a sulfur-providing additive including a thiadiazole, wherein the thiadiazole provides at least 1000 ppm of thiadiazole sulfur (S) to the electric driveline fluid;

wherein the combined dispersant phosphorus and thiadiazole sulfur (P + S) is at least 1300 ppm and wherein a weight ratio of the dispersant phosphorus to the thiadiazole sulfur (P/S) is at least 0.1;

a detergent system providing one or more calcium-containing detergents, and wherein the one or more calcium-containing detergents provide no more than 200 ppm of calcium;

a friction modifier, but no more than 0.4 weight percent of friction modifier;

wherein the electric driveline fluid has a kV100 viscosity of 3.2 cSt or more, 150 to 270 ppm of total phosphorus, and an electrical conductivity of 130 nS/M or less as measured by a modified conductivity test pursuant to ASTM D2624-15 using the electric driveline fluid and measured at 20 Hz and at 170° C; and

wherein the friction modifier is an alkyl imide, an alkyl amine, a hydrocarbyl imidazole, or combinations thereof, an ethoxylated alkyl amine, a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia; and provided that the friction modifier comprises 0 to 0.08 weight percent of the ethoxylated alkyl amine and/or 0 to 0.4 weight percent of a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia.

[006] In other approaches or examples, the electric driveline fluid of the previous paragraph may include one or more optional features or examples in any combination. These optional features or examples may include one or more of the following: wherein the friction modifier is an alkyl imide, an alkyl amine, a hydrocarbyl imidazole, derivatives thereof, or combinations thereof; and/or wherein the friction modifier comprises 0 to about 0.4 weight percent of one or more of a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia (preferably, reacted with ammonia), 0 to about 0.08 weight percent of ethoxylated alkyl amine (preferably, ethoxylated tallow amine); and/or wherein the friction modifier is 0 to about 0.1 weight percent of a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia (preferably reacted with ammonia); and/or wherein the number average molecular weight of the

ppm of dispersant phosphorus (P) to the electric driveline fluid; (iii) a sulfur-providing additive including a thiadiazole or derivative thereof providing at least about 1000 ppm of thiadiazole sulfur (S) to the electric driveline fluid (preferably about 1000 to about 1400 ppm), wherein the combined dispersant phosphorus and thiadiazole sulfur (P + S) is at least about 1300 ppm (preferably about 1300 to about 1400) and wherein a weight ratio of the dispersant phosphorus to the thiadiazole sulfur (P/S) is at least about 0.1 (preferably about 0.1 to about 0.3); (iv) a detergent system providing one or more calcium-containing detergents, wherein the one or more calcium-containing detergents provide no more than about 200 ppm of calcium; and (v) no more than about 0.4 weight percent of a friction modifier; and wherein the electric driveline fluid has a kV100 viscosity of about 3.2 cSt or more, about 150 to about 270 ppm of total phosphorus, and an electrical conductivity of about 130 nS/M or less as measured by a modified conductivity test pursuant to ASTM D2624-15 using the electric driveline fluid and measured at 20 Hz and at 170°C.

[007a] In one aspect, the present disclosure refers to method for lubricating a driveline component including an electric motor, the method comprising:

lubricating the driveline component with an electric driveline fluid;

the electric driveline fluid includes (i) one or more base oils of lubricating viscosity; (ii) a succinimide dispersant derived from a polyisobutylene having a number average molecular weight of 2,000 or greater, wherein the succinimide dispersant has up to 1 weight percent nitrogen and is post treated with a phosphorus containing compound and a boron containing compound, and wherein the succinimide dispersant delivers 150 to 270 ppm of dispersant phosphorus (P) to the electric driveline fluid; (iii) a sulfur-providing additive including a thiadiazole providing at least 1000 ppm of thiadiazole sulfur (S) to the electric driveline fluid, wherein the combined dispersant phosphorus and thiadiazole sulfur (P + S) is at least 1300 ppm and wherein a weight ratio of the dispersant phosphorus to the thiadiazole sulfur (P/S) is at least 0.1; (iv) a detergent system providing one or more calcium-containing detergents, wherein the one or more calcium-containing detergents provide no more than 200 ppm of calcium; and (v) a friction modifier, but no more than 0.4 weight percent of a friction modifier and wherein the friction modifier is an alkyl imide, an alkyl amine, a hydrocarbyl imidazole, or combinations

thereof, an ethoxylated alkyl amine, a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia; and provided that the friction modifier comprises 0 to 0.08 weight percent of the ethoxylated alkyl amine and/or 0 to 0.4 weight percent of a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia; and

wherein the electric driveline fluid has a kV100 viscosity of 3.2 cSt or more, 150 to 270 ppm of total phosphorus, and an electrical conductivity of 130 nS/M or less as measured by a modified conductivity test pursuant to ASTM D2624-15 using the electric driveline fluid and measured at 20 Hz and at 170°C.

[008] In yet further approaches or examples, the method for lubricating a driveline component including an electric motor as described in the previous paragraph may include one or more optional method steps, features, or examples in any combination. These optional method steps, features, or examples may include one or more of the following: wherein the friction modifier is an alkyl imide, an alkyl amine, a hydrocarbyl imidazole, derivatives thereof, or combinations thereof; and/or wherein the friction modifier is 0 to about 0.08 weight percent of an ethoxylated alkyl amine (preferably, ethoxylated tallow amine); and/or wherein wherein the organic friction modifier is 0 to about 0.4 weight percent of a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia (preferably, reacted with ammonia); and/or wherein wherein the number average molecular weight of the polyisobutylene is about 2,000 to about 2,400; and/or wherein the electric driveline fluid includes about 2 to about 8 weight percent of the succinimide dispersant (preferably, about 4 to about 8 weight percent); and/or wherein the electric driveline fluid has a change in viscosity of less than about 0.5 cST after the electric driveline fluid has been aged according to CEC L-48-A; and/or wherein wherein the electric driveline fluid achieves a failure load stage of at least about 8 in the FZG A10/16.6R/120 scuffing test of CEC L-84-02; and/or wherein wherein about 90 to about 100 percent of the total phosphorus is provided by the succinimide dispersant; and/or

CLAIMS

WHAT IS CLAIMED IS:

1. An electric driveline fluid comprising:

one or more base oils of lubricating viscosity;

a succinimide dispersant derived from a polyisobutylene having a number average molecular weight of 2,000 or greater, wherein the succinimide dispersant has up to 1 weight percent nitrogen and is post treated with a phosphorus containing compound and a boron containing compound, and wherein the succinimide dispersant delivers 150 to 270 ppm of dispersant phosphorus (P) to the electric driveline fluid;

a sulfur-providing additive including a thiadiazole, wherein the thiadiazole provides at least 1000 ppm of thiadiazole sulfur (S) to the electric driveline fluid;

wherein the combined dispersant phosphorus and thiadiazole sulfur (P + S) is at least 1300 ppm and wherein a weight ratio of the dispersant phosphorus to the thiadiazole sulfur (P/S) is at least 0.1;

a detergent system providing one or more calcium-containing detergents, and wherein the one or more calcium-containing detergents provide no more than 200 ppm of calcium;

a friction modifier, but no more than 0.4 weight percent of friction modifier;

wherein the electric driveline fluid has a kV100 viscosity of 3.2 cSt or more, 150 to 270 ppm of total phosphorus, and an electrical conductivity of 130 nS/M or less as measured by a modified conductivity test pursuant to ASTM D2624-15 using the electric driveline fluid and measured at 20 Hz and at 170° C; and

wherein the friction modifier is an alkyl imide, an alkyl amine, a hydrocarbyl imidazole, or combinations thereof, an ethoxylated alkyl amine, a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia; and provided that the friction modifier comprises 0 to 0.08 weight percent of the ethoxylated alkyl amine and/or 0 to 0.4 weight percent of a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia.

2. The electric driveline fluid of claim 1, wherein the number average molecular weight of the polyisobutylene is 2,000 to 2,400.

3. The electric driveline fluid of claim 2, wherein the electric driveline fluid includes 2 to 8 weight percent of the succinimide dispersant.

4. The electric driveline fluid of claim 1, wherein the electric driveline fluid has a change in viscosity of less than 0.5 cSt after the electric driveline fluid has been aged according to CEC L-48-A.

5. The electric driveline fluid of claim 1, wherein the electric driveline fluid achieves a failure load stage of at least 8 in the FZG A10/16.6R/120 scuffing test of CEC L-84-02.

6. The electric driveline fluid of claim 1, wherein the thiadiazole provides 1500 ppm or less of sulfur.

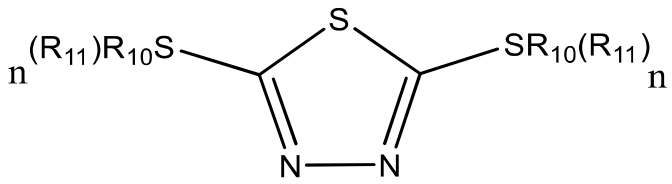
7. The electric driveline fluid of claim 1, wherein the combined dispersant phosphorus and thiadiazole sulfur (P + S) is 1300 ppm to 1400 ppm.

8. The electric driveline fluid of claim 1, wherein the weight ratio of the dispersant phosphorus to the thiadiazole sulfur (P/S) is 0.1 to 0.3.

9. The electric driveline fluid of claim 1, wherein 90 to 100 percent of the total phosphorus is provided by the succinimide dispersant.

10. The electric driveline fluid of claim 9, wherein the amount of provided phosphorus is 1 ppm of phosphorus per each 8 to 13 number average molecular weight units of the polyisobutylene moiety of the succinimide dispersant.

11. The electric driveline fluid of claim 1, wherein the thiadiazole includes one or more compounds having a structure of Formula I:



(Formula III)

wherein

each R_{10} is, independently, hydrogen or sulfur;

each R_{11} is, independently, an alkyl group;

n is an integer of 0 or 1 and if R_{10} is hydrogen then the integer n of the adjacent R_{11} moiety is 0 and if R_{10} is sulfur then the n of the adjacent R_{11} moiety is 1; and

wherein at least one R_{10} is sulfur.

12. A method for lubricating a driveline component including an electric motor, the method comprising:

lubricating the driveline component with an electric driveline fluid;

the electric driveline fluid includes (i) one or more base oils of lubricating viscosity; (ii) a succinimide dispersant derived from a polyisobutylene having a number average molecular weight of 2,000 or greater, wherein the succinimide dispersant has up to 1 weight percent nitrogen and is post treated with a phosphorus containing compound and a boron containing compound, and wherein the succinimide dispersant delivers 150 to 270 ppm of dispersant phosphorus (P) to the electric driveline fluid; (iii) a sulfur-providing additive including a thiadiazole providing at least 1000 ppm of thiadiazole sulfur (S) to the electric driveline fluid, wherein the combined dispersant phosphorus and thiadiazole sulfur (P + S) is at least 1300 ppm and wherein a weight ratio of the dispersant phosphorus to the thiadiazole sulfur (P/S) is at least 0.1; (iv) a detergent system providing one or more calcium-containing detergents, wherein the one or more calcium-containing detergents provide no more than 200 ppm of calcium; and (v) a friction modifier, but no more than 0.4 weight percent of a friction modifier and wherein the friction modifier is an alkyl imide, an alkyl amine, a hydrocarbyl imidazole, or combinations thereof, an ethoxylated alkyl amine, a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia; and provided that the friction modifier comprises 0 to 0.08 weight percent of the ethoxylated alkyl amine and/or 0 to 0.4 weight percent

of a linear or branched C16 to C18 substituted succinic acid or anhydride reacted with an amine, polyamine, or ammonia; and

wherein the electric driveline fluid has a kV100 viscosity of 3.2 cSt or more, 150 to 270 ppm of total phosphorus, and an electrical conductivity of 130 nS/M or less as measured by a modified conductivity test pursuant to ASTM D2624-15 using the electric driveline fluid and measured at 20 Hz and at 170°C.

13. The method for lubricating a driveline component including an electric motor of claim 12, wherein the number average molecular weight of the polyisobutylene is 2,000 to 2,400.

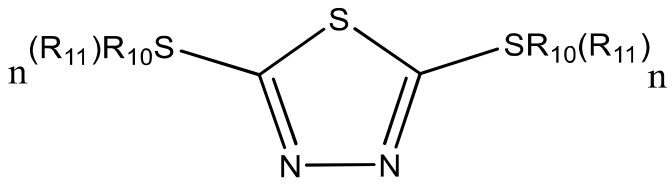
14. The method for lubricating a driveline component including an electric motor of claim 13, wherein the electric driveline fluid includes 2 to 8 weight percent of the succinimide dispersant.

15. The method for lubricating a driveline component including an electric motor of claim 12, wherein the electric driveline fluid has a change in viscosity after aging of less than 0.5 cSt after the electric driveline fluid has been aged according to CEC L-48-A.

16. The method for lubricating a driveline component including an electric motor of claim 12, wherein the electric driveline fluid achieves a failure load stage of at least 8 in the FZG A10/16.6R/120 scuffing test of CEC L-84-02.

17. The method for lubricating a driveline component including an electric motor of claim 12, wherein 90 to 100 percent of the total phosphorus is provided by the succinimide dispersant.

18. The method for lubricating a driveline component including an electric motor of claim 12, wherein the thiadiazole includes one or more compounds having a structure of Formula III:



(Formula III)

wherein

each R_{10} is, independently, hydrogen or sulfur;

each R_{11} is, independently, an alkyl group;

n is an integer of 0 or 1 and if R_{10} is hydrogen then the integer n of the adjacent R_{11} moiety is 0 and if R_{10} is sulfur then the n of the adjacent R_{11} moiety is 1; and

wherein at least one R_{10} is sulfur.