Title (en)

Hot-rolled steel flat product and method for its production

Title (de)

Warmgewalztes Stahlflachprodukt und Verfahren zu seiner Herstellung

Title (fr)

Produit plat en acier laminé à chaud et son procédé de fabrication

Publication

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Application

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Priority

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Abstract (en)

Hot-rolled flat steel product comprises 0.1-0.6 wt.% carbon, 0.4-2 wt.% silicon, up to 2 wt.% aluminum, 0.4-2.5 wt.% manganese, up to 1 wt. % nickel, up to 2 wt.% copper, up to 0.4 wt.% molybdenum, up to 2 wt.% chromium, up to 0.2 wt.% titanium, up to 0.2 wt.% niobium, up to 0.5% vanadium, iron and unavoidable impurities. The structure of the flat steel product comprises optionally up to 5 vol.% ferrite, up to 10 vol.% martensite, at least 60 vol.% bainite and balance of residual austenite. At least a part of the residual austenite is present in block form. Hot-rolled flat steel product comprises 0.1-0.6 wt.% carbon, 0.4-2 wt.% silicon, up to 2 wt.% aluminum, 0.4-2.5 wt.% manganese, up to 1 wt.% nickel, up to 2 wt.% copper, up to 0.4 wt.% molybdenum, up to 2 wt.% chromium, up to 0.2 wt.% titanium, up to 0.2 wt.% niobium, up to 0.5% vanadium, iron and unavoidable impurities. The structure of the flat steel product comprises optionally up to 5 vol.% ferrite, up to 10 vol.% martensite, at least 60 vol.% bainite and balance of residual austenite. At least a part of the residual austenite in block form and blocks of the austenite present in block form to at least 98% exhibits an average diameter of less than 5 mu m. The flat steel product exhibits a product of tensile strength and elongation of at least 18000 Mpa.%. An independent claim is also included for producing the flat steel product, comprising providing an intermediate product in the form of a slab, thin slab or cast strip, which comprises 0.1-0.6 wt.% carbon, 0.4-2 wt.% silicon, up to 2 wt.% aluminum, 0.4-2.5 wt.% manganese, up to 1 wt.% nickel, up to 2 wt.% copper, up to 0.4 wt.% molybdenum, up to 2 wt.% chromium, up to 0.2 wt.% titanium, up to 0.2 wt.% niobium, up to 0.5% vanadium, iron and unavoidable impurities, hot rolling the intermediate product to form a hot strip in at least one roll stitch, accelerating cooling of the resulting hot strip at a cooling rate of at least 5[deg] C/second to a coiling temperature, which lies in the region between the martensite starting temperature and 600[deg] C, coiling the hot strip to form a coil, and cooling the coils, where (a) the temperature of the coil during cooling to form bainite is maintained at a temperature range with upper limit and lower limit until at least 60 vol.% structure of the hot strip is made of bainite, (b) the upper limit is equal to the bainite starting temperature for producing bainite in the structure of the hot strip, and lower limit is equal to the martensite starting temperature for producing martensite in the structure of the hot strip, and (c) the resulting hot strip on leaving the last roll stitch, exhibits a final hot-rolling of at least 880[deg] C.

Abstract (de)

Die Erfindung betrifft ein warmgewalztes Stahlflachprodukt mit einem Produkt aus Rm und A80 #¥ 18000 MPa*%, einer Zusammensetzung, die aus (in Gew.-%) C: 0,10 - 0,60 %, Si: 0, 4 - 2,0 %, Al: #¤ 2,0 %, Mn: 0,4 - 2,5 %, Ni: #¤ 1 %, Cu: #¤ 2,0 %, Mo: #¤ 0,4 %, Cr: #¤ 2 %, Ti: #¤ 0,2 %, Nb: #¤ 0,2 %, V: #¤ 0,5 %, Rest Fe und unvermeidbaren Verunreinigungen besteht, und einem Gefüge, das (in Vol.-%) aus #¤ 5 % Ferrit, #¤ 10 % Martensit, #¥ 60 % Bainit und als Rest aus Restaustenit besteht, wobei zumindest ein Teil des Restaustenits blockigförmig ist und #¥ 98 % der Restaustenit-Blöcke #¤ 5 µm groß sind. Zur Herstellung des Stahlflachprodukts wird eine Bramme, Dünnbramme oder ein gegossenes Bands mit der genannten Zusammensetzung bereitgestellt, das Vorprodukt mit einer Warmwalzendtemperatur #¥ 880 °C zu einem Warmband warmgewalzt, das erhaltene Warmband mit einer Abkühlrate #¥ 5 °C/s auf eine zwischen der Martensitstarttemperatur MS und 600 °C liegende Haspeltemperatur abgekühlt, das Warmband zu einem Coil gehaspelt und im Coil abgekühlt, wobei die Temperatur des Coils solange zwischen der Bainitstarttemperatur BS und der Martensitstarttemperatur MS gehalten wird, bis #¥ 60 Vol.-% des Warmbandgefüges aus Bainit bestehen.

IPC 8 full level

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CPC (source: CN EP KR US)

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