Claims

1. An S355G10+N heavy steel plate for offshore structures, produced by a method comprising:

a slab vacuum welding process that 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, resulting in a composite slab with a thickness more than 600 mm;

a composite slab heating process that comprises heating the composite slab to 1200-1250 ℃ for 5-10 h;

a rolling process that comprises performing a two-stage rolling process through a wide and heavy plate mill, with a final rolling temperature for rough rolling of ≥ 950 °C, and an initial rolling temperature for finish rolling of ≤ 840 °C, followed by air-cooling of the steel plate obtained;

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

wherein, the S355G10+N heavy steel plate has 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%, Al total or Alt: 0.020%-0.055%, Ni: 0.10%-0.50%, Carbon Equivalent Value or CEV ≤ 0.43%, cold cracking susceptibility index or Pcm ≤ 0.21%, and a balance of Fe and inevitable impurities; and

wherein an impact toughness at -40 ℃ of the steel plate at 1/2 thickness is greater than 100 J and wherein a thickness of the S355G10+N heavy steel plate is up to 150 mm.

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%, Al total or Alt: 0.020%-0.031%, Ni: 0.10%-0.31%, Carbon Equivalent Value or CEV ≤ 0.40%, cold cracking susceptibility index or 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 steel plate has a thickness of 150mm, and is produced by a method comprising:

a slab vacuum welding process, that comprises using two 310mm continuous casting slabs of the same batch number and composition, welding under a vacuum of 0.03 Pa to obtain a welded composite slab with a thickness of 620mm;

a composite billet heating process, that comprises heating the slab to 1243°C, holding for 8h;

a rolling process, that comprises performing a rolling in two stages through a wide and thick plate rolling mill, with the final rolling temperature of the rough rolling stage being 988°C, and the starting rolling temperature of the finishing rolling stage being 832°C, followed by air cooling of the steel plate obtained;

a normalization heat treatment process, wherein the steel plate is normalized in a heat treatment furnace, with the normalization temperature being 892°C, and the holding time being 279 minutes;

wherein the S355G10+N heavy has 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%, Al: 0.031%, Ni: 0.31%, CEV: 0.40%, Pcm: 0.20%, with the remainder being Fe and unavoidable impurities.