N, and C, with very minor amounts of other elements. In some embodiments, SAPS levels derived from the components in the additive package can be essentially zero.

"Ultra-Low SAPS' lubricating oil compositions are defined as: lubricating oil compositions wherein Sulfur is present at less than 1000 ppm, Phosphorous is present at less than 300 ppm, and Sulfated Ash is present at less than 0.25 wt%. In some embodiments S (Sulfur) is present at <1000 ppm, <800 ppm, <500 ppm, <300 ppm, <100 ppm, < 50 ppm, <10 ppm, and could be zero; P (Phosphorous) is present at <300 ppm, <200 ppm, <100 ppm, <50 ppm, <10 ppm, and could be zero; and Sulfated Ash is present as <0.25 wt%, <0.20 wt%, <0.15 wt%, <0.10 wt%, <0.05wt%, <0.01 wt% and could be 0 wt% in the finished lubricant.

In accordance with one embodiment, there is provided an ultra-low SAPS lubricating oil composition comprising:

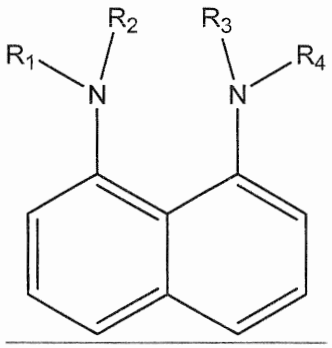
an oil of lubricating viscosity;

a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;

an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;

a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;

wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash, wherein the ashless peroxide decomposer is a compound according to formula 1:



Formula I

wherein R_1 and R_2 and R_3 and R_4 are each independently selected from the group consisting of alkyl from 1 to 20 carbon atoms, more preferably alkyl from 1 to 10 carbon atoms and even more preferably lower alkyl from 1 to six carbon atoms.

In accordance with one embodiment, there is provided a method of lubricating an engine with an ultra-low SAPS lubricating oil composition comprising:

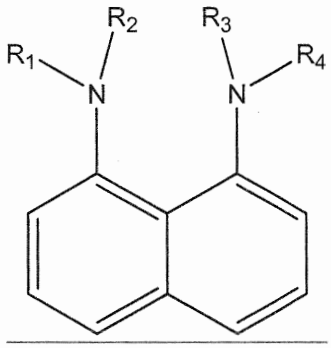
an oil of lubricating viscosity;

a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;

an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;

a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;

wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash, wherein the ashless peroxide decomposer is a compound according to formula I:



Formula I

wherein R_1 and R_2 and R_3 and R_4 are each independently selected from the group consisting of alkyl from 1 to 20 carbon atoms, more preferably alkyl from 1 to 10 carbon atoms and even more preferably lower alkyl from 1 to six carbon atoms.

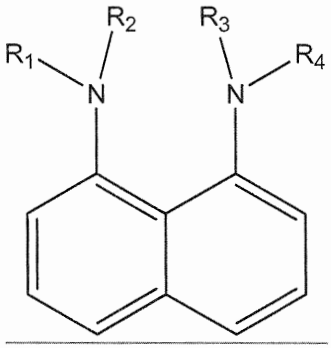
In accordance with one embodiment, there is provided a method of making a low SAPS lubricating oil composition, comprising mixing together:

an oil of lubricating viscosity;

a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;

an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;

a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%; wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash, wherein the ashless peroxide decomposer is a compound according to formula I:



Formula I

wherein R_1 and R_2 and R_3 and R_4 are each independently selected from the group consisting of alkyl from 1 to 20 carbon atoms, more preferably alkyl from 1 to 10 carbon atoms and even more preferably lower alkyl from 1 to six carbon atoms.

~~In accordance with one embodiment of the present invention, there is provided an ultra-low SAPS lubricating oil composition comprising:~~

~~an oil of lubricating viscosity;~~

~~a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;~~

~~an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;~~

~~a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;~~

~~wherein said lubricating oil composition contains less than 1000 ppm sulfur less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash.~~

~~In accordance with another embodiment of the present invention, there is provided a method of lubricating an engine with an ultra-low SAPS lubricating oil composition comprising:~~

~~an oil of lubricating viscosity;~~

~~a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;~~

~~an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;~~

~~a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;~~

~~wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and <0.25 wt% sulfated ash.~~

WHAT IS CLAIMED IS:

1. An ultra-low SAPS lubricating oil composition comprising:

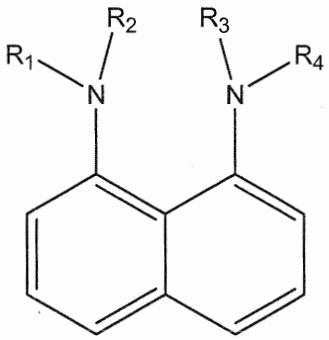
   an oil of lubricating viscosity;

   a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;

   an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;

   a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;

   wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash, wherein the ashless peroxide decomposer is a compound according to formula 1:



Formula I

   wherein R_1 and R_2 and R_3 and R_4 are each independently selected from the group consisting of alkyl from 1 to 20 carbon atoms, more preferably alkyl from 1 to 10 carbon atoms and even more preferably lower alkyl from 1 to six carbon atoms.

2. The composition of Claim 1, wherein the borated dispersant supplying at least 500 ppm boron is selected from a borated bis-succinimide, a borated mono-succinimide, or mixtures thereof.
3. The composition of Claim 1, wherein the borated dispersant supplies 500 to 3000 ppm boron.
4. The composition of Claim 1, wherein the ashless peroxide decomposer is N,N,N',N'-tetramethyl-naphthalene-1,8-diamine.
5. The composition of Claim 1, wherein the metal deactivator is present at a treat rate of from about 0.08 to 3.0 wt%.

6. The composition of Claim 1, wherein the metal deactivator is selected from benzotriazole, tolyltriazole, and mixtures thereof.
7. A method of lubricating an engine with an ultra-low SAPS lubricating oil composition comprising:

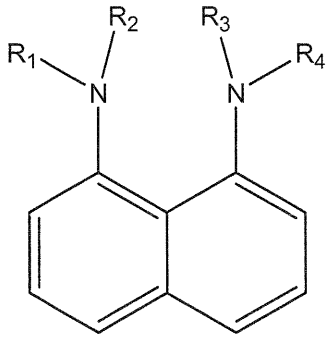
   an oil of lubricating viscosity;

   a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;

   an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;

   a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;

   wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash, wherein the ashless peroxide decomposer is a compound according to formula I:



Formula I

   wherein R_1 and R_2 and R_3 and R_4 are each independently selected from the group consisting of alkyl from 1 to 20 carbon atoms, more preferably alkyl from 1 to 10 carbon atoms and even more preferably lower alkyl from 1 to six carbon atoms.
8. The method of Claim 7, wherein the borated dispersant supplying at least 500 ppm boron is selected from a borated bis-succinimide, a borated mono-succinimide, or mixtures thereof.
9. The method of Claim 7, wherein the borated dispersant supplies 500 to 3000 ppm boron.

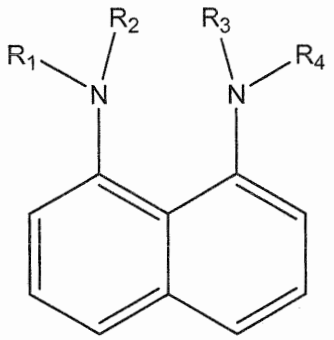
10. The method of Claim 7, wherein the ashless peroxide decomposer is N,N,N',N'-tetramethyl-naphthalene-1,8-diamine.
11. The method of Claim 7, wherein the metal deactivator is present at a treat rate of from about 0.08 to 3.0 wt%.
12. The method of Claim 7, wherein the metal deactivator is selected from benzotriazole, tolyltriazole, and mixtures thereof.
13. A method of making a low SAPS lubricating oil composition, comprising mixing together:

an oil of lubricating viscosity;

a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;

an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;

a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%; wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash, wherein the ashless peroxide decomposer is a compound according to formula I:

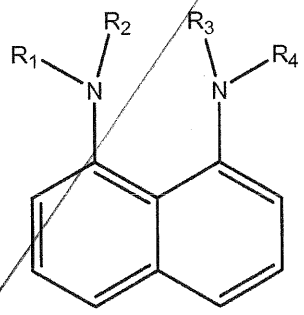


Formula I

wherein R_1 and R_2 and R_3 and R_4 are each independently selected from the group consisting of alkyl from 1 to 20 carbon atoms, more preferably alkyl from 1 to 10 carbon atoms and even more preferably lower alkyl from 1 to six carbon atoms.

WHAT IS CLAIMED IS:

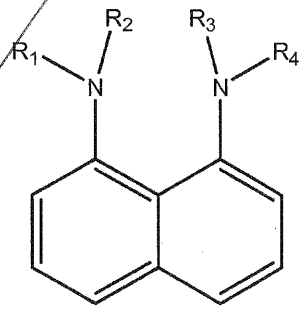
1. An ultra-low SAPS lubricating oil composition comprising:
an oil of lubricating viscosity;
a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;
an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;
a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;
wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash.
2. The composition of Claim 1, wherein the borated dispersant supplying at least 500 ppm boron is selected from a borated bis-succinimide, a borated mono-succinimide, or mixtures thereof.
3. The composition of Claim 1, wherein the borated dispersant supplies 500 to 3000 ppm boron.
4. The composition of Claim 1, wherein the ashless peroxide decomposer is a compound according to formula 1:



Formula I

wherein R_1 and R_2 and R_3 and R_4 are each independently selected from the group consisting of alkyl from 1 to 20 carbon atoms, more preferably alkyl from 1 to 10 carbon atoms and even more preferably lower alkyl from 1 to six carbon atoms.
5. The composition of Claim 1, wherein the ashless peroxide decomposer is N,N,N',N'-tetramethyl-naphthalene-1,8-diamine.

6. The composition of Claim 1, wherein the metal deactivator is present at a treat rate of from about 0.08 to 3.0 wt%.
7. The composition of Claim 1, wherein the metal deactivator is selected from benzotriazole, tolyltriozole, and mixtures thereof.
8. A method of lubricating an engine with an ultra-low SAPS lubricating oil composition comprising:
an oil of lubricating viscosity;
a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;
an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;
a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;
wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash.
9. The method of Claim 8, wherein the borated dispersant supplying at least 500 ppm boron is selected from a borated bis-succinimide, a borated mono-succinimide, or mixtures thereof.
10. The method of Claim 8, wherein the borated dispersant supplies 500 to 3000 ppm boron.
11. The method of Claim 8, wherein the ashless peroxide decomposer is a compound according to formula I:



Formula I

wherein R_1 and R_2 and R_3 and R_4 are each independently selected from the group consisting of alkyl from 1 to 20 carbon atoms, more preferably alkyl from 1 to 10 carbon atoms and even more preferably lower alkyl from 1 to six carbon atoms.

12. The method of Claim 8, wherein the ashless peroxide decomposer is N,N,N',N'-tetramethyl-naphthalene-1,8-diamine.

13. The method of Claim 8, wherein the metal deactivator is present at a treat rate of from about 0.08 to 3.0 wt%.

14. The method of Claim 8, wherein the metal deactivator is selected from benzotriazole, tolyltriozole, and mixtures thereof.

15. A method of making a low SAPS lubricating oil composition, comprising mixing together:

an oil of lubricating viscosity;

a borated dispersant supplying at least 500 ppm boron to said lubricating oil composition;

an ashless peroxide decomposer present at a treat rate of from about 0.4 to 5.0 wt%;

a metal deactivator wherein the metal deactivator is present at a treat rate of greater than 0.08 wt%;

wherein said lubricating oil composition contains less than 1000 ppm sulfur, less than 300 ppm phosphorus and less than 0.25 wt% sulfated ash.