[0056] I claim:

1. A calcium sulfonate complex grease composition comprising the following ingredients:

less than 36% overbased oil-soluble calcium sulfonate;

2% to 20% added calcium carbonate; and

wherein the calcium sulfonate complex grease has a worked 60 stroke penetration between 220 and 295 and a dropping point of 575 F or higher.

2. The calcium sulfonate complex grease composition according to claim 1 wherein no calcium oxide or calcium hydroxide is added.

3. The calcium sulfonate complex grease composition according to claim 1 further comprising:

2% to 10% water;

one or more other converting agents in a total amount of 0.5% to 5%; and

one or more complexing acids in a total amount of 2.8% to 11%.

4. The calcium sulfonate complex grease composition according to claim 3 wherein the one or more other converting agents are selected from the group consisting of alcohols, ethers, glycols, glycol ethers, glycol polyethers, carboxylic acids, inorganic acids, organic nitrates, compounds that contain active hydrogen or compounds that contain tautomeric hydrogen; and

wherein the one or more complexing acids are selected from the group consisting of a long chain carboxylic acid, a short chain carboxylic acid, boric acid, and phosphoric acid.

5. The calcium sulfonate complex grease composition according to claim 4 further comprising 0.5% to 5% dodecylbenzene sulfonic acid.

6. The calcium sulfonate complex grease composition of claim 1 wherein the amount of overbased oil-soluble calcium sulfonate is less than 32%.

7. The calcium sulfonate complex grease composition of claim 2 wherein the amount of overbased calcium sulfonate is less than 32%.

8. The calcium sulfonate grease composition of claim 7 further comprising:

2% to 10% water;

one or more other converting agents in a total amount of 0.5% to 5%; and

one or more complexing acids in a total amount of 2.8% to 11%.

9. The calcium sulfonate complex grease composition according to claim 8 wherein the one or more converting agents are selected from the group consisting of alcohols, ethers, glycols, glycol ethers, glycol polyethers, carboxylic acids, inorganic acids, organic nitrates, compounds that contain active hydrogen or compounds that contain tautomeric hydrogen; and

wherein the one or more complexing acids are selected from the group consisting of a long chain carboxylic acid, a short chain carboxylic acid, boric acid, and phosphoric acid.

10. The calcium sulfonate complex grease composition of claim 9 further comprising 0.5% to 5% facilitating acid.

11. The calcium sulfonate complex grease composition according to claim 10 wherein the facilitating acid is dodecylbenzene sulfonic acid.

12. A calcium sulfonate complex grease composition comprising the following ingredients:

oil-soluble overbased calcium sulfonate having calcium carbonate dispersed therein;

added calcium carbonate;

one or more converting agents; and

one or more complexing acids;

wherein no calcium oxide or calcium hydroxide is added.

13. The calcium sulfonate complex grease composition according to claim 12 wherein the grease has a worked 60 stroke penetration between 265 and 295 and a dropping point of 575 F or higher.

14. The calcium sulfonate complex grease composition according to claim 13 comprising less than 45% oil-soluble overbased calcium sulfonate.

15. The calcium sulfonate grease composition according to claim 12 wherein the calcium carbonate is added in a stoichiometrically excess amount relative to the total amount of complexing acids.

16. A simple calcium sulfonate grease composition comprising the following ingredients:

less than 45% overbased calcium sulfonate;

2% to 20% added calcium carbonate;

wherein the simple grease has a worked penetration between 240 and 475.

17. The simple calcium sulfonate grease composition according to claim 16 wherein no calcium oxide or calcium hydroxide is added.

18. The simple calcium sulfonate grease composition according to claim 16 further comprising:

0.5% to 5.0% C12 alkylbenzene sulfonic acid; and

one or more converting agents selected from the group consisting of alcohols, ethers, glycols, glycol ethers, glycol polyethers, carboxylic acids, inorganic acids, organic nitrates, compounds that contain active hydrogen or compounds that contain tautomeric hydrogen, in a total amount of 0.1% to 5.0%.

19. The simple calcium sulfonate grease composition of claim 17 further comprising

0.5% to 5.0% C12 alkylbenzene sulfonic acid; and

one or more converting agents selected from the group consisting of alcohols, ethers, glycols, glycol ethers, glycol polyethers, carboxylic acids, inorganic acids, organic nitrates, compounds that contain active hydrogen or compounds that contain tautomeric hydrogen, in a total amount of 0.1% to 5.0%.

20. A method for making an overbased calcium sulfonate complex grease comprising the steps of:

mixing 10 to 45 parts overbased calcium sulfonate having amorphous calcium carbonate dispersed therein with 30 to 60 parts of a base oil, 2 to 20 parts of calcium carbonate, 2 to 10 parts water, and 0.5 to 5 total parts of one or more other converting agents to form a pre-conversion mixture;

converting the pre-conversion mixture to a converted mixture by heating until conversion of the amorphous calcium carbonate to crystalline calcium carbonate has occurred; and

mixing 2.8 to 11 total parts of one or more complexing acids with the pre-conversion mixture, converted mixture, or both;

wherein no calcium oxide or calcium hydroxide is added.

21. The method according to claim 20 further comprising the steps of:

mixing 0.5 to 5 parts of a facilitating acid prior to addition of the one or more converting agents; and

heating the mixture after addition of the one or more complexing acids to the converted mixture.

22. The method according to claim 20 wherein 15% to 45% of the total weight of a first complexing acid is added to the pre-conversion mixture prior to adding any converting agents with the other 85% to 55% of the total weight of such first complexing acid being added to the converted mixture.

23. The method according to claim 20 wherein the one or more complexing acids mixed with the pre-conversion mixture are different than the one or more complexing acids mixed with the converted mixture

24. The method according to claim 20 wherein the pre-conversion mixture is mixed at ambient temperature for 5 to 20 minutes before applying heat.

25. The method according to claim 20 wherein 15% to 45% of the total weight of the one or more complexing acids is mixed with the pre-conversion and 85% to 55% of the total weight of the one or more complexing acids is mixed with the converted mixture.

26. The calcium sulfonate grease product made by the process of claim 20.

27. The calcium sulfonate grease product made by the process of claim 22.

28. The calcium sulfonate grease product made by the process of claim 23.

CLAIMS:

1. A calcium sulfonate complex grease composition comprising the following ingredients:

around 10% to 36% overbased oil-soluble calcium sulfonate containing 28% to 36% dispersed calcium carbonate and 0% to 8% residual calcium oxide or calcium hydroxide;

2% to 20% crystalline calcium carbonate added in addition to the amount of dispersed calcium carbonate contained in the overbased oil-soluble calcium sulfonate;

wherein the calcium sulfonate complex grease has a worked 60 stroke penetration between 220 and 295 and a dropping point of 575 F or higher;

wherein the amount of dispersed calcium carbonate and residual calcium oxide or calcium hydroxide are by weight of the overbased oil-soluble calcium sulfonate and all other amounts are by weight of the final complex grease; and

wherein no calcium oxide or calcium hydroxide is added in addition to the amount of residual calcium oxide or calcium hydroxide contained in the overbased oil-soluble calcium sulfonate.

2. The calcium sulfonate complex grease composition according to claim 1 further comprising:

2% to 10% water;

one or more other converting agents in a total amount of 0.5% to 5%; and

one or more complexing acids in a total amount of 2.8% to 11%.

3. The calcium sulfonate complex grease composition according to claim 2 wherein the one or more other converting agents are selected from the group consisting of alcohols, ethers, glycols, glycol ethers, glycol polyethers, carboxylic acids, inorganic acids, organic nitrates, compounds that contain active hydrogen or compounds that contain tautomeric hydrogen; and

wherein the one or more complexing acids are selected from the group consisting of a long chain carboxylic acid, a short chain carboxylic acid, boric acid, and phosphoric acid.

4. The calcium sulfonate complex grease composition according to claim 3 further comprising 0.5% to 5% dodecylbenzene sulfonic acid.

5. The calcium sulfonate complex grease composition of claim 1 wherein the amount of overbased oil-soluble calcium sulfonate is around 10% to 32%.

6. The calcium sulfonate complex grease composition of claim 2 wherein the amount of overbased calcium sulfonate is around 10% to 32%.

7. The calcium sulfonate complex grease composition of claim 3 further comprising 0.5% to 5% facilitating acid.

8. A calcium sulfonate complex grease composition comprising the following ingredients:

oil-soluble overbased calcium sulfonate having 28% to 36% dispersed calcium carbonate and 0% to 8% residual calcium oxide or calcium hydroxide dispersed therein, such amounts by weight of the oil-soluble overbased calcium sulfonate;

crystalline calcium carbonate added in addition to the amount of dispersed calcium carbonate contained in the oil-soluble overbased calcium sulfonate;

one or more converting agents;

one or more complexing acids;

wherein no calcium oxide or calcium hydroxide is added in addition to any amount of residual calcium oxide or calcium hydroxide contained in the oil-soluble overbased calcium sulfonate.

9. The calcium sulfonate complex grease composition according to claim 8 wherein the grease has a worked 60 stroke penetration between 265 and 295 and a dropping point of 575 F or higher.

10. The calcium sulfonate complex grease composition according to claim 9 comprising around 10% to 45% oil-soluble overbased calcium sulfonate.

11. The calcium sulfonate grease composition according to claim 8 wherein the crystalline calcium carbonate is added in a stoichiometrically excess amount relative to the total amount of complexing acids.

12. A simple calcium sulfonate grease composition comprising the following ingredients:

around 10% to 45% overbased calcium sulfonate containing calcium carbonate dispersed therein, wherein the dispersed calcium carbonate is in an amorphous state when the overbased calcium sulfonate is first added to the other ingredients and is converted to a crystalline state in the final simple grease product;

2% to 20% crystalline calcium carbonate added in addition to the amount of amorphous calcium carbonate contained in the overbased calcium sulfonate;

wherein the simple grease has a worked penetration between 240 and 475; and

wherein the overbased calcium sulfonate contains 0% to 8% residual dispersed calcium oxide or calcium hydroxide and wherein no additional calcium oxide or calcium hydroxide is separately added.

13. The simple calcium sulfonate grease composition according to claim 12 further comprising:

0.5% to 5.0% C12 alkylbenzene sulfonic acid; and

one or more converting agents selected from the group consisting of alcohols, ethers, glycols, glycol ethers, glycol polyethers, carboxylic acids, inorganic acids, organic nitrates, compounds that contain active hydrogen or compounds that contain tautomeric hydrogen, in a total amount of 0.1% to 5.0%.

14. A method for making an overbased calcium sulfonate complex grease comprising the steps of:

providing 10 to 45 parts overbased calcium sulfonate having 28% to 36% amorphous calcium carbonate and 0% to 8% residual calcium oxide or calcium hydroxide dispersed therein;

providing 2 to 20 parts of crystalline calcium carbonate as a separately added ingredient in addition to the amount of amorphous calcium carbonate contained in the overbased calcium sulfonate;

mixing the overbased calcium sulfonate with 30 to 60 parts of a base oil, the separately added crystalline calcium carbonate, 2 to 10 parts water, and 0.5 to 5 total parts of one or more other converting agents to form a pre-conversion mixture;

converting the pre-conversion mixture to a converted mixture by heating until conversion of the amorphous calcium carbonate contained in the overbased calcium sulfonate to a crystalline form has occurred; and

mixing 2.8 to 11 total parts of one or more complexing acids with the pre-conversion mixture, converted mixture, or both;

wherein no additional calcium oxide or calcium hydroxide is added in addition to any amount of residual calcium oxide or calcium hydroxide contained in the overbased calcium sulfonate and the separately added crystalline calcium carbonate is the sole calcium containing base added as a separate ingredient for reacting with the one or more complexing acids; and

wherein the amount of amorphous calcium carbonate and residual calcium oxide or calcium hydroxide is by weight of the overbased calcium sulfonate and all other amounts are by weight of the final complex grease product.

15. The method according to claim 14 further comprising the steps of:

mixing 0.5 to 5 parts of a facilitating acid prior to addition of the one or more converting agents; and

heating the mixture after addition of the one or more complexing acids to the converted mixture.

16. The method according to claim 14 wherein 15% to 45% of the total weight of a first complexing acid is added to the pre-conversion mixture prior to adding any converting agents with the other 85% to 55% of the total weight of such first complexing acid being added to the converted mixture.

17. The method according to claim 14 wherein the one or more complexing acids mixed with the pre-conversion mixture are different than the one or more complexing acids mixed with the converted mixture.

18. The method according to claim 14 wherein the pre-conversion mixture is mixed at ambient temperature for 5 to 20 minutes before applying heat.

19. The method according to claim 14 wherein 15% to 45% of the total weight of the one or more complexing acids is mixed with the pre-conversion mixture and 85% to 55% of the total weight of the one or more complexing acids is mixed with the converted mixture.

20. The calcium sulfonate grease product made by the process of claim 14.

21. The calcium sulfonate grease product made by the process of claim 16.

22. The calcium sulfonate grease product made by the process of claim 17.

23. The calcium sulfonate complex grease composition according to claim 2 wherein the separately added calcium carbonate is the only calcium containing base separately added for reaction with the one or more complexing acids.

24. The calcium sulfonate complex grease composition according to claim 2 wherein the dispersed calcium carbonate contained in the oil-soluble overbased calcium sulfonate is in an amorphous state when the overbased calcium sulfonate is first added to one or more of the other ingredients and is converted to a crystalline state in the final complex grease product.

25. The calcium sulfonate complex grease composition according to claim 1 wherein the crystalline calcium carbonate has a mean particle size between about 1 to 20 microns.

26. The calcium sulfonate complex grease composition according to claim 8 wherein the crystalline calcium carbonate has a mean particle size between about 1 to 20 microns.

27. The simple calcium sulfonate grease composition according to claim 12 wherein the crystalline calcium carbonate added in addition to the amount of amorphous calcium carbonate contained in the overbased calcium sulfonate has a mean particle size between about 1 to 20 microns.

28. The method according to claim 14 wherein the separately added crystalline calcium carbonate has a mean particle size between about 1to 20 microns.