WHAT IS CLAIMED IS:

1. A durable lubricating composition for electric or hybrid-electric vehicles, the lubricating composition comprising:

a base oil of lubricating viscosity;

at least about 0.7 weight percent of a thiadiazole or derivative thereof,

an amine salt of a phosphoric acid ester providing at least about 100 ppm of phosphorus to the durable lubricating composition;

a sulfur plus phosphorus to nitrogen ((S+P)/N) weight ratio of at least 2.3;

the lubricating composition having at least about 150 ppm of phosphorus and at least about 2000 ppm of sulfur; and

a conductivity durability of about 50,000 pS/m or less.

2. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the thiadiazole is selected from a mono hydrocarbyl thiol-substituted thiadiazole, a bishydrocarbyl thiol-substituted thiadiazole, or combinations thereof.

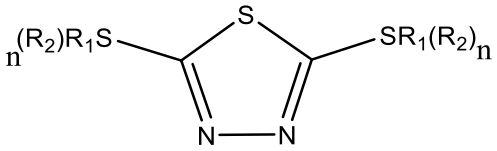
3. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the thiadiazole is 1,3,4-thiadiazole or derivative thereof.

4. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the thiadiazole provides at least about 2000 ppm sulfur to the durable lubricating composition.

5. The durable lubricating composition for electric or hybrid-electric vehicles of claim 4, wherein the durable lubricating composition includes up to about 3500 ppm total sulfur and up to about 300 ppm total phosphorus.

6. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the lubricating composition includes about 1 weight percent or less of the thiadiazole or derivative thereof.

7. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the thiadiazole or derivative thereof includes one or more compounds having a structure of Formula I:



(Formula I)

wherein

Each R_1 is independently hydrogen or sulfur;

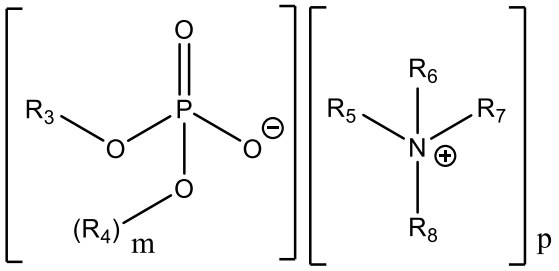
Each R_2 is independently an alkyl group;

n is an integer of 0 or 1 and if R_1 is hydrogen then the integer n of the adjacent R_2 moiety is 0 and if R_1 is sulfur then the n of the adjacent R_2 moiety is 1; and

wherein at least one R_1 is sulfur.

8. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the amine salt of a phosphoric acid ester includes one or more of a monoalkyl phosphoric acid ester and/or a dialkyl phosphoric acid esters and wherein the alkyl groups thereof may be linear or branched.

9. The durable lubricating composition for electric or hybrid-electric vehicles of claim 7, wherein the amine salt of a phosphoric acid ester is represented by Formula II



(Formula II)

wherein

R_3 and R_4 may be independently hydrogen or a linear, branched, or cyclic hydrocarbyl group;

m is an integer from 0 to 1, p is an integer from 1 to 2, and m + p equals 2;

R_5, R_6, R_7 and R_8 may be independently hydrogen or a hydrocarbyl group and at least one of R_5 to R_8 is a hydrocarbyl group.

10. The durable lubricating composition for electric or hybrid-electric vehicles of claim 9, wherein R_3 and R_4 may independently be a C3 to C10 alkyl group.

11. The durable lubricating composition for electric or hybrid-electric vehicles of claim 10, wherein at least one of R_5, R_6, R_7 and R_8 is C10 to C20 alkyl group.

12. The durable lubricating composition for electric or hybrid-electric vehicles of claim 10, wherein two of R_5, R_6, R_7 and R_8 are independently a C10 to C20 alkyl group.

13. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the amine salt of a phosphoric acid ester provides about 40 to about 90 weight % of the total phosphorus in the durable lubricating composition.

14. The durable lubricating composition for electric or hybrid-electric vehicles of claim 13, wherein the thiadiazole or derivative thereof provides at least about 99 weight % of the total sulfur in the durable lubricating composition.

15. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the lubricating composition includes about 0.25 to about 0.5 weight percent of the amine salt of a phosphoric acid ester.

16. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the lubricating composition has an initial conductivity before aging of about 150,000 or less when measured according to ASTM D2624-15 at 1.5 volts, 20 Hz, and at 160 C.

17. The durable lubricating composition for electric or hybrid-electric vehicles of claim 1, wherein the conductivity durability is the difference between an initial conductivity and a final conductivity, and the initial and final conductivities are measured according to ATSM D2624-15 at 1.5 volts, 20 Hz, and at 160 C, and wherein the final conductivity is measured after the lubricating composition has been aged according to CEC L-48-A-00 at 170° C for 192 hours.