CLAIMS

1. A process of producing a product having a wrought structure from a cold spray deposition preform having a consolidated particle structure, the process comprising:

applying heat and a compressive load simultaneously to an application area of the cold spray deposition preform using a compressive load applicator,

wherein the compressive load is applied laterally to the application area in a direction that is substantially perpendicular to the tangential plane of the application area or point,

and wherein the applied compressive load and heat raises the temperature of the material of the preform in the application area to between the recrystallisation temperature and the melting point of the material, thereby transforming the consolidated particle structure of the cold spray deposition preform into a wrought structure.

2. A process according to claim 1, wherein the heat is applied by a rapid heating technique, preferably at least one of: current, induction heating or laser heating.

3. A process according to claim 1 or 2, wherein the heat is applied using current comprising at least one of alternating current or pulsed direct current.

4. A process according to claim 2 or 3, wherein the heat is applied using current having a current density of from 500 to 2000 A/mm^2, preferably from 800 to 1500 A/mm^2, more preferably 1000 to 1100 A/mm^2.

5. A process according to claim 3 or 4, wherein the voltage associated with the current is 2 to 3 volts.

6. A process according to any preceding claim, wherein the applied compressive load is from 10 to 100 kg/m^2, preferably from 20 to 60 kg/m^2.

7. A process according to any preceding claim, wherein the process comprises a continuous manufacturing process.

8. A process according to any preceding claim, wherein the preform is an elongate body.

9. A process according to any preceding claim, wherein the preform comprises a strip, sheet, wire, rod or bar.

10. A process according to any preceding claim, wherein the compressive load is applied using at least one roller configured to compressively engage the preform.

11. A process according to claim 10, further comprising at least two rollers, between which the preform is fed and compressed.

12. A process according to claim 10 or 11, wherein at least one roller is configured to apply heat, preferably current, to the preform.

13. A process according to any one of claims 10 to 12, wherein at least a portion of the rollers comprise a conductive material.

14. A process according to any one of claims 10 to 13, wherein at least one roller includes a cooling system or arrangement.

15. A process according to any preceding claim, further comprising the step prior to applying heat and compressive load of:

forming a preform having a consolidated particle structure using cold spray deposition to additively build the structure in a desired configuration.

16. A process according to claim 15, wherein the compressive load is applied using at least one roller configured to compressively engage the preform and wherein the preform is formed on the surface of one roller of the at least one rollers prior to being compressed.

17. A process according to claim 15 or 16, wherein the preform is formed on or about a feed axis along which the preform moves in the process.

18. A process according to any one of claims 15 to 17, wherein the preform is formed by depositing material onto a deposition surface.

19. A process according to any one of claims 15 to 18, wherein the forming step comprises:

using a cold spray applicator to deposit cold sprayed material on a deposition surface to form a product deposition surface on or about a feed axis;

successively depositing material onto a respective top product deposition surface using cold spray deposition to form successive deposition layers of the material; and

moving at least one of: the cold spray applicator, or the preform, relative to the other in an axial direction along the feed axis,

thereby forming a preform of a selected length.

20. A process according to any one of claims 15 to 19, wherein the preform is formed as a continuous element, preferably an elongate body.

21. A process according to any one of claims 15 to 20, wherein the preform is formed as a strip, sheet, wire, rod or bar.

22. A process according to any one of claims 15 to 21, wherein the heat and compressive load is applied to the application area of the preform immediately after formation of the application area of the preform by cold spray deposition.

23. A process according to any preceding claim, wherein the cold spray deposition preform comprises a metal or alloy thereof, preferably at least one of titanium, copper, aluminium, iron, scandium, nickel, magnesium, tantalum or an alloy thereof.

24. A process according to any preceding claim, wherein the cold spray deposition preform comprises a mixture of at least two different powders.

25. An apparatus configured to produce a product having a wrought structure from a cold spray deposition preform having a consolidated particle structure, comprising:

a compressive load applicator configured to simultaneously apply heat and a compressive load to an application area of the cold spray deposition preform,

wherein the compressive load applicator applies the compressive load laterally to the application area in a direction that is substantially perpendicular to the tangential plane of the application area or point,

and wherein the applied compressive load and heat raises the temperature of the material of the preform in the application area to between the recrystallisation temperature and the melting point of the material to transform the consolidated particle structure of the cold spray deposition preform into a wrought structure.

26. An apparatus according to claim 25, wherein the heat is applied by a rapid heating technique, preferably at least one of: current, induction heating or laser heating.

27. An apparatus according to claim 25 or 26, wherein the heat is applied using current comprising at least one of alternating current or pulsed direct current.

28. An apparatus according to claims 27, wherein the compressive load applicator is configured to provide a current having:

current density of the applied current is from 500 to 2000 A/mm^2, preferably from 800 to 1500 A/mm^2, more preferably 1000 to 1100 A/mm^2.

29. An apparatus according to any one of claims 25 to 28, wherein thecompressive load applicator can apply a load of from 10 to 100 kg/m^2, preferably from 20 to 60 kg/m^2 to the application area.

30. An apparatus according to any one of claims 25 to 29, wherein the compressive load applicator comprises at least one roller configured to compressively engage the preform.

31. An apparatus according to claim 30, further comprising at least two rollers, between which the preform is fed and compressed.

32. An apparatus according to claim 30 or 31, wherein at least one roller is configured to apply heat, preferably current, to the preform.

33. An apparatus according to claim 30, 31 or 32, wherein at least a portion of the rollers comprise a conductive material.

34. An apparatus according to any one of claims 30 to 33, wherein at least one roller includes a cooling system or arrangement.

35. An apparatus according to any one of claims 25 to 34, further including a cold spray deposition apparatus for forming the cold spray deposition preform on a deposition surface.

36. An apparatus according to claim 35 when dependent on any one of claims 30 to 34, wherein the preform is formed on the surface of at least one of the rollers prior to being compressed by said rollers.

37. An apparatus according to claim 35 or 36, wherein the preform is formed on or about a feed axis along which the preform moves in the process.