CLAIMS

1. A method for producing a stainless steel diffusion-bonded product, comprising:

providing a dual phase steel having an austenite transformation starting temperature Ac_1 point of 650 to 950 °C during the temperature elevation and having an austenite + ferrite dual-phase temperature region in the range of 880 °C or higher and another stainless steel; and

diffusion bonding the at least one dual phase steel to the other stainless steel to unify the materials together by direct contact without using any insert material, the diffusion bonding being advanced under conditions such that the contact surface pressure is in the range of 1.0 MPa or less and the heating temperature is in the range of from 880 to 1,080 °C while being accompanied by the movement of grain boundary caused when the ferrite phase in the dual-phase steel undergoes transformation to an austenite phase.

2. A method for producing a stainless steel diffusion-bonded product, comprising:

providing a dual phase steel having a dual-phase temperature region in the range of 880 °C or higher and another stainless steel, the providing step further comprising providing the dual phase steel with a chemical composition (A) comprising from 0.0001 to 0.15% of C, from 0.001 to 1.0% of Si, from 0.001 to 1.0% of Mn, from 0.05 to 2.5% of Ni, from 13.0 to 18.5% of Cr, from 0 to 0.2% of Cu, from 0 to 0.5% of Mo, from 0 to 0.05% of Al, from 0 to 0.2% of Ti, from 0 to 0.2% of Nb, from 0 to 0.2% of V, from 0 to 0.01% of B, and from 0.005 to 0.1% of N, all in terms of percentage by mass, with the balance of Fe and unavoidable impurities and having the composition satisfy a formula (1) where X is 650 to 950 and X is defined by the formula (1) wherein

X value = 35(Cr + 1.72Mo + 2.09Si + 4.86Nb + 8.29V + 1.77Ti + 21.4Al + 40.0B - 7.14C - 8.0N - 3.2 - 8Ni - 1.89Mn - 0.51Cu) + 310 (1); and

diffusion bonding the at least one dual phase steel to the

other stainless steel to unify the materials together by direct contact without using any insert material, the diffusion bonding being advanced under conditions such that the contact surface pressure is in the range of 1.0 MPa or less and the heating temperature is in the range of from 880 to 1,080 °C while being accompanied by the movement of grain boundary caused when the ferrite phase in the dual-phase steel undergoes transformation to an austenite phase.

3. A method for producing a stainless steel diffusion-bonded product, comprising: providing a dual phase steel having a dual-phase temperature region in the range of 880 °C or higher and another stainless steel, the providing step further comprising providing the dual phase steel with a chemical composition (A) comprising from 0.0001 to 0.15% of C, from 0.001 to 1.0% of Si, from 0.001 to 1.0% of Mn, from 0.05 to 2.5% of Ni, from 13.0 to 18.5% of Cr, from 0 to 0.2% of Cu, from 0 to 0.5% of Mo, from 0 to 0.05% of Al, from 0 to 0.2% of Ti, from 0 to 0.2% of Nb, from 0 to 0.2% of V, from 0 to 0.01% of B, and from 0.005 to 0.1% of N, all in terms of percentage by mass, with the balance of Fe and unavoidable impurities and having the composition satisfy a formula (1) where X is 650 to 950 and X is defined by the formula (1) wherein

X value = 35(Cr + 1.72Mo + 2.09Si + 4.86Nb + 8.29V + 1.77Ti + 21.4Al + 40.0B -7.14C - 8.0N - 3.2 - 8Ni - 1.89Mn - 0.51Cu) + 310 (1); and

providing the other stainless steel with a chemical composition (B) comprising from 0.0001 to 0.15% of C, from 0.001 to 4.0% of Si, from 0.001 to 2.5% of Mn, from 0.001 to 0.045% of P, from 0.0005 to 0.03% of S, from 6.0 to 28.0% of Ni, from 15.0 to 26.0% of Cr, from 0 to 7.0% of Mo, from 0 to 3.5% of Cu, from 0 to 1.0% of Nb, from 0 to 1.0% of Ti, from 0 to 0.1% of Al, from 0 to 0.3% of N, from 0 to 0.01% of B, from 0 to 0.5% of V, from 0 to 0.3% of W, and from 0 to 0.1% of the total of Ca, Mg, Y, and REM (rare earth elements), all in terms of percentage by mass, with the balance of Fe and unavoidable impurities; and

diffusion bonding the dual phase steel and the other

stainless steel with each other to unify the materials together by direct contact without using any insert material, the diffusion bonding being advanced under conditions such that the contact surface pressure is in the range of 1.0 MPa or less and the heating temperature is in the range of from 880 to 1,080 ºC while being accompanied by the movement of grain boundary caused when the ferrite phase in the dual-phase steel undergoes transformation to an austenite phase.

4. A method for producing a stainless steel diffusion-bonded product, comprising:

providing a dual phase steel having a dual-phase temperature region in the range of 880 ºC or higher and another stainless steel, the providing step further comprising providing the dual phase steel with a chemical composition (A) comprising from 0.0001 to 0.15% of C, from 0.001 to 1.0% of Si, from 0.001 to 1.0% of Mn, from 0.05 to 2.5% of Ni, from 13.0 to 18.5% of Cr, from 0 to 0.2% of Cu, from 0 to 0.5% of Mo, from 0 to 0.05% of Al, from 0 to 0.2% of Ti, from 0 to 0.2% of Nb, from 0 to 0.2% of V, from 0 to 0.01% of B, and from 0.005 to 0.1% of N, all in terms of percentage by mass, with the balance of Fe and unavoidable impurities, and having the composition satisfy a formula (1) where X is 650 to 950 and X is defined by the formula (1) wherein

X value = 35(Cr + 1.72Mo + 2.09Si + 4.86Nb + 8.29V + 1.77Ti + 21.4Al + 40.0B - 7.14C-8.0N-3.2- 8Ni-1.89Mn-0.51Cu) + 310 (1), and

providing the other stainless steel with a chemical composition (C) comprising from 0.0001 to 0.15% of C, from 0.001 to 1.2% of Si, from 0.001 to 1.2% of Mn, from 0.001 to 0.04% of P, from 0.0005 to 0.03% of S, from 0 to 0.6% of Ni, from 11.5 to 32.0% of Cr, from 0 to 2.5% of Mo, from 0 to 1.0% of Cu, from 0 to 1.0% of Nb, from 0 to 1.0% of Ti, from 0 to 0.2% of Al, from 0 to 0.025% of N, from 0 to 0.01% of B, from 0 to 0.5% of V, from 0 to 0.3% of W, and from 0 to 0.1% of the total of Ca, Mg, Y, and REM (rare earth elements), all in terms of percentage by mass, with the balance of Fe and unavoidable impurities; and

diffusion bonding the dual phase steel to the other

stainless steel to unify the materials together by direct contact without using any insert material, the diffusion bonding being advanced under conditions such that the contact surface pressure is in the range of 1.0 MPa or less and the heating temperature is in the range of from 880 to 1,080 ºC while being accompanied by the movement of grain boundary caused when the ferrite phase in the dual-phase steel undergoes transformation to an austenite phase.

5. The method for producing a stainless steel diffusion-bonded product according to claim 2, wherein the dual-phase steel having the chemical composition (A) is a steel having a γmax represented by the formula (2) below of 20 to less than 100:

γmax = 420C – 11.5Si + 7Mn + 23Ni – 11.5Cr – 12Mo + 9Cu – 49Ti - 50Nb - 52Al + 470N + 189 (2).

6. The method for producing a stainless steel diffusion-bonded product according to claim 2, wherein the dual-phase steel having the chemical composition (A) is a steel having a γmax represented by the formula (2) below of 20 to less than 100, and the diffusion bonding is advanced under conditions such that the contact surface pressure is in the range of from 0.03 to 0.8 MPa and the heating temperature is in the range of from 880 to 1,030 ºC while being accompanied by the movement of grain boundary caused when the ferrite phase in the dual-phase steel undergoes transformation to an austenite phase:

γmax = 420C – 11.5Si + 7Mn + 23Ni – 11.5Cr – 12Mo + 9Cu – 49Ti - 50Nb - 52Al + 470N + 189 (2).

7. The method for producing a stainless steel diffusion-bonded product according to claim 3, wherein the dual-phase steel having the chemical composition (A) is a steel having a γmax represented by the formula (2) below of 20 to less than 100:

γmax = 420C – 11.5Si + 7Mn + 23Ni – 11.5Cr – 12Mo + 9Cu – 49Ti - 50Nb - 52Al + 470N + 189

(2).

8. The method for producing a stainless steel diffusion-bonded product according to claim 3, wherein the dual-phase steel having the chemical composition (A) is a steel having a γmax represented by the formula (2) below of 20 to less than 100, and the diffusion bonding is advanced under conditions such that the contact surface pressure is in the range of from 0.03 to 0.8 MPa and the heating temperature is in the range of from 880 to 1,030 ºC while being accompanied by the movement of grain boundary caused when the ferrite phase in the dual-phase steel undergoes transformation to an austenite phase:

γmax = 420C – 11.5Si + 7Mn + 23Ni – 11.5Cr – 12Mo + 9Cu – 49Ti - 50Nb - 52Al + 470N + 189 (2).

9. The method for producing a stainless steel diffusion-bonded product according to claim 4, wherein the dual-phase steel having the chemical composition (A) is a steel having a γmax represented by the formula (2) below of 20 to less than 100:

γmax = 420C – 11.5Si + 7Mn + 23Ni – 11.5Cr – 12Mo + 9Cu – 49Ti - 50Nb - 52Al + 470N + 189 (2).

10. The method for producing a stainless steel diffusion-bonded product according to claim 4, wherein the dual-phase steel having the chemical composition (A) is a steel having a γmax represented by the formula (2) below of 20 to less than 100, and the diffusion bonding is advanced under conditions such that the contact surface pressure is in the range of from 0.03 to 0.8 MPa and the heating temperature is in the range of from 880 to 1,030 ºC while being accompanied by the movement of grain boundary caused when the ferrite phase in the dual-phase steel undergoes transformation to an austenite phase:

γmax = 420C – 11.5Si + 7Mn + 23Ni – 11.5Cr – 12Mo + 9Cu – 49Ti - 50Nb - 52Al + 470N + 189 (2).