CLAIMS

What is claimed is:

1. A method of processing an alloy workpiece to reduce thermal cracking, the method comprising:

spraying a metallic coating material onto at least a portion of a surface of an alloy workpiece to form a surface coating metallurgically bonded to the alloy workpiece;

wherein the surface coating is more ductile than the alloy workpiece; and

wherein the surface coating reduces heat loss from the alloy workpiece.

2. The method of claim 1, wherein the alloy workpiece is a generally cylindrical alloy workpiece and the method comprises:

spraying the metallic coating material onto at least a portion of a circumferential surface of the alloy workpiece to form the surface coating metallurgically bonded to the alloy workpiece.

3. The method of claim 1 or 2, wherein the alloy workpiece is rotated about a long axis of the workpiece during the spraying of the metallic coating material onto at least a portion of the circumferential surface of the alloy workpiece.

4. The method of claim 1, wherein the metallic coating material comprises particles selected from stainless steel particles and nickel base alloy particles.

5. The method of claim 1, wherein the metallic coating material comprises particles of at least one austenitic stainless steel stainless selected from the group consisting of Type 304 stainless steel (UNS No. S30400), Type 304 L stainless steel (UNS No. S30403), Type 316 stainless steel (UNS No. S31600), and Type 316L stainless steel (UNS No. S31603).

6. The method of claim 1, herein the metallic coating material comprises particles of at least one nickel base alloy selected from the group consisting of alloy 600 (UNS No. N06600) and alloy 625 (UNS No. N06625).

7. The method of claim 1, wherein spraying a metallic coating material onto at least a portion of the circumferential surface comprises spraying the metallic coating material onto at least a portion of the circumferential surface of the alloy workpiece at a temperature less than the melting point of the metallic coating material and the melting point of the alloy workpiece.

8. The method of claim 7, wherein spraying a metallic coating material onto at least a portion of the circumferential surface comprises spraying solid metallic particles onto the circumferential surface.

9. The method of claim 7, wherein the metallic coating material comprises solid metallic particles.

10. The method of claim 1, wherein spraying a metallic coating material onto at least a portion of the circumferential surface comprises:

spraying the metallic coating material onto at least a portion of the circumferential surface of the alloy workpiece at a temperature greater than or equal to the melting point of the metallic coating material and less than the melting point of the alloy workpiece.

11. The method of claim 10, wherein spraying a metallic coating material onto at least a portion of the circumferential surface comprises at least one of semi-molten metallic particles and molten metallic droplets onto the circumferential surface.

12. The method of claim 10, wherein the metallic coating material comprises at least one of semi-molten metallic particles and molten metallic droplets.

13. The method claim 1, further comprising, prior to spraying a metallic coating material onto at least a portion of the circumferential surface:

heating at least a portion of the circumferential surface of the alloy workpiece to a temperature greater than 2000°F.

14. The method of claim 1, wherein the alloy workpiece comprises a material selected from the group consisting of a nickel base alloy, a nickel base superalloy, an iron base alloy, a nickel-iron base alloy, a titanium base alloy, a titanium-nickel base alloy, and a cobalt base alloy.

15. The method of claim 1, wherein the alloy workpiece comprises a material selected from the group consisting of Alloy 718 (UNS No. N07718), Alloy 720 (UNS No. N07720), Rene 41™ alloy (UNS No. N07041), Rene 88™ alloy, Waspaloy® alloy (UNS No. N07001), and Inconel® 100 alloy.

16. The method of claim 1, wherein the metallic coating material and the alloy workpiece comprise a base metal selected from the group consisting of cobalt, iron, and nickel.

17. The method of claim 16, wherein the base metal of the metallic coating material is the same as the base metal of the alloy workpiece.

18. The method of claim 16, wherein the base metal of the metallic coating material differs from the base metal of the alloy workpiece.

19. The method of claim 1, further comprising, prior to spraying a metallic coating material onto at least a portion of the circumferential surface:

conditioning at least a portion of the circumferential surface of the alloy workpiece.

20. The method of claim 3, further comprising:

moving the alloy workpiece in a direction along the long axis of the alloy workpiece after completing at least one rotation of the alloy workpiece;

spraying the metallic coating material onto a subsequent portion of the circumferential surface of the alloy workpiece; and

repeating the moving and spraying until a desired metallic coating thickness is achieved.

21. The method of claim 1, further comprising:

spraying the metallic coating material onto at least a portion of a longitudinal end of the alloy workpiece to form a surface coating metallurgically bonded to the alloy workpiece.

22. The method of claim 1, further comprising, after spraying a metallic coating material onto at least a portion of the circumferential surface:

rolling the alloy workpiece to consolidate the metallic surface coating.

23. The method of claim 1, further comprising, after spraying a metallic coating material onto at least a portion of the circumferential surface:

hot working the alloy workpiece by at least one of forging and extruding to deform the alloy workpiece.

24. The method of claim 23, further comprising, after hot working the alloy workpiece:

removing at least a portion of the metallic surface coating from the alloy workpiece.

25. A method of processing an alloy workpiece to reduce thermal cracking, the method comprising:

inserting the alloy workpiece into a metallic canister, wherein the metallic canister has a lower coefficient of thermal expansion than the alloy workpiece and includes an

inner surface comprising a nickel-boron coating on at least a portion of the inner surface;

encapsulating the alloy workpiece in the metallic canister to provide a canned assembly;

removing at least a portion of gas from the interior of the canned assembly; and

heating the canned assembly to transient liquid phase bond the alloy workpiece to the metallic canister.

26. The method of claim 25, wherein the coefficient of thermal expansion of the metallic canister is at least 20 percent less than the coefficient of thermal expansion of the alloy workpiece.

27. The method of claim 25, wherein heating the canned assembly to transient liquid phase bond the alloy workpiece to the metallic canister metallurgically bonds the alloy workpiece to the metallic canister.

28. The method of claim 25, wherein encapsulating the alloy workpiece in the metallic canister comprises welding a metallic cover to an open end of the metallic canister.

29. The method of claim 28, further comprising:

providing an outlet in at least one of the metallic canister and metallic cover; and

applying a vacuum to the outlet to remove at least a portion of gas from the canned assembly.

30. The method of claim 25, wherein heating the canned assembly comprises heating the canned assembly to a homogenization temperature at which the alloy workpiece is homogenized and which is greater than or equal to the melting temperature of the nickel-boron coating.

31. The method of claim 30, wherein the homogenization temperature is 2100°F to 2200°F and the melting temperature of the nickel-boron coating is 1800°F to 2000°F.

32. The method of claim 30, wherein heating the canned assembly comprises:

heating the canned assembly at a temperature of 1850°F to 1930°F for up to two hours to melt the nickel-boron coating and, subsequently:

heating the canned assembly to a homogenization temperature of 2100°F to 2200°F.

33. The method of claim 30, wherein heating the canned assembly to a homogenization temperature of 2100°F to 2200°F comprises holding the canned assembly at the homogenization temperature for 36 hours to 48 hours.

34. The method of claim 25, wherein the alloy workpiece comprises a tapered, generally cylindrical outer surface and the metallic canister comprises a complementary tapered, generally cylindrical inner surface.

35. The method of claim 25, wherein metallic canister comprises a material selected from the group consisting of a nickel base alloy, an iron base alloy, and a stainless steel.

36. The method of claim 35, wherein the metallic canister comprises a material selected from Alloy 902 (UNS No. N09902) and Type 430 stainless steel (UNS No. S43000).

37. The method of claim 25, wherein the alloy workpiece comprises a material selected from the group consisting of Alloy 718 (UNS No. N07718), Alloy 720 (UNS No. N07720), Rene 41™ alloy (UNS No. N07041), Rene 88™ alloy, Waspaloy® alloy (UNS No. N07001), and Inconel® 100 alloy.

38. The method of claim 25, wherein the metallic canister and the alloy workpiece comprise a base metal selected from the group consisting of cobalt, iron, and nickel.

39. The method of claim 38, wherein the base metal of the metallic canister and the base metal of the alloy workpiece are different.

40. The method of claim 25, further comprising, prior to inserting the alloy workpiece into the metallic canister:

grinding at least a region of at least one of an outer surface of the alloy workpiece and an inner surface of the metallic canister.

41. The method of claim 25, further comprising, prior to inserting the alloy workpiece into the metallic canister:

heating the metallic canister.

42. The method of claim 25, wherein in the canned assembly, the alloy workpiece contacts at least a portion of the nickel-boron coating.

43. The method of claim 25, wherein the canned assembly lacks a gap between the alloy workpiece and the metallic canister.

44. The method of claim 25, further comprising:

simultaneously removing at least a portion of gas from an interior of the canned assembly and heating the canned assembly to transient liquid phase bond the alloy workpiece to the metallic canister.

45. The method of claim 25, further comprising:

depositing a nickel-boron coating on at least a portion of an inner surface of the metallic canister by electroless plating to form the nickel-boron coating.

46. The method of claim 45, wherein the nickel-boron coating comprises 3 to 5 weight percent boron.

47. The method of claim 45, wherein the nickel-boron coating has a thickness from 0.005 inches to 0.01 inches.

48. The method of claim 25, further comprising, after heating the canned assembly to transient liquid phase bond the alloy workpiece to the metallic canister:

hot working the canned assembly by at least one of forging and extruding to deform the canned assembly.

49. The method of claim 48, further comprising, after hot working the canned assembly:

removing at least a portion of the metallic canister from the deformed canned assembly.

CLAIMS

1. A method of processing an alloy workpiece to reduce thermal cracking, the method comprising:

spraying a metallic coating material onto at least a portion of a circumferential surface of a generally cylindrical alloy workpiece to form a surface coating metallurgically bonded to the alloy workpiece;

wherein the surface coating is more ductile than the alloy workpiece; and

wherein the surface coating reduces heat loss from the alloy workpiece.

2. The method of claim 1, wherein the alloy workpiece is rotated about a long axis of the workpiece during the spraying of the metallic coating material onto at least a portion of the circumferential surface of the alloy workpiece.

3. The method of claim 1, wherein the metallic coating material comprises particles selected from stainless steel particles and nickel base alloy particles.

4. The method of claim 1, wherein the metallic coating material comprises particles of at least one austenitic stainless steel stainless selected from the group consisting of Type 304 stainless steel (UNS No. S30400), Type 304 L stainless steel (UNS No. S30403), Type 316 stainless steel (UNS No. S31600), and Type 316L stainless steel (UNS No. S31603).

5. The method of claim 1, herein the metallic coating material comprises particles of at least one nickel base alloy selected from the group consisting of alloy 600 (UNS No. N06600) and alloy 625 (UNS No. N06625).

6. The method of claim 1, wherein spraying a metallic coating material onto at least a portion of the circumferential surface comprises spraying the metallic coating material onto at least a portion of the circumferential surface of the alloy workpiece at a temperature less than the melting point of the metallic coating material and the melting point of the alloy workpiece.

7. The method of claim 6, wherein spraying a metallic coating material onto at least a portion of the circumferential surface comprises spraying solid metallic particles onto the circumferential surface.

8. The method of claim 6, wherein the metallic coating material comprises solid metallic particles.

9. The method of claim 1, wherein spraying a metallic coating material onto at least a portion of the circumferential surface comprises:

spraying the metallic coating material onto at least a portion of the circumferential surface of the alloy workpiece at a temperature greater than or equal to the melting point of the metallic coating material and less than the melting point of the alloy workpiece.

10. The method of claim 9, wherein spraying a metallic coating material onto at least a portion of the circumferential surface comprises at least one of semi-molten metallic particles and molten metallic droplets onto the circumferential surface.

11. The method of claim 9, wherein the metallic coating material comprises at least one of semi-molten metallic particles and molten metallic droplets.

12. The method claim 1, further comprising, prior to spraying a metallic coating material onto at least a portion of the circumferential surface:

heating at least a portion of the circumferential surface of the alloy workpiece to a temperature greater than 2000° F.

13. The method of claim 1, wherein the alloy workpiece comprises a material selected from the group consisting of a nickel base alloy, a nickel base superalloy, an iron base alloy, a nickel-iron base alloy, a titanium base alloy, a titanium-nickel base alloy, and a cobalt base alloy.

14. The method of claim 1, wherein the alloy workpiece comprises a material selected from the group consisting of Alloy 718 (UNS No. N07718), Alloy 720 (UNS No. N07720), Rene 41.TM. alloy (UNS No. N07041), Rene 88.TM. alloy, Waspaloy.RTM. alloy (UNS No. N07001), and Inconel.RTM. 100 alloy.

15. The method of claim 1, wherein the metallic coating material and the alloy workpiece comprise a base metal selected from the group consisting of cobalt, iron, and nickel.

16. The method of claim 15, wherein the base metal of the metallic coating material is the same as the base metal of the alloy workpiece.

17. The method of claim 15, wherein the base metal of the metallic coating material differs from the base metal of the alloy workpiece.

18. The method of claim 1, further comprising, prior to spraying a metallic coating material onto at least a portion of the circumferential surface:

conditioning at least a portion of the circumferential surface of the alloy workpiece.

19. The method of claim 2, further comprising:

moving the alloy workpiece in a direction along the long axis of the alloy workpiece after completing at least one rotation of the alloy workpiece;

spraying the metallic coating material onto a subsequent portion of the circumferential surface of the alloy workpiece; and

repeating the moving and spraying until a desired metallic coating thickness is achieved.

20. The method of claim 1, further comprising:

spraying the metallic coating material onto at least a portion of a longitudinal end of the alloy workpiece to form a surface coating metallurgically bonded to the alloy workpiece.

21. The method of claim 1, further comprising, after spraying a metallic coating material onto at least a portion of the circumferential surface:

rolling the alloy workpiece to consolidate the metallic surface coating.

22. The method of claim 1, further comprising, after spraying a metallic coating material onto at least a portion of the circumferential surface:

hot working the alloy workpiece by at least one of forging and extruding to deform the alloy workpiece.

23. The method of claim 22, further comprising, after hot working the alloy workpiece:

removing at least a portion of the metallic surface coating from the alloy workpiece.

24. A method of processing an alloy workpiece to reduce thermal cracking, the method comprising:

inserting the alloy workpiece into a metallic canister, wherein the metallic canister has a lower coefficient of thermal expansion than the alloy workpiece and includes an inner surface comprising a nickel-boron coating on at least a portion of the inner surface;

encapsulating the alloy workpiece in the metallic canister to provide a canned assembly;

removing at least a portion of gas from the interior of the canned assembly; and

heating the canned assembly to transient liquid phase bond the alloy workpiece to the metallic canister.

25. The method of claim 24, wherein the coefficient of thermal expansion of the metallic canister is at least 20 percent less than the coefficient of thermal expansion of the alloy workpiece.

26. The method of claim 24, wherein heating the canned assembly to transient liquid phase bond the alloy workpiece to the metallic canister metallurgically bonds the alloy workpiece to the metallic canister.

27. The method of claim 24, wherein encapsulating the alloy workpiece in the metallic canister comprises welding a metallic cover to an open end of the metallic canister.

28. The method of claim 27, further comprising:

providing an outlet in at least one of the metallic canister and metallic cover; and

applying a vacuum to the outlet to remove at least a portion of gas from the canned assembly.

29. The method of claim 24, wherein heating the canned assembly comprises heating the canned assembly to a homogenization temperature at which the alloy workpiece is

homogenized and which is greater than or equal to the melting temperature of the nickel-boron coating.

30. The method of claim 29, wherein the homogenization temperature is 2100° F. to 2200° F. and the melting temperature of the nickel-boron coating is 1800° F. to 2000° F.

31. The method of claim 29, wherein heating the canned assembly comprises:

heating the canned assembly at a temperature of 1850° F. to 1930° F. for up to two hours to melt the nickel-boron coating and, subsequently:

heating the canned assembly to a homogenization temperature of 2100° F. to 2200° F.

32. The method of claim 29, wherein heating the canned assembly to a homogenization temperature of 2100° F. to 2200° F. comprises holding the canned assembly at the homogenization temperature for 36 hours to 48 hours.

33. The method of claim 24, wherein the alloy workpiece comprises a tapered, generally cylindrical outer surface and the metallic canister comprises a complementary tapered, generally cylindrical inner surface.

34. The method of claim 24, wherein metallic canister comprises a material selected from the group consisting of a nickel base alloy, an iron base alloy, and a stainless steel.

35. The method of claim 34, wherein the metallic canister comprises a material selected from Alloy 902 (UNS No. N09902) and Type 430 stainless steel (UNS No. S43000).

36. The method of claim 24, wherein the alloy workpiece comprises a material selected from the group consisting of Alloy 718 (UNS No. N07718), Alloy 720 (UNS No. N07720), Rene 41.TM. alloy (UNS No. N07041), Rene 88.TM. alloy, Waspaloy.RTM. alloy (UNS No. N07001), and Inconel.RTM. 100 alloy.

37. The method of claim 24, wherein the metallic canister and the alloy workpiece comprise a base metal selected from the group consisting of cobalt, iron, and nickel.

38. The method of claim 37, wherein the base metal of the metallic canister and the base metal of the alloy workpiece are different.

39. The method of claim 24, further comprising, prior to inserting the alloy workpiece into the metallic canister:

grinding at least a region of at least one of an outer surface of the alloy workpiece and an inner surface of the metallic canister.

40. The method of claim 24, further comprising, prior to inserting the alloy workpiece into the metallic canister:

heating the metallic canister.

41. The method of claim 24, wherein in the canned assembly, the alloy workpiece contacts at least a portion of the nickel-boron coating.

42. The method of claim 24, wherein the canned assembly lacks a gap between the alloy workpiece and the metallic canister.

43. The method of claim 24, further comprising:

simultaneously removing at least a portion of gas from an interior of the canned assembly and heating the canned assembly to transient liquid phase bond the alloy workpiece to the metallic canister.

44. The method of claim 24, further comprising:

depositing a nickel-boron coating on at least a portion of an inner surface of the metallic canister by electroless plating to form the nickel-boron coating.

45. The method of claim 44, wherein the nickel-boron coating comprises 3 to 5 weight percent boron.

46. The method of claim 44, wherein the nickel-boron coating has a thickness from 0.005 inches to 0.01 inches.

47. The method of claim 24, further comprising, after heating the canned assembly to transient liquid phase bond the alloy workpiece to the metallic canister:

hot working the canned assembly by at least one of forging and extruding to deform the canned assembly.

48. The method of claim 47, further comprising, after hot working the canned assembly:

removing at least a portion of the metallic canister from the deformed canned assembly.

49. A method of processing an alloy workpiece to reduce thermal cracking, the method comprising:

spraying a metallic coating material onto at least a portion of a surface of an alloy workpiece to form a surface coating metallurgically bonded to the alloy workpiece;

wherein the surface coating is more ductile than the alloy workpiece;

wherein the surface coating reduces heat loss from the alloy workpiece; and

wherein the alloy workpiece is rotated about a long axis of the workpiece during the spraying of the metallic coating material onto at least a portion of the surface of the alloy workpiece.

50. The method of claim 49, wherein the metallic coating material comprises particles selected from stainless steel particles and nickel base alloy particles.

51. The method of claim 49, wherein the metallic coating material comprises particles of at least one austenitic stainless steel stainless selected from the group consisting of Type 304 stainless steel (UNS No. S30400), Type 304 L stainless steel (UNS No. S30403), Type 316 stainless steel (UNS No. S31600), and Type 316L stainless steel (UNS No. S31603).

52. The method of claim 49, wherein the metallic coating material comprises particles of at least one nickel base alloy selected from the group consisting of alloy 600 (UNS No. N06600) and alloy 625 (UNS No. N06625).

53. The method claim 49, further comprising, prior to spraying a metallic coating material onto at least a portion of the surface:

heating at least a portion of the surface of the alloy workpiece to a temperature greater than 2000°. F.

54. The method of claim 49, wherein the alloy workpiece comprises a material selected from the group consisting of a nickel base alloy, a nickel base superalloy, an iron base alloy, a nickel-iron base alloy, a titanium base alloy, a titanium-nickel base alloy, and a cobalt base alloy.

55. The method of claim 49, wherein the alloy workpiece comprises a material selected from the group consisting of Alloy 718 (UNS No. N07718), Alloy 720 (UNS No. N07720), Rene 41.TM. alloy (UNS No. N07041), Rene 88.TM. alloy, Waspaloy.RTM. alloy (UNS No. N07001), and Inconel.RTM. 100 alloy.

56. The method of claim 49, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying the metallic coating material onto at least a portion of the surface of the alloy workpiece at a temperature less than the melting point of the metallic coating material and the melting point of the alloy workpiece.

57. The method of claim 49, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying solid metallic particles onto the surface.

58. The method of claim 49, wherein spraying a metallic coating material onto at least a portion of the surface comprises:

spraying the metallic coating material onto at least a portion of the surface of the alloy workpiece at a temperature greater than or equal to the melting point of the metallic coating material and less than the melting point of the alloy workpiece.

59. The method of claim 49, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying at least one of semi-molten metallic particles and molten metallic droplets onto the surface.

60. A method of processing an alloy workpiece to reduce thermal cracking, the method comprising:

spraying a metallic coating material onto at least a portion of a surface of an alloy workpiece to form a surface coating metallurgically bonded to the alloy workpiece;

wherein the surface coating is more ductile than the alloy workpiece;

wherein the surface coating reduces heat loss from the alloy workpiece; and

wherein the metallic coating material comprises particles selected from stainless steel particles and nickel base alloy particles.

61. The method of claim 60, wherein the metallic coating material comprises particles of at least one austenitic stainless steel stainless selected from the group consisting of Type 304 stainless steel (UNS No. S30400), Type 304 L stainless steel (UNS No. S30403), Type 316 stainless steel (UNS No. S31600), and Type 316L stainless steel (UNS No. S31603).

62. The method of claim 60, wherein the metallic coating material comprises particles of at least one nickel base alloy selected from the group consisting of alloy 600 (UNS No. N06600) and alloy 625 (UNS No. N06625).

63. The method of claim 60, wherein the alloy workpiece comprises a material selected from the group consisting of a nickel base alloy, a nickel base superalloy, an iron base alloy, a nickel-iron base alloy, a titanium base alloy, a titanium-nickel base alloy, and a cobalt base alloy.

64. The method of claim 60, wherein the alloy workpiece comprises a material selected from the group consisting of Alloy 718 (UNS No. N07718), Alloy 720 (UNS No. N07720), Rene 41.TM. alloy (UNS No. N07041), Rene 88.TM. alloy, Waspaloy.RTM. alloy (UNS No. N07001), and Inconel.RTM. 100 alloy.

65. The method of claim 60, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying the metallic coating material onto at least a portion of the surface of the alloy workpiece at a temperature less than the melting point of the metallic coating material and the melting point of the alloy workpiece.

66. The method of claim 60, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying solid metallic particles onto the surface.

67. The method of claim 60, wherein spraying a metallic coating material onto at least a portion of the surface comprises:

spraying the metallic coating material onto at least a portion of the surface of the alloy workpiece at a temperature greater than or equal to the melting point of the metallic coating material and less than the melting point of the alloy workpiece.

68. The method of claim 60, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying at least one of semi-molten metallic particles and molten metallic droplets onto the surface.

69. The method claim 60, further comprising, prior to spraying a metallic coating material onto at least a portion of the surface:

heating at least a portion of the surface of the alloy workpiece to a temperature greater than 2000° F.

70. A method of processing an alloy workpiece to reduce thermal cracking, the method comprising:

spraying a metallic coating material onto at least a portion of a surface of an alloy workpiece to form a surface coating metallurgically bonded to the alloy workpiece;

wherein the surface coating is more ductile than the alloy workpiece;

wherein the surface coating reduces heat loss from the alloy workpiece; and

wherein prior to spraying a metallic coating material onto at least a portion of the surface, at least a portion of the surface is heated to a temperature greater than 2000° F.

71. The method of claim 70, wherein the metallic coating material comprises particles of at least one austenitic stainless steel stainless selected from the group consisting of Type 304 stainless steel (UNS No. S30400), Type 304 L stainless steel (UNS No. S30403), Type 316 stainless steel (UNS No. S31600), and Type 316L stainless steel (UNS No. S31603).

72. The method of claim 70, wherein the metallic coating material comprises particles of at least one nickel base alloy selected from the group consisting of alloy 600 (UNS No. N06600) and alloy 625 (UNS No. N06625).

73. The method of claim 70, wherein the alloy workpiece comprises a material selected from the group consisting of a nickel base alloy, a nickel base superalloy, an iron base alloy, a nickel-iron base alloy, a titanium base alloy, a titanium-nickel base alloy, and a cobalt base alloy.

74. The method of claim 70, wherein the alloy workpiece comprises a material selected from the group consisting of Alloy 718 (UNS No. N07718), Alloy 720 (UNS No. N07720), Rene 41.TM. alloy (UNS No. N07041), Rene 88.TM. alloy, Waspaloy.RTM. alloy (UNS No. N07001), and Inconel.RTM. 100 alloy.

75. The method of claim 70, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying the metallic coating material onto at least a portion of the surface of the alloy workpiece at a temperature less than the melting point of the metallic coating material and the melting point of the alloy workpiece.

76. The method of claim 70, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying solid metallic particles onto the surface.

77. The method of claim 70, wherein spraying a metallic coating material onto at least a portion of the surface comprises:

spraying the metallic coating material onto at least a portion of the surface of the alloy workpiece at a temperature greater than or equal to the melting point of the metallic coating material and less than the melting point of the alloy workpiece.

78. The method of claim 70, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying at least one of semi-molten metallic particles and molten metallic droplets onto the surface.

79. A method of processing an alloy workpiece to reduce thermal cracking, the method comprising:

spraying a metallic coating material onto at least a portion of a surface of an alloy workpiece to form a surface coating metallurgically bonded to the alloy workpiece;

wherein the alloy workpiece comprises a material selected from the group consisting of a nickel base alloy, a nickel base superalloy, an iron base alloy, a nickel-iron base alloy, a titanium base alloy, a titanium-nickel base alloy, and a cobalt base alloy;

wherein the surface coating is more ductile than the alloy workpiece; and

wherein the surface coating reduces heat loss from the alloy workpiece.

80. The method of claim 79, wherein the alloy workpiece comprises a material selected from the group consisting of Alloy 718 (UNS No. N07718), Alloy 720 (UNS No. N07720), Rene 41.TM. alloy (UNS No. N07041), Rene 88.TM. alloy, Waspaloy.RTM. alloy (UNS No. N07001), and Inconel.RTM. 100 alloy.

81. The method of claim 79, wherein the metallic coating material comprises particles of at least one austenitic stainless steel stainless selected from the group consisting of Type 304 stainless steel (UNS No. S30400), Type 304 L stainless steel (UNS No. S30403), Type 316 stainless steel (UNS No. S31600), and Type 316L stainless steel (UNS No. S31603).

82. The method of claim 79, wherein the metallic coating material comprises particles of at least one nickel base alloy selected from the group consisting of alloy 600 (UNS No. N06600) and alloy 625 (UNS No. N06625).

83. The method of claim 79, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying the metallic coating material onto at least a portion of the surface of the alloy workpiece at a temperature less than the melting point of the metallic coating material and the melting point of the alloy workpiece.

84. The method of claim 79, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying solid metallic particles onto the surface.

85. The method of claim 79, wherein spraying a metallic coating material onto at least a portion of the surface comprises:

spraying the metallic coating material onto at least a portion of the surface of the alloy workpiece at a temperature greater than or equal to the melting point of the metallic coating material and less than the melting point of the alloy workpiece.

86. The method of claim 79, wherein spraying a metallic coating material onto at least a portion of the surface comprises spraying at least one of semi-molten metallic particles and molten metallic droplets onto the surface.