Claims

1. An austenitic stainless steel consisting of, in % weight,

up to 0.20 C,

2.0-9.0 Mn,

up to 0.50 Si,

16.0-23.0 Cr,

1.0-3.0 Ni,

up to 3.0 Mo,

0.1-0.35 N,

0.05 to 4.0 W,

up to 0.01 B,

up to 1.0 Co,

iron and

impurities,

the steel having a ferrite number of at least 3 up to less than 10, and a MD_{30} value less than 20°C.

2. The austenitic stainless steel according to claim 1, wherein:

$$0.5 \leq (Mo + W/2) \leq 5.0.$$

3. The austenitic stainless steel according to claim 1, having a PRE_w value of greater than 22.

4. The austenitic stainless steel of claim 1, having a PRE_w value greater than 22 and up to 30.

5. The austenitic stainless steel of claim 1, having a ferrite number of 3 up to 5.

6. The austenitic stainless steel of claim 1, having a MD_{30} value less than -10°C.

7. The austenitic stainless steel of claim 1, wherein C is limited to up to 0.08.

8. The austenitic stainless steel of claim 1, wherein Si is limited to 0.2 to 0.50.

9. The austenitic stainless steel of claim 1, wherein Mn is limited to 2.0-8.0.

10. The austenitic stainless steel of claim 1, wherein Mn is limited to 3.0-6.0.

11. The austenitic stainless steel of claim 1, wherein Cr is limited to 16.0-22.0.

12. The austenitic stainless steel of claim 1, wherein Cr is limited to 17.0-21.0.

13. The austenitic stainless steel of claim 1, wherein Cr is limited to 17.0-20.0.

14. The austenitic stainless steel of claim 1, wherein Cr is limited to 16.0-18.0.

15. The austenitic stainless steel of claim 1, wherein N is limited to 0.1-0.30.

16. The austenitic stainless steel of claim 1, wherein N is limited to 0.14-0.30.

17. The austenitic stainless steel of claim 1, wherein Mo is limited to 0.40-3.0.

18. The austenitic stainless steel of claim 1, wherein Mo is limited to 0.5-2.0.

19. The austenitic stainless steel of claim 1, wherein B is limited to up to 0.008.

20. The austenitic stainless steel of claim 1, wherein W is limited to 0.05-0.60.

21. The austenitic stainless steel of claim 1, wherein Mo is limited to 0.40-2.0 and having a MD_{30} value less than -10°C.

22. The austenitic stainless steel of claim 1, wherein Mo is limited to 0.40-2.0 and wherein $0.5 \leq (Mo + W/2) \leq 4.0$.

23. The austenitic stainless steel of claim 19, having a MD_{30} value less than -10°C.

24. The austenitic stainless steel according to claim 1, consisting of, in % weight,

up to 0.10 C,

2.0-8.0 Mn,

up to 0.50 Si,

16.0-22.0 Cr,

1.0-3.0 Ni,

0.40-2.0 Mo,

0.12-0.30 N,

0.050-0.60 W,

up to 1.0 Co,

up to 0.008 B,

iron and

impurities comprising up to 0.04 P and up to 0.03 S,

the steel having a ferrite number of at least 3 up to less than 10 and a MD_{30} value less than 20°C.

25. The austenitic stainless steel of claim 24, having a MD_{30} value less than -10°C.

26. The austenitic stainless steel of claim 24, having a PRE_w value greater than 22 up to 30.

27. The austenitic stainless steel according to claim 1, consisting of, in % weight,

up to 0.08 C,

3.0-6.0 Mn,

up to 0.5 Si,

17.0-21.0 Cr,

1.0-3.0 Ni,

0.50-2.0 Mo,

0.14-0.30 N,

up to 1.0 Co,

0.05-0.60 W,

iron and

impurities comprising up to 0.05 P and up to 0.03 S,

the steel having a ferrite number of at least 3 up to less than 10 and a MD_{30} value of less than 20°C.

28. The austenitic stainless steel of claim 27 having a MD_{30} value less than -10°C.

29. The austenitic stainless steel of claim 27, having a PRE_w value greater than 22 and up to 30.

30. An austenitic stainless steel consisting of, in % weight,

up to 0.20 C,

2.0-9.0 Mn,

up to 0.50 Si,

16.0-23.0 Cr,

1.0-3.0 Ni,

0.40-3.0 Mo,

0.1-0.30 N,

0.05 to 4.0 W,

up to 0.01 B,

up to 1.0 Co,

iron and

impurities,

the steel having a ferrite number at least 3 up to 10, a PRE_w value greater than 22 up to 30, and a MD_{30} value of less than 20°C.

31. The austenitic stainless steel of claim 30, wherein Mo is limited to 0.40-2.0 and wherein $0.5 \leq (Mo + W/2) \leq 4.0$.

32. The austenitic stainless steel of claim 30, wherein the Si is limited to 0.2-0.5 and Mn is limited to 6.0-9.0.

33. An article of manufacture including an austenitic stainless steel consisting of, in % weight,

up to 0.20 C,

2.0-9.0 Mn,

up to 0.50 Si,

16.0-23.0 Cr,

1.0-3.0 Ni,

up to 3.0 Mo,

0.1-0.35 N,

0.05 to 4.0 W,

up to 0.01 B,

up to 1.0 Co,

iron and

impurities,

the steel having a ferrite number of at least 3 up to less than 10, and a MD_{30} value less than 20°C.

34. The article of manufacture of claim 33, wherein the austenitic stainless steel has a MD_{30} value less than -10°C.

35. The article of manufacture of claim 33, wherein in the austenitic stainless steel Mo is limited to 0.40-2.0 Mo.

36. The article of manufacture of claim 33, wherein the article is adapted for use in at least one of a low temperature environment and a cryogenic environment.

37. The article of manufacture of claim 33, wherein the article is selected from the group consisting of a corrosion resistant article, a corrosion resistant architectural panel, a flexible connector, a bellows, a tube, a pipe, a chimney liner, a flue liner, a plate frame heat exchanger part, a condenser part, a part for pharmaceutical processing equipment, a sanitary part, and a part for ethanol production or processing equipment.

38. The article of manufacture of claim 34 including an austenitic stainless steel consisting of, in % weight,

up to 0.20 C,

2.0-9.0 Mn,

up to 0.50 Si,

16.0-23.0 Cr,

1.0-3.0 Ni,

0.40-3.0 Mo,

0.1-0.30 N,

0.05 to 4.0 W,

up to 0.01 B,

up to 1.0 Co,

iron and

impurities,

the steel having a ferrite number at least 3 up to 10, a PRE_w value greater than 22 up to 30, and a MD_{30} value of less than 20°C.

39. An austenitic stainless steel consisting of, in weight percent:

up to 0.20 C,

2.0-9.0 Mn,

up to 1.0 Si,

16.0-23.0 Cr,

1.0-3.0 Ni,

up to 2.0 Mo,

0.1-0.35 N,

0.05 to 4.0 W,

up to 0.01 B,

up to 1.0 Co,

iron and

impurities,

the austenitic stainless steel having a ferrite number of at least 3 up to less than 10, and a MD_{30} value less than 20°C.

40. The austenitic stainless steel according to claim 39, wherein: $0.5 \leq (Mo+W/2) \leq 5.0$.

41. The austenitic stainless steel according to claim 39, having a PRE_w value of greater than 22.

42. The austenitic stainless steel of claim 39, having a PRE_w value greater than 22 and up to 30.

43. The austenitic stainless steel of claim 39, having a ferrite number of 3 up to 5.

44. The austenitic stainless steel of claim 39, having a MD_{30} value less than -10°C.

45. The austenitic stainless steel of claim 39, wherein C is limited to up to 0.08.

46. The austenitic stainless steel of claim 39, wherein Mn is limited to 2.0-8.0.

47. The austenitic stainless steel of claim 39, wherein Mn is limited to 3.0-6.0.

48. The austenitic stainless steel of claim 39, wherein Cr is limited to 16.0-22.0.

49. The austenitic stainless steel of claim 39, wherein Cr is limited to 17.0-21.0.

50. The austenitic stainless steel of claim 39, wherein Cr is limited to 17.0-20.0.

51. The austenitic stainless steel of claim 39, wherein Cr is limited to 16.0-18.0.

52. The austenitic stainless steel of claim 39, wherein N is limited to 0.1-0.30.

53. The austenitic stainless steel of claim 39, wherein N is limited to 0.14-0.30.

54. The austenitic stainless steel of claim 39, wherein Mo is limited to 0.40-2.0.

55. The austenitic stainless steel of claim 39, wherein Mo is limited to 0.5-2.0.

56. The austenitic stainless steel of claim 39, wherein B is limited to up to 0.008.

57. The austenitic stainless steel of claim 39, wherein W is limited to 0.05-0.60.

58. The austenitic stainless steel of claim 39, wherein Mo is limited to 0.40-2.0 and having a MD_{30} value less than -10°C.

59. The austenitic stainless steel of claim 39, wherein Mo is limited to 0.40-2.0 and wherein $0.5 \leq (Mo+W/2) \leq 4.0$.

60. The austenitic stainless steel of claim 59, having a MD_{30} value less than -10°C.

61. An austenitic stainless steel consisting of, weight percent:

up to 0.20 C,

2.0-9.0 Mn,

up to 1.0 Si,

16.0-23.0 Cr,

1.0-3.0 Ni,

0.40-2.0 Mo,

0.1-0.30 N,

0.05 to 4.0 W,

up to 0.01 B,

up to 1.0 Co,

iron and

impurities,

the austenitic stainless steel having a ferrite number at least 3 up to 10, a PRE_w value greater than 22 up to 30, and a MD_{30} value of less than 20°C.

62. The austenitic stainless steel of claim 61, wherein Mo is limited to 0.40-2.0 and wherein $0.5(Mo+W/2) \leq 4.0$.

63. The austenitic stainless steel of claim 61, wherein Mn is limited to 6.0-9.0.

64. An article of manufacture including an austenitic stainless steel consisting of, in weight percent:

up to 0.20 C,

2.0-9.0 Mn,

up to 1.0 Si,

16.0-23.0 Cr,

1.0-3.0 Ni,

up to 2.0 Mo,

0.1-0.35 N,

0.05 to 4.0 W,

up to 0.01 B,

up to 1.0 Co,

iron and

impurities, the austenitic stainless steel having a ferrite number of at least 3 up to less than 10, and a MD_{30} value less than 20°C.

65. The article of manufacture of claim 64, wherein the austenitic stainless steel has a MD_{30} value less than -10°C.

66. The article of manufacture of claim 64, wherein in the austenitic stainless steel Mo is limited to 0.40-2.0 Mo.

67. The article of manufacture of claim 64, wherein the article is adapted for use in at least one of a low temperature environment and a cryogenic environment.

68. The article of manufacture of claim 64, wherein the article is selected from the group consisting of a corrosion resistant article, a corrosion resistant architectural panel, a flexible connector, a bellows, a tube, a pipe, a chimney liner, a flue liner, a plate

frame heat exchanger part, a condenser part, a part for pharmaceutical processing equipment, a sanitary part, and a part for ethanol production or processing equipment.

69. The austenitic stainless steel of claim 39, wherein the ferrite number is calculated according to the following equation, in which elemental contents are weight percentages:

$$\text{ferrite number} = 3.34 \times (Cr + 1.5Si + Mo + 2Ti + 0.5Cb)$$

$$- 2.46 \times (Ni + 30N + 30C + 0.5Mn + 0.5Cu) - 28.6 .$$

70. The austenitic stainless steel of claim 61, wherein the ferrite number is calculated according to the following equation, in which elemental contents are weight percentages:

$$\text{ferrite number} = 3.34 \times (Cr + 1.5Si + Mo + 2Ti + 0.5Cb)$$

$$- 2.46 \times (Ni + 30N + 30C + 0.5Mn + 0.5Cu) - 28.6 .$$

71. The article of manufacture of claim 64, wherein the ferrite number of the austenitic stainless steel is calculated according to the following equation, in which elemental contents are weight percentages:

$$\text{ferrite number} = 3.34 \times (Cr + 1.5Si + Mo + 2Ti + 0.5Cb)$$

$$- 2.46 \times (Ni + 30N + 30C + 0.5Mn + 0.5Cu) - 28.6 .$$