Claims

1. An for offshore structures, wherein, a thickness of the S355G10+N heavy steel plate is up to 150 mm, and the S355G10+N heavy steel plate is composed of the following chemical composition in mass percentage: C: 0.08%-0.14%, Mn: 1.30%-1.65%, Si: 0.10%-0.50%, P ≤ 0.015%, S ≤ 0.005%, Nb: 0.015%-0.030%, V ≤ 0.03%, Ti: 0.10%-0.020%, Alt: 0.020%-0.055%, Ni: 0.10%-0.50%, CEV ≤ 0.43%, Pcm ≤ 0.21%, and a balance of Fe and inevitable impurities.

2. The S355G10+N heavy steel plate for offshore structures according to claim 1, wherein, the S355G10+N heavy steel plate is composed of the following chemical composition in mass percentage: C: 0.08%-0.10%, Mn: 1.58%-1.65%, Si: 0.34%-0.50%, P ≤ 0.010%, S ≤ 0.002%, Nb: 0.015%-0.021%, V ≤ 0.028%, Ti: 0.10 %-0.020%, Alt: 0.020%-0.031%, Ni: 0.10%-0.31%, CEV ≤ 0.40%, Pcm ≤ 0.20%, and the balance of Fe and inevitable impurities.

3. The S355G10+N heavy steel plate for offshore structures according to claim 1, wherein, the S355G10+N heavy steel plate is composed of the following chemical composition in mass percentage: C: 0.12%-0.14%, Mn: 1.30%-1.41%, Si: 0.10%-0.21%, P ≤ 0.011%, S ≤ 0.001%, Nb: 0.027%-0.030%, V ≤ 0.03%, Ti: 0.10 %-0.020%, Alt: 0.036%-0.055%, Ni: 0.43%-0.50%, CEV ≤ 0.40%, Pcm ≤ 0.21%, and the balance of Fe and inevitable impurities.

4. A method for manufacturing the S355G10+N heavy steel plate for offshore structures of claim 1, wherein, the method comprises a slab vacuum welding process, a composite slab heating process, a rolling process, and a normalizing process; wherein, the method specifically comprises the following steps:

the slab vacuum welding process: welding two or more continuous casting slabs with the same heat number and the same composition under the condition that a vacuum degree is less than or equal to 0.05 Pa, to obtain a composite slab with a thickness more than 600 mm;

the composite slab heating process: heating the composite slab to 1200-1250 ℃ for 5-10 h;

the rolling process: performing a two-stage rolling process through a wide and heavy

plate mill; wherein, a final rolling temperature for rough rolling is ≥ 950 °C, and an initial rolling temperature for finish rolling is ≤ 840 °C; and a steel plate obtained is air-cooled after the two-stage rolling process; and

the normalizing process: normalizing the steel plate in a heat treatment furnace at 880-920 °C for (1.8-2.0) × H min; wherein, H is the thickness of the steel plate with a unit of mm.

5. The method for manufacturing the S355G10+N heavy steel plate for offshore structures according to claim 4, wherein, the thickness of the S355G10+N heavy steel plate is 150 mm, and the S355G10+N heavy steel plate is composed of the following chemical composition in mass percentage: C: 0.10%, Mn: 1.58%, Si: 0.34%, P: 0.010%, S: 0.002%, Nb: 0.021%, V: 0.028%, Ti: 0.14%, Alt: 0.031%, Ni: 0.31%, CEV: 0.40%, Pcm: 0.20%, and the balance of Fe and inevitable impurities; the method comprises the following steps:

the slab vacuum welding process: welding two 310 mm continuous casting slabs with the same heat number and the same composition under the condition that the vacuum degree is 0.03 Pa, to obtain a composite slab with a thickness of 620 mm;

the composite slab heating process: heating the composite slab with the thickness of 620 mm to 1243 ℃ for 8 h;

the rolling process: performing the two-stage rolling process through the wide and heavy plate mill; wherein, the final rolling temperature for the rough rolling is 988 °C, and the initial rolling temperature for the finish rolling is 832 °C; and the steel plate obtained is air-cooled after the two-stage rolling process; and

the normalizing process: normalizing the steel plate in the heat treatment furnace at 892 °C for 279 min.

6. The method for manufacturing the S355G10+N heavy steel plate for offshore structures according to claim 4, wherein, the thickness of the S355G10+N heavy steel plate is 150 mm, and the S355G10+N heavy steel plate is composed of the following chemical composition in mass percentage: C: 0.12%, Mn: 1.41%, Si: 0.21%, P: 0.011%, S: 0.001%, Nb: 0.027%, V: 0.03%, Ti: 0.020%, Alt: 0.036%, Ni: 0.43%, CEV: 0.40%, Pcm: 0.20%, and the balance of Fe and inevitable impurities; the method comprises the following steps:

the slab vacuum welding process: welding two 300 mm continuous casting slabs

with the same heat number and the same composition under the condition that the vacuum degree is 0.04 Pa, to obtain a composite slab with a thickness of 600 mm;

the composite slab heating process: heating the composite slab with the thickness of 600 mm to 1234 ℃ for 7 h;

the rolling process: performing the two-stage rolling process through the wide and heavy plate mill; wherein, the final rolling temperature for the rough rolling is 997 °C, and the initial rolling temperature for the finish rolling is 836 °C; and the steel plate obtained is air-cooled after the two-stage rolling process; and

the normalizing process: normalizing the steel plate in the heat treatment furnace at 905 °C for 293 min.

Claims

1. An S355G10+N heavy steel plate for offshore structures, wherein, a thickness of the S355G10+N heavy steel plate is up to 150 mm, and the S355G10+N heavy steel plate is composed of the following chemical composition in mass percentage: C: 0.08%-0.10%, Mn: 1.30%-1.65%, Si: 0.10%-0.50%, P ≤ 0.015%, S ≤ 0.005%, Nb: 0.015%-0.030%, V ≤ 0.03%, Ti: 0.020%-0.10%, Alt: 0.020%-0.055%, Ni: 0.10%-0.50%, CEV ≤ 0.43%, Pcm ≤ 0.21%, and a balance of Fe and inevitable impurities; a method for manufacturing the S355G10+N heavy steel plate comprises a slab vacuum welding process, a composite slab heating process, a rolling process, and a normalizing process; the slab vacuum welding process comprises welding two or more continuous casting slabs with the same heat number and the same composition under the condition that a vacuum degree is less than or equal to 0.05 Pa, and a composite slab with a thickness more than 600 mm is obtained; the composite slab heating process comprises heating the composite slab to 1200-1250 ℃ for 5-10 h; the rolling process comprises performing a two-stage rolling process through a wide and heavy plate mill, a final rolling temperature for rough rolling is ≥ 950 °C, and an initial rolling temperature for finish rolling is ≤ 840 °C; a steel plate obtained is air-cooled after the two-stage rolling process; the normalizing process comprises normalizing the steel plate in a heat treatment furnace at 880-920 °C for (1.8-2.0) × H min, and H is the thickness of the steel plate with a unit of mm; and an impact toughness at -40 ℃ of the steel plate at 1/2 thickness is greater than 100 J.

2. The S355G10+N heavy steel plate for offshore structures according to claim 1, wherein, the S355G10+N heavy steel plate is composed of the following chemical composition in mass percentage: C: 0.08%-0.10%, Mn: 1.58%-1.65%, Si: 0.34%-0.50%, P ≤ 0.010%, S ≤ 0.002%, Nb: 0.015%-0.021%, V ≤ 0.028%, Ti: 0.020 %-0.10%, Alt: 0.020%-0.031%, Ni: 0.10%-0.31%, CEV ≤ 0.40%, Pcm ≤ 0.20%, and the balance of Fe and inevitable impurities.