Claims

1. A composition comprising particles selected from particles having wear resistance properties, particles having surface enhancing properties, particles having catalytic properties or combinations thereof, and a mechanical blend comprising at least one powder of particles of a boron source and at least one powder of particles of a silicon source, each particle in the powders is either of a silicon source or of a boron source and wherein the particles have an average particle size less than 250 µm, and wherein:

- the mechanical blend comprises boron and silicon in a weight ratio boron to silicon within a range from about 3:100 wt:wt to about 100:3 wt:wt;
- silicon and boron are present in the blend in at least 25 wt%;
- the at least one boron source and the at least one silicon source are oxygen free except for inevitable amounts of contaminating oxygen, and wherein the inevitable amount of contaminating oxygen is less than 10 wt.

2. The composition according to claim 1, wherein the blend comprises that the silicon source is selected from one or more of elemental silicon, an alloy containing silicon, or compound containing silicon.

3. The composition according to claim 1 or 2, wherein the blend comprises that the boron source is selected from one or more of elemental boron, an alloy containing boron, or compound containing boron.

4. The composition according to any one of claims 1, 2 or 3, wherein the blend comprises that the boron source is selected from elemental boron, boron carbides, nickel borides, and silicon is selected from elemental silicon, silicon carbides, iron silicides.

5. The composition according to any one of claims 1 to 4, wherein the particles having wear resistance properties are hard particles selected from particles based on oxides, nitrides, carbides, borides, or mixtures thereof.

6. The composition according to any one of claims 1 to 5, wherein the particles having wear resistance properties are selected from one or more of tungsten carbide, (cubic) boron nitride, titanium nitride, diamonds, metal composites, chromium borides.

7. The composition according to claim 6, wherein the composition also comprises powders of a parent material, wherein the parent material is present in an amount less than 75 wt% calculated on the total weight of silicon, boron and parent material.

8. The composition according to any one of the preceding claims, wherein the composition also comprises a braze alloy.

9. The composition according to any one of the preceding claims, wherein the composition also comprises at least one binder selected from solvents, water, oils, gels, lacquers, varnish, polymers, and waxes.

10. The composition according claim 9, wherein the polymer is selected from the polyesters, polyethylenes, polypropylenes, acrylic polymers, (met)acrylic polymers, polyvinyl alcohols, polyvinyl acetates, polystyrenes, and waxes.

11. The composition according to claim 9 or 10, wherein the blend is dispersed in the binder.

12. The composition according to any one of the preceding claims, wherein the mechanical blend the at least one boron source and the at least one silicon source are oxygen free except for inevitable amounts of contaminating oxygen.

13. A product comprising a substrate of a parent material and the composition according to any one of claim 1 to 12, which parent material has a solidus temperature above 1100 °C, , wherein at least a part of the product has a coated layer of the composition.

14. The product according to claim 13, wherein the parent material is selected from iron based alloys, nickel based alloys, chromium based alloys, cobolt based, and copper based alloys.

15. The product according to any one of claims 13 or 14, wherein the parent material comprises from about 15 to about 22 wt% chromium, from about 8 to about 22 wt% nickel, from about 0 to about 3 wt% manganese, from about 0 to about 1.5 wt% silicon, from about 0 to about 8 wt% molybdenum, and balanced with iron.

16. The product according to claim 13 or 14, wherein the parent material comprises more than 50 wt% Fe, less than 13 wt% Cr, less than 1 wt% Mo, less than 1 wt% Ni and less than 3 wt% Mn.

17. The product according to claim 13 or 14, wherein the parent material comprises more than 10 wt% Cr and more than 60 wt% Ni.

18. The product according to claim 13 or 14, wherein the parent material comprises more than 15 wt% Cr, more than 10 wt% Mo, and more than 50 wt% Ni.

19. The product according to claim 13 or 14, wherein the parent material comprises more than 10 wt% Fe, 0.1 to 30wt% Mo, 0.1 to 30 wt% Ni, and more than 50 wt% Co.

20. The product according to claim 13 or 14, wherein the parent material comprises more than 80 wt% Ni.

21. The product according to any one of claims 13 to 20, wherein the substrates are coils, plates, parts, sheets.

22. A coated product obtained by heating a product according to any one of claims 13 to 20 to a brazing temperature and obtaining a coated product having wear resistance properties, obtaining a coated product having surface enhancing properties, obtaining a coated product having catalytic properties or combinations thereof.

23. A method for providing a coated product comprising the following steps:

- applying at least one silicon source and at least one boron source on at least one substrate together with particles selected from particles having wear resistance properties, particles having surface enhancing properties, particles having catalytic properties or combinations thereof;

- heating the applied at least one substrate to a brazing temperature below 1250 °C, in a furnace in vacuum, in an inert gas, in a reducing atmosphere, or combinations thereof; and

- cooling the heated applied at least one substrate and obtaining a coated product.

24. The method according to claim 23 , wherein the method further comprise applying a mechanical blend of at least one silicon source and the at least one boron source in the application step.

25. The method according to claim 23 , wherein the the at least one silicon source and the at least one boron source are the same, preferably the boron source and the silicon source are silicon borides.

26. The method according to claim 23 , wherein the method further comprise applying the at least one silicon source as one layer on the substrate, and applying the at least one boron source as another layer on the substrate in the application step.

27. The method according to claim 23, wherein the method further comprise application of a coating composition according to any one of claims 1 to 11 in the application step.

28. The method according to any one of claims 23 to 27, wherein the applied substrate from the application step is a product according to any one of claims 13 to 21.

29. The method according to any one of claims 23 to 28, wherein the obtained product is according to claim 22.

30. The method according to claim 29, wherein coated heat exchanger plates, coated reactor plates, coated parts of reactors, coated parts of separators, coated parts of decanters, coated parts of pumps, coated parts of valves are obtained.

31. Use of a composition according to any one of claims 1 to 12 for providing a coated product.

32. Use of a composition according to any one of claims 1 to 12, for coating of parts or plates for heat exchangers, coating of plate reactors, coating of parts of reactors, coating of parts of separators, coating of parts of decanters, coating parts of pumps, or coating of parts of valves.

Claims

1. A coating composition comprising particles selected from particles having wear resistance properties, particles having surface enhancing properties, particles having catalytic properties or combinations thereof, and a mechanical blend comprising at least one powder of particles of a boron source and at least one powder of particles of a silicon source, each particle in the powders is either of a silicon source or of a boron source and wherein the particles have an average particle size less than 250 µm, and wherein:

- the mechanical blend comprises boron and silicon in a weight ratio boron to silicon within a range from about 3:100 wt:wt to about 100:3 wt:wt;
- silicon and boron are present in the blend in at least 25 wt%;
- the at least one boron source and the at least one silicon source are oxygen free except for inevitable amounts of contaminating oxygen, and wherein the inevitable amount of contaminating oxygen is less than 10 wt.

2. The coating composition according to claim 1, wherein the silicon source is selected from one or more of elemental silicon, an alloy containing silicon, or compound containing silicon.

3. The coating composition according to claim 1 or 2, the boron source is selected from one or more of elemental boron, an alloy containing boron, or compound containing boron.

4. The coating composition according to any one of claims 1, 2 or 3, wherein the boron source is selected from elemental boron, boron carbides, nickel borides, and silicon is selected from elemental silicon, silicon carbides, iron silicides.

5. The coating composition according to any one of claims 1 to 4, wherein the particles having wear resistance properties are hard particles selected from particles based on oxides, nitrides, carbides, borides, or mixtures thereof.

6. The coating composition according to any one of claims 1 to 5, wherein the particles having wear resistance properties are selected from one or more of tungsten carbide, (cubic) boron nitride, titanium nitride, diamonds, metal composites, chromium borides.

7. The coating composition according to claim 6, wherein the composition also comprises powders of a parent material, wherein the parent material is present in an amount less than 75 wt% calculated on the total weight of silicon, boron and parent material.

8. The coating composition according to any one of the preceding claims, wherein the composition also comprises a braze alloy.

9. The coating composition according to any one of the preceding claims, wherein the composition also comprises at least one binder selected from solvents, water, oils, gels, lacquers, varnish, polymers, and waxes.

10. The coating composition according claim 9, wherein the polymer is selected from the polyesters, polyethylenes, polypropylenes, acrylic polymers, (met)acrylic polymers, polyvinyl alcohols, polyvinyl acetates, polystyrenes, and waxes.

11. The coating composition according to claim 9 or 10, wherein the blend is dispersed in the binder.

12. A coated product comprising a substrate of a parent material and the composition according to any one of claim 1 to 11, which parent material has a solidus temperature above 1100 °C, wherein at least a part of the product has a coated layer of the composition.

13. The coated product according to claim 12, wherein the parent material is selected from iron based alloys, nickel based alloys, chromium based alloys, cobolt based, and copper based alloys.

14. The coated product according to any one of claims 12 or 13, wherein the parent material comprises from about 15 to about 22 wt% chromium, from about 8 to about

22 wt% nickel, from about 0 to about 3 wt% manganese, from about 0 to about 1.5 wt% silicon, from about 0 to about 8 wt% molybdenum, and balanced with iron, or wherein the parent material comprises more than 50 wt% Fe, less than 13 wt% Cr, less than 1 wt% Mo, less than 1 wt% Ni and less than 3 wt% Mn, or wherein the parent material comprises more than 10 wt% Cr and more than 60 wt% Ni, wherein the parent material comprises more than 15 wt% Cr, more than 10 wt% Mo, and more than 50 wt% Ni, or wherein the parent material comprises more than 10 wt% Fe, 0.1 to 30wt% Mo, 0.1 to 30 wt% Ni, and more than 50 wt% Co, or wherein the parent material comprises more than 80 wt% Ni.

15. The coated product according to any one of claims 12 to 14, wherein the substrates are coils, plates, parts, sheets.

16. A coated product obtained by heating a product according to any one of claims 12 to 14 to a brazing temperature and obtaining a coated product having wear resistance properties, obtaining a coated product having surface enhancing properties, obtaining a coated product having catalytic properties or combinations thereof.

17. A method for providing a coated product comprising the following steps:

- applying a coating composition according to any one of claims 1 to 11 on at least one substrate;

- heating the applied at least one substrate to a brazing temperature below 1250 °C, in a furnace in vacuum, in an inert gas, in a reducing atmosphere, or combinations thereof; and

- cooling the heated applied at least one substrate and obtaining a coated product.

18. The method according to claim 17, wherein the method further comprise applying the at least one silicon source as one layer on the substrate, and applying

the at least one boron source as another layer on the substrate in the application step.

19. The method according to claim 18 or 19, wherein the applied substrate from the application step is a product according to any one of claims 12 to 16.

20. The method according to any one of claims 17 or 18, wherein the obtained coated product is according to claim 16.

21. The method according to claim 20, wherein the coated products are any one of coated heat exchanger plates, coated reactor plates, coated parts of reactors, coated parts of separators, coated parts of decanters, coated parts of pumps, coated parts of valves.

22. Use of a composition according to any one of claims 1 to 11 for providing a coated product.

23. Use of a composition according to any one of claims 1 to 11, for coating of parts or plates for heat exchangers, coating of plate reactors, coating of parts of reactors, coating of parts of separators, coating of parts of decanters, coating parts of pumps, or coating of parts of valves.