, a borate post-treated succinimide, an ethylene carbonate post-treated succinimide, and mixtures thereof.

4. The method according to Claim 1 or Claim 2, wherein the one or more dispersants is an alkenyl succinimide.

5. The method according to Claims 1-4, wherein each X is independently selected from the group consisting of a C_1 to C_6 alkoxy group, C_6 to C_{20} aryloxy group, C_7 to C_{20} alkylaryloxy group, C_7 to C_{20} arylalkyloxy group, C_6 to C_{20} cycloalkyloxy group, C_7 to C_{20} cycloalkylalkyloxy group, and C_7 to C_{20} alkylcycloalkyloxy group.

6. The method according to Claims 1-4, wherein each X is independently selected from the group consisting of a C_1 to C_6 alkoxy, C_6 to C_{20} aryloxy, and C_1 to C_6 acyloxy.

7. The method according to Claims 1-4, wherein the one or more copper corrosion performance improving agents are one or more oil-soluble tetra-functional hydrolyzable silane compounds of formula I or a hydrolysis product thereof:



$$(RO)_a-Si-(OCR^1)_{4-a} \quad (I)$$

wherein each R is independently a substituted or unsubstituted C_1 to C_{20} hydrocarbyl group; each R^1 is independently a straight or branched chain alkyl, cycloalkyl or aryl group; and a is an integer of 0 to 4.

8. The method according to Claim 7, wherein a is an integer from 1 to 4 and each R is independently a C_1 to C_6 alkoxy group, C_6 to C_{20} aryloxy group, C_7 to C_{20} alkylaryloxy group, C_7 to C_{20} arylalkyloxy group, C_6 to C_{20} cycloalkyloxy group, C_7 to C_{20} cycloalkylalkyloxy group, and C_7 to C_{20} alkylcycloalkyloxy group.

9. The method according to Claims 1-5, wherein the one or more copper corrosion performance improving agents are selected from the group consisting of tetramethoxysilane, tetraethoxysilane, tetrapropoxysilane, tetraisopropoxysilane, tetrabutoxysilane, tetraisobutoxysilane, tetrakis(methoxyethoxy)silane, tetrakis(methoxypropoxy)silane, tetrakis(ethoxyethoxy)silane, tetrakis(methoxyethoxyethoxy)silane, trimethoxyethoxysilane, dimethoxydiethoxysilane, triethoxymethoxysilane, and mixtures thereof.

10. The method according to Claims 1-9, wherein the lubricating oil composition comprises:

about 0.05 to about 15 wt. % of the one or more dispersants; and

about 0.01 to about 5 wt. % of the one or more copper corrosion performance improving agents, based on the total weight of the lubricating oil composition.

11. The method according to Claims 1-10, wherein the lubricating oil composition further comprises one or more lubricating oil additives selected from the group consisting of an antioxidant, detergent, rust inhibitor, dehazing agent, demulsifying agent, metal deactivating agent, friction modifier, antiwear agent, pour point depressant, antifoaming agent, co-solvent, package compatibiliser, corrosion-inhibitor, dye, extreme pressure agent and mixtures thereof.

12. The method according to Claims 1-11, wherein the lubricating oil composition is a crankcase lubricating oil composition for an internal combustion engine.

13. The method according to Claims 1-11, wherein the lubricating oil composition is a crankcase lubricating oil composition for a compression-ignited diesel engine.

14. The method according to Claims 1-11, wherein the lubricating oil composition is a crankcase lubricating oil composition for an internal combustion heavy duty diesel engine.

15. The use of one or more copper corrosion performance improving agents of the general formula $Si\text{-}X_4$ or a hydrolysis product thereof, wherein each X is independently a hydroxyl-containing group, hydrocarbyloxy-containing group, acyloxy-containing group, amino-containing group, monoalkyl amino-containing group or dialkyl amino-containing group in a lubricating oil composition comprising (a) a major amount of a base oil of lubricating viscosity; and (b) one or more dispersants containing one or more basic

nitrogen atoms, for the purpose of improving copper corrosion performance of the lubricating oil composition in an internal combustion engine.