CLAIMS

What is claimed is:

1. A production method for non-oriented silicon steel, wherein a finished product of the non-oriented silicon steel satisfying the following chemical composition design solution is prepared by using the processes of molten iron desulfurization, converter smelting, RH refining, continuous casting, hot rolling, acid tandem rolling, annealing, coating and finishing;

the chemical composition design solution is as follows in mass percent:

C≤0.003%, S≤0.008%, Si: 0.35%+Δ1, Mn: 0.15-0.25%, P: 0.04-0.06%, Sn: 0.015%+Δ2, Nb≤0.004%, V≤0.004%, Ti≤0.005%, Mo≤0.004%, Cr≤0.03%, Ni≤0.03%, Cu≤0.03%, N≤0.003% and the balance of Fe and inevitable inclusions;

in the molten iron desulfurization process:

the temperature of molten iron before desulfurization is controlled to be greater than or equal to 1350°C, the chemical composition is as follows in mass percent: Si: 0.20-0.70%, S≤0.05%, Nb≤0.005%, V≤0.04%, Ti≤0.06%, Mo≤0.001%, Cr≤0.03%, Ni≤0.03% and Cu≤0.03%, the molten iron before desulfurization is desulfurized so as to control the temperature of the molten iron after desulfurization to be greater than or equal to 1320°C, and the S content in mass percent is less than or equal to 0.0015%;

in the converter smelting process:

the molten iron after desulfurization is mixed with scrap steel to be smelted in a converter; in the steel tapping process, sufficient tin ingots are added to steel tapping liquid according to the chemical composition base solution Δ1=Δ2=0 in

the chemical composition design solution; after steel tapping is finished, a slag surface deoxidizer is added to the molten steel;

in the RH refining process:

the mass percent of S in the molten steel reaching RH refining is detected, and values of Δ1 and Δ2 in the chemical composition design solution are determined to obtain a final chemical composition solution;

if the mass percent of S contained in the molten steel reaching RH refining is less than or equal to 0.0030%, then Δ1=Δ2=0;

if the mass percent of S contained in the molten steel reaching RH refining is more than 0.0030% and less than or equal to 0.0045%, then Δ1=0.05% and Δ2=0.005%;

if the mass percent of S contained in the molten steel reaching RH refining more than 0.0045% and less than or equal to 0.0060%, then Δ1=0.15% and Δ2=0.010%; and

if the mass percent of S contained in the molten steel reaching RH refining is more than 0.0060% and less than or equal to 0.0075%, then Δ1=0.25% and Δ2=0.020%

in the RH refining furnace to be vacuumized, decarburization is performed on the molten steel, then, according to the final chemical composition solution, ultra-low-titanium ferrosilicon, tin ingots, low-titanium ferrophosphorus and manganese metal are added to the molten steel, steel tapping is performed after net circulation for seven minutes; and the desulfurizer is not added in the RH refining process.

2. The production method for the non-oriented silicon steel according to

claim 1, wherein the finished product of the non-oriented silicon steel has the thickness of 0.500±0.005 mm, the iron loss $P_{1.5/50}$≤5.5 W/kg and the magnetic induction intensity B_{5000}≥1.75.

3. The production method for the non-oriented silicon steel according to claim 1, wherein in the molten iron desulfurization process, the slagging-off rate of the molten iron after desulfurization is controlled to be greater than or equal to 98%.

4. The production method for the non-oriented silicon steel according to claim 1, wherein in the converter smelting process, the addition of the scrap steel accounts for 20 to 25% of the total of the scrap steel and the molten iron; and in the steel tapping process, lime is added first, and then tin ingots are added.

5. The production method for the non-oriented silicon steel according to claim 1, wherein in the hot rolling process: a continuous casting billet is subjected to continuous casting billet heating, intermediate billet rolling, finish rolling and reeling in sequence to prepare a hot coil, wherein the continuous casting billet heating temperature is 1130 to 1160°C, the holding time is greater than or equal to 180 min, the intermediate billet thickness is 35 to 40 mm, the final rolling temperature is 865±15°C, the coiling temperature is 680°C±20°C, and the hot coil thickness is 2.70±0.1 mm.

6. The production method for the non-oriented silicon steel according to claim 1, wherein in the acid tandem rolling process: after the hot coil prepared by hot rolling is pickled with HCl, rinsed and dried, cold rolling is performed to prepare a rolled hard coil, wherein the cold rolled reduction rate is 80 to 83%, and

the rolled hard thickness is 0.501±0.005 mm.

7. The production method for the non-oriented silicon steel according to claim 6, wherein three-stage pickling is performed with HCl, wherein the first-stage concentration of an acid solution is 50 to 80 g/L, and the Fe^{2+} concentration of the acid solution is less than or equal to 130 g/L; the second-stage concentration of the acid solution is 90 to 120 g/L, and the Fe^{2+} concentration of the acid solution is less than or equal to 90 g/L; the third-stage concentration of the acid solution is 140 to 160 g/L, and the Fe^{2+} concentration of the acid solution is less than or equal to 50 g/L;

during pickling at each stage, the temperature of the acid solution is 75 to 85°C, a silicon steel pickling accelerator is added to the acid solution, and the silicon steel pickling accelerator accounts for 0.05 to 0.10% of the acid solution in percentage by weight; and

the temperature of rinse water is 45 to 55°C, and the pickling and rinsing speed is controlled to be 100 to 180 mpm.

8. The production method for the non-oriented silicon steel according to claim 1, wherein in the annealing process: a steel belt of a cold hard coil is annealed in a mixed atmosphere of H_2 and N_2 in a continuous annealing furnace, the annealing temperature is 850±5°C, the annealing time is 60±5 seconds, and the annealed steel belt is cooled by using three-stage cooling, wherein:

the first-stage cooling is slow cooling of a high-temperature section, so that the steel belt is cooled to 800°C from the annealing temperature at the cooling speed less than or equal to 5°C/s;

the second-stage cooling is circulating gas injection controlled cooling, so

that the steel belt continues to be cooled to below 300°C at the cooling speed less than or equal to 15°C/s; and

the third-stage cooling is circulating water injection cooling, so that the steel belt continues to be cooled to below 100°C.

9. The production method for the non-oriented silicon steel according to claim 1, wherein in the coating and finishing process, coating and finishing are performed on the steel belt cooled to below 100°C during annealing to obtain the finished product of the non-oriented silicon steel having the thickness of 0.500±0.005 mm.

10. The production method for the non-oriented silicon steel, wherein a product of the non-oriented silicon steel having the thickness of 0.5±0.005 mm is prepared by using the processes of molten iron desulfurization, converter smelting, RH refining, continuous casting, hot rolling, acid tandem rolling, annealing, coating and finishing, and the product of the non-oriented silicon steel has the iron loss $P_{1.5/50}\leq 5.5$ W/kg and the magnetic induction intensity $B_{5000}\geq 1.75$, wherein

in the molten iron desulfurization process:

the temperature of molten iron before desulfurization is controlled to be greater than or equal to 1350°C, the chemical composition is as follows in mass percent: Si: 0.20-0.70%, S≤0.05%, Nb≤0.005%, V≤0.04%, Ti≤0.06%, Mo≤0.001%, Cr≤0.03%, Ni≤0.03% and Cu≤0.03%, the molten iron before desulfurization is desulfurized so as to control the temperature of the molten iron after desulfurization to be greater than or equal to 1320°C, and the S content in mass percent is less than or equal to 0.0015%;

in the converter smelting process:

the molten iron after desulfurization is mixed with scrap steel to be smelted in a converter; in the steel tapping process, sufficient tin ingots are added to steel tapping liquid according to the chemical composition base solution; after steel tapping is finished, a slag surface deoxidizer is added to the molten steel; and the chemical composition base solution is as follows in mass percent: C≤0.003%, S≤0.008%, Si: 0.35%, Mn: 0.15-0.25%, P: 0.04-0.06%, Sn: 0.015%, Nb≤0.004%, V≤0.004%, Ti≤0.005%, Mo≤0.004%, Cr≤0.03%, Ni≤0.03%, Cu≤0.03%, N≤0.003% and the balance of Fe and inevitable inclusions;

in the RH refining process:

in the RH refining furnace to be vacuumized, decarburization is performed on the molten steel;

then, alloying is performed according to the mass percent of S in the molten steel reaching RH refining, wherein if the mass percent of S contained in the molten steel reaching RH refining is less than or equal to 0.0030%, ultra-low-titanium ferrosilicon, low-titanium ferrophosphorus and manganese metal are added to the molten steel according to the chemical composition base solution; if the mass percent of S contained in the molten steel reaching RH refining is more than 0.0030% and less than or equal to 0.0045%, Si and Sn in the chemical composition base solution are adjusted to 0.40% and 0.020% respectively; if the mass percent of S contained in the molten steel reaching RH refining is more than 0.0045% and less than or equal to 0.0060%, Si and Sn in the chemical composition base solution are adjusted to 0.50% and 0.025% respectively; if the mass percent of S contained in the molten steel reaching RH refining is more than 0.0060% and less than or equal to 0.0075%, Si and Sn in the chemical

composition base solution are adjusted to 0.60% and 0.035% respectively, and ultra-low-titanium ferrosilicon, tin ingots, low-titanium ferrophosphorus and manganese metal are added to the molten steel according to the adjusted chemical composition solution;

then, steel tapping is performed after net circulation for seven minutes; and the desulfurizer is not added in the RH refining process.