WHAT IS CLAIMED IS:

1. A method of coating a metal substrate comprising:

pretreating the metal substrate with a pretreatment composition comprising a Group IIIB and/or Group IVB metal, free fluoride, and molybdenum; and

electrophoretically depositing a coating composition onto the metal substrate, wherein the coating composition comprises yttrium.

2. The method according to claim 1, wherein the pretreatment composition comprises a Group IVB metal.

3. The method according to claim 1, wherein the Group IVB metal is provided in the form of hexafluorozirconic acid, hexafluorotitanic acid, or salts thereof.

4. The method according to claim 1, wherein the Group IVB metal is zirconium.

5. The method according to claim 1, wherein the Group IVB metal is provided in the form of oxides or hydroxides of zirconium.

6. The method according to claim 1, wherein the Group IVB metal is provided in the form of zirconyl nitrate, zirconyl sulfate, or zirconium basic carbonate.

7. The method according to claim 1, wherein the Group IIIB and/or Group IVB metal is provided in the form of an acid or salt.

8. The method according to claim 1, wherein the Group IIIB and/or Group IVB metal comprises from 50 to 500 parts per million metal, based on a total weight of the ingredients in the pretreatment composition.

9. The method according to claim 1, wherein the Group IVB metal comprises from 75 to 250 parts per million metal, based on a total weight of the ingredients in the pretreatment composition.

10. The method according to claim 1, wherein a molar ratio of the Group IIIB and/or Group IVB metal to the molybdenum is between 100: 1 and 1:10.

11. The method according to claim 1, wherein the free fluoride comprises from 5 to 250 ppm of the pretreatment composition.

12. The method according to claim 1, wherein the free fluoride comprises from 25 to 100 ppm of the pretreatment composition.

13. The method according to claim 1, wherein the molybdenum is provided in the form of a salt.

14. The method according to claim 1, wherein the salt comprises sodium molybdate, calcium molybdate, potassium molybdate, ammonium molybdate, molybdenum chloride, molybdenum acetate, molybdenum sulfamate, molybdenum formate, or molybdenum lactate.

15. The method according to claim 1, wherein the molybdenum comprises from 2 to 500 parts per million, based on a total weight of the ingredients in the pretreatment composition.

16. The method according to claim 1, wherein the molybdenum comprises from 5 to 150 parts per million, based on a total weight of the ingredients in the pretreatment composition.

17. The method according to claim 1, wherein the pretreatment composition is substantially free of phosphate ions.

18. The method according to claim 1, wherein the pretreatment composition is substantially free of chromate.

19. The method according to claim 1, wherein the pretreatment composition is aqueous.

20. The method of claim 1, wherein the pretreatment composition is used in a dip application.

21. The method of claim 1, wherein the pretreatment composition is used in a spray application.

22. The method according to claim 1, wherein a K ratio is equal to A/B, wherein A is a mole weight of a compound (A) containing the Group IIIB and/or Group IVB metal, and wherein B is a mole weight calculated as HF of a compound containing fluorine as a supplying source of the fluoride, wherein $K>0.10$.

23. The method according to claim 1, wherein a K ratio is equal to A/B, wherein A is a mole weight of a compound (A) containing the Group IIIB and/or Group IVB metal, and wherein B is a mole weight calculated as HF of a compound containing fluorine as a supplying source of the fluoride, wherein $0.11<K<0.25$.

24. The method according to claim 1, wherein the pretreatment composition further comprises an electropositive metal.

25. The method according to claim 24, wherein the electropositive metal is selected from the group consisting of copper, nickel, silver, gold, and combinations thereof.

26. The method according to claim 24, wherein the electropositive metal comprises copper.

27. The method according to claim 26, wherein the copper is provided in the form of copper nitrate, copper sulfate, copper chloride, copper carbonate, or copper fluoride.

28. The method according to claim 24, wherein the electropositive metal comprises from 0 to 100 parts per million, based on a total weight of the ingredients in the pretreatment composition.

29. The method according to claim 24, wherein the electropositive metal comprises from 2 to 35 parts per million, based on a total weight of the ingredients in the pretreatment composition.

30. The method according to claim 1, wherein the pretreatment composition further comprises lithium.

31. The method according to claim 30, wherein the lithium is provided in the form of a salt.

32. The method according to claim 31, wherein the salt is lithium nitrate, lithium sulfate, lithium fluoride, lithium chloride, lithium hydroxide, lithium carbonate, or lithium iodide.

33. The method according to claim 30, wherein the lithium comprises from 5 to 500 parts per million, based on a total weight of the ingredients in the pretreatment composition.

34. The method according to claim 30, wherein the lithium comprises from 25 to 125 parts per million, based on a total weight of the ingredients in the pretreatment composition.

35. A method of coating a metal substrate comprising electrophoretically depositing a coating composition onto the metal substrate, wherein the coating composition comprises yttrium, and wherein the metal substrate comprises a treated surface layer comprising a Group IIIB and/or Group IVB metal, fluoride, and molybdenum.

36. A pretreatment composition for treating a metal substrate comprising:
a Group IIIB and/or Group IVB metal;
free fluoride;
molybdenum; and
lithium.

37. The pretreatment composition of claim 36, wherein the Group IIIB and/or Group IVB metal comprises zirconium.

38. The pretreatment composition of claim 36, wherein the molybdenum is provided in the form of a salt.

39. The pretreatment composition of claim 38, wherein the salt comprises sodium molybdate, calcium molybdate, potassium molybdate, ammonium molybdate, molybdenum chloride, or molybdenum acetate, molybdenum acetate, molybdenum sulfamate, molybdenum formate, or molybdenum lactate

40. The pretreatment composition of claim 36, wherein the lithium is provided in the form of a salt.

41. The pretreatment composition of claim 40, wherein the salt comprises lithium nitrate, lithium sulfate, lithium fluoride, lithium chloride, lithium hydroxide, lithium carbonate, or lithium iodide.

42. A pretreated metal substrate comprising a surface layer comprising a Group IIIB and/or Group IVB metal, free fluoride, molybdenum, and lithium on at least a portion of the substrate.

43. An electrophoretically coated metal substrate comprising:

a treated surface layer comprising a Group IIIB and/or Group IVB metal, fluoride, and molybdenum on a surface of the metal substrate; and

an electrophoretically deposited coating composition over at least a portion of the treated surface layer, wherein the coating composition comprises yttrium.

WHAT IS CLAIMED IS:

1. A method of coating a metal substrate comprising:

pretreating the metal substrate with a pretreatment composition comprising a Group IIIB and/or Group IVB metal, free fluoride, and molybdenum; and

wherein the molybdenum comprises from 2 to 500 parts per million, based on a total weight of the ingredients in the pretreatment composition; and

electrophoretically depositing a coating composition onto the metal substrate, wherein the coating composition comprises yttrium.

2. The method according to claim 1, wherein the pretreatment composition comprises a Group IVB metal.

3. The method according to claim 1, wherein the Group IVB metal is provided in the form of hexafluorozirconic acid, hexafluorotitanic acid, or salts thereof.

4. The method according to claim 1, wherein the Group IVB metal is zirconium.

5. The method according to claim 1, wherein the Group IVB metal is provided in the form of oxides or hydroxides of zirconium.

6. The method according to claim 1, wherein the Group IVB metal is provided in the form of zirconyl nitrate, zirconyl sulfate, or zirconium basic carbonate.

7. The method according to claim 1, wherein the Group IIIB and/or Group IVB metal is provided in the form of an acid or salt.

8. The method according to claim 1, wherein the Group IIIB and/or Group IVB metal comprises from 50 to 500 parts per million metal, based on a total weight of the ingredients in the pretreatment composition.

9. The method according to claim 1, wherein the Group IVB metal comprises from 75 to 250 parts per million metal, based on a total weight of the ingredients in the pretreatment composition.

10. The method according to claim 1, wherein a molar ratio of the Group IIIB and/or Group IVB metal to the molybdenum is between 100: 1 and 1: 10.

11. The method according to claim 1, wherein the free fluoride comprises from 5 to 250 ppm of the pretreatment composition.

12. The method according to claim 1, wherein the free fluoride comprises from 25 to 100 ppm of the pretreatment composition.

13. The method according to claim 1, wherein the molybdenum is provided in the form of a salt.

14. The method according to claim 1, wherein the salt comprises sodium molybdate, calcium molybdate, potassium molybdate, ammonium molybdate, molybdenum chloride, molybdenum acetate, molybdenum sulfamate, molybdenum formate, or molybdenum lactate.

15. The method according to claim 1, wherein the molybdenum comprises from 5 to 150 parts per million, based on a total weight of the ingredients in the pretreatment composition.

16. The method according to claim 1, wherein the pretreatment composition is substantially free of phosphate ions.

17. The method according to claim 1, wherein the pretreatment composition is substantially free of chromate.

18. The method according to claim 1, wherein the pretreatment composition is aqueous.

19. The method of claim 1, wherein the pretreatment composition is used in a dip application.

20. The method of claim 1, wherein the pretreatment composition is used in a spray application.

21. The method according to claim 1, wherein A is a mole weight of a compound (A) containing the Group IIIB and/or Group IVB metal, and wherein B is a mole weight of a compound (B) containing free fluoride calculated as HF, wherein K=A/B and wherein $K>0.10$.

22. The method according to claim 1, wherein A is a mole weight of a compound (A) containing the Group IIIB and/or Group IVB metal, and wherein B is a mole weight of a compound (B) containing free fluoride calculated as HF, wherein K=A/B and wherein $0.11<K<0.25$.

23. The method according to claim 1, wherein the pretreatment composition further comprises an electropositive metal.

24. The method according to claim 23, wherein the electropositive metal is selected from the group consisting of copper, nickel, silver, gold, and combinations thereof.

25. The method according to claim 23, wherein the electropositive metal comprises copper.

26. The method according to claim 25, wherein the copper is provided in the form of copper nitrate, copper sulfate, copper chloride, copper carbonate, or copper fluoride.

27. The method according to claim 23, wherein the electropositive metal comprises from 0 to 100 parts per million, based on a total weight of the ingredients in the pretreatment composition.

28. The method according to claim 23, wherein the electropositive metal comprises from 2 to 35 parts per million, based on a total weight of the ingredients in the pretreatment composition.

29. The method according to claim 1, wherein the pretreatment composition further comprises lithium.

30. The method according to claim 29, wherein the lithium is provided in the form of a salt.

31. The method according to claim 30, wherein the salt is lithium nitrate, lithium sulfate, lithium fluoride, lithium chloride, lithium hydroxide, lithium carbonate, or lithium iodide.

32. The method according to claim 29, wherein the lithium comprises from 5 to 500 parts per million, based on a total weight of the ingredients in the pretreatment composition.

33. The method according to claim 29, wherein the lithium comprises from 25 to 125 parts per million, based on a total weight of the ingredients in the pretreatment composition.

34. A pretreatment composition for treating a metal substrate comprising:

a Group IIIB and/or Group IVB metal;

free fluoride; and

molybdenum, wherein the molybdenum comprises from 2 to 500 parts per million, based on a total weight of the ingredients in the pretreatment composition.

35. The pretreatment composition of claim 34, wherein the Group IIIB and/or Group IVB metal comprises zirconium.

36. The pretreatment composition of claim 34, wherein the molybdenum is provided in the form of a salt.

37. The pretreatment composition of claim 36, wherein the salt comprises sodium molybdate, calcium molybdate, potassium molybdate, ammonium molybdate, molybdenum chloride, molybdenum acetate, molybdenum sulfamate, molybdenum formate, or molybdenum lactate

38. The pretreatment composition of claim 34, wherein the lithium is provided in the form of a salt.

39. The pretreatment composition of claim 38, wherein the salt comprises lithium nitrate, lithium sulfate, lithium fluoride, lithium chloride, lithium hydroxide, lithium carbonate, or lithium iodide.

40. A pretreated metal substrate comprising a surface layer comprising the residue of the pretreatment composition of claim 34 on at least a portion of the substrate.

41. An electrophoretically coated metal substrate comprising:

a treated surface layer comprising the residue of the pretreatment composition of claim 34 on a surface of the metal substrate; and

an electrophoretically deposited coating composition over at least a portion of the treated surface layer, wherein the coating composition comprises yttrium.

42. The pretreatment composition of Claim 34, further comprising lithium.