CLAIMS

1. A non-oriented electrical steel sheet having an inner layer defined as a region where a Si content is less than an average Si content in a total sheet thickness, and surface layers defined as regions where a Si content is greater than or equal to the average Si content in the total sheet thickness, the surface layers being provided on both sides of the inner layer, the non-oriented electrical steel sheet comprising a chemical composition containing:

Si; and

C: 0.020 mass% or less,

Mn: 0.010 mass% to 2.0 mass%, ~~and~~

S: 0.0100 mass% or less, and

at least one of Sn: 0.10 mass% or less and Sb: 0.10 mass% or less,

as average contents in the total sheet thickness, with the balance being Fe and inevitable impurities, wherein

each of the surface layers has an average Si content $[Si]_1$ of 2.5 mass% to 7.0 mass%,

the inner layer has an average Si content $[Si]_0$ of 1.5 mass% to 5.0 mass%,

ΔSi defined as the difference between the average Si content of the surface layers $[Si]_1$ and the average Si content of the inner layer $[Si]_0$, $[Si]_1 - [Si]_0$, is 1.0 mass% to 3.3 mass%,

an average content of Mn, in mass%, in the total sheet thickness, [Mn], and an average content of S, in mass%, in the total sheet thickness, [S], satisfy the following formula (2),

each of the surface layers has an in-plane tensile stress of 5 MPa to 50 M~~p~~Pa,

the non-oriented electrical steel sheet has a sheet thickness t of 0.0~~1~~5 mm to 0.35 mm,

the surface layers have a total thickness t_1 with a ratio t_1/t of the total thickness t_1 to the sheet thickness t being 0.~~1~~30 to 0.~~7~~50,

the non-oriented electrical steel sheet has an average N content [N] in the total sheet thickness of 40 ppm or less, and

an iron loss $W_{10/400}$ in W/kg at a maximum magnetic flux density of 1.0 T and a frequency of 400 Hz and the sheet thickness t in mm satisfy the following formula (1),~~:~~

the non-oriented electrical steel sheet has a texture where a ratio {100}/{111} of an integration degree of {100} plane to an integration degree of {111} plane is 51 % to 90 % in a cross section with Φ_2 = 45° of an orientation distribution function at a depth of 1/4 of the sheet thickness from a surface of the non-oriented electrical steel sheet,

$W_{10/400} \leq 8 + 30t$ ... (1),

$[Mn][S] \leq 0.0030$ ... (2).

2. The non-oriented electrical steel sheet according to claim 1, wherein the chemical composition further contains, as average contents in the total sheet thickness, at least one ~~selected from the group consisting~~ of

Al: 0.10 mass% or less~~,~~ and

P: 0.10 mass% or less~~,~~

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~~Sn: 0.10 mass% or less, and~~

~~Sb: 0.10 mass% or less~~.

3. The non-oriented electrical steel sheet according to claim 1 or 2, ~~further comprising a texture~~ wherein the ~~a~~ ratio {100}/{111} ~~of an integration degree of {100} plane to an integration degree of {111} plane~~ is 55 % to 90 % ~~in a cross section with Φ_2 = 45° of an orientation distribution function at a depth of 1/4 of the sheet thickness from a surface of the non-oriented electrical steel sheet~~.

~~4. The non-oriented electrical steel sheet according to any one of claims 1 to 3, wherein the chemical composition further satisfies the following formula (2):~~

~~[Mn][S] ≤ 0.0030 ... (2),~~

~~where [Mn] and [S] are average contents in mass% of Mn and S in the total sheet thickness, respectively.~~

~~5~~4. A method of producing ~~the~~ a non-oriented electrical steel sheet ~~according to any one of claims 1 to 4~~, the method comprising:

subjecting a steel sheet with a Si content of 1.5 mass% to 5.0 mass% to a siliconizing treatment in a $SiCl_4$ atmosphere at a siliconizing treatment temperature of 1000 °C or more and 1300 °C or less;

subjecting the steel sheet after the siliconizing treatment to a diffusion treatment in an N_2 atmosphere at a temperature of 950 °C or more and 1300 °C or less; and

cooling the steel sheet after the diffusion treatment under a set of conditions including an average cooling rate v_1 of 5 °C/s to 20 °C/s in a temperature range from the diffusion treatment temperature to 900 °C and an average cooling rate v_2 of 30 °C/s to 100 °C/s in a temperature range from 900 °C to 100 °C,

wherein the non-oriented electrical steel sheet has an inner layer defined as a region where a Si content is less than an average Si content in a total sheet thickness, and surface layers defined as regions where a Si content is greater than or equal to the average Si content in the total sheet thickness, the surface layers being provided on both sides of the inner layer, the non-oriented electrical steel sheet comprising a chemical composition containing:

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Si; and

C: 0.020 mass% or less,

Mn: 0.010 mass% to 2.0 mass%, and

S: 0.0100 mass% or less, as average contents in the total sheet thickness, with the balance being Fe and inevitable impurities, wherein

each of the surface layers has an average Si content $[Si]_1$ of 2.5 mass% to 7.0 mass%,

the inner layer has an average Si content $[Si]_0$ of 1.5 mass% to 5.0 mass%,

ΔSi defined as the difference between the average Si content of the surface layers $[Si]_1$ and the average Si content of the inner layer $[Si]_0$, $[Si]_1 - [Si]_0$, is 1.0 mass% to 3.3 mass%,

an average content of Mn, in mass%, in the total sheet thickness, [Mn], and an average content of S, in mass%, in the total sheet thickness, [S], satisfy the following formula (2),

each of the surface layers has an in-plane tensile stress of 5 MPa to 50 MPa,

the non-oriented electrical steel sheet has a sheet thickness t of 0.05 mm to 0.35 mm,

the surface layers have a total thickness t_1 with a ratio t_1/t of the total thickness t_1 to the sheet thickness t being 0.30 to 0.50,

the non-oriented electrical steel sheet has an average N content [N] in the total sheet thickness of 40 ppm or less, and

an iron loss $W_{10/400}$ in W/kg at a maximum magnetic flux density of 1.0 T and a frequency of 400 Hz and the sheet thickness t in mm satisfy the following formula (1),

the non-oriented electrical steel sheet has a texture where a ratio {100}/{111} of an integration degree of {100} plane to an integration degree of {111} plane is 51 % to 90 % in a cross section with $\Phi_2 = 45°$ of an orientation distribution function at a depth of 1/4 of the sheet thickness from a surface of the non-oriented electrical steel sheet,

$W_{10/400} \leq 8 + 30t$ ... (1),

$[Mn][S] \leq 0.0030$ ... (2).

5. The method of producing the non-oriented electrical steel sheet according to claim 4, wherein the chemical composition further contains, as

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average contents in the total sheet thickness, at least one of

Al: 0.10 mass% or less,

P: 0.10 mass% or less,

Sn: 0.10 mass% or less, and

Sb: 0.10 mass% or less.

6. The method of producing the non-oriented electrical steel sheet according to claim 4 or 5, wherein the ratio {100}/{111} is 55 % to 90 %.