Title (en)

Method of manufacturing annealed, very high-resistance, cold-laminated steel sheets, and sheets produced thereby

Title (de)

Verfahren zur Herstellung von kalt gewalzten und geglühten Stahlblechen mit sehr hoher Festigkeit und so hergestellte Bleche

Title (fr)

Procédé de fabrication de tôles d'acier laminées à froid et recuites à très haute résistance, et tôles ainsi produites

Publication

EP 1990431 A1 20081112 (FR)

Application

EP 07290598 A 20070511

Priority

EP 07290598 A 20070511

Abstract (en)

A high-strength, cold rolled, annealed steel sheet (I) has composition (by weight, excluding iron, processing impurities and various optional components) 0.10-0.25% carbon, 1-3% manganese, at least 0.010% aluminum, up to 2.990% silicon (provided that Si + Al is 1-3%), up to 0.015% sulfur, up to 0.1% phosphorus and up to 0.008% nitrogen. The microstructure is 15-90% bainite, the remainder being martensite and residual austenite. A cold rolled, annealed steel sheet (I), with strength more than 1200 MPa, has composition (by weight, excluding iron and processing impurities) (i) 0.10-0.25% carbon, 1-3% manganese, at least 0.010% aluminum, up to 2.990% silicon (provided that Si + Al is 1-3%), up to 0.015% sulfur, up to 0.1% phosphorus and up to 0.008% nitrogen and optionally (ii) 0.05-0.15% vanadium, up to 0.25% molybdenum, up to 1.65% chromium (provided that Cr + (3 x Mo) is at least 0.3%) and up to 0.040% titanium (provided that Ti/N is at least 4). The microstructure is 15-90% bainite, the remainder being martensite and residual austenite. Independent claims are included for: (1) the production of (I) with elongation at break more than 8% from a steel as above, by (A) casting a semi-finished product from the steel; (B) heating to more than 1150[deg] C; (C) rolling to give a hot-rolled sheet; (D) coiling the sheet; (E) cleaning the sheet; (F) cold rolling the sheet at a degree of reduction of 30-80%; and (G) reheating the sheet at 5-15[deg] C per second to a temperature of Ac3 to Ac3 plus 20[deg] C, maintaining the temperature for 50-150 seconds, cooling at more than 25[deg] C per second to a temperature between B s and M s minus 20[deg] C, maintaining this temperature for 150-350 seconds and cooling at less than 30[deg] C per second to ambient temperature; and (2) the production of (I) with elongation at break more than 10% by a variant of the process, involving steps (A) - (G) as above except that (1) the steel contains more than 0.005% molybdenum, more than 0.005% chromium and no boron and consists of 65-90% bainite, the remainder being islets of martensite and residual austenite, and (2) in the reheating step (G) the sheet is cooled from the temperature of Ac3 to Ac3 plus 20[deg] C at more than 40[deg] C per second to a temperature between M s plus 30[deg] C and M s minus 30[deg] C (the holding time at this temperature and further cooling being as above).

Abstract (fr)

L'invention concerne une tôle d'acier laminée à froid et recuite de résistance supérieure à 1200 MPa, dont la composition comprend, les teneurs étant exprimées en poids : 0,10% # C # 0,25%, 1%# Mn # 3% , Al #¥ 0,010 %, Si#2,990%, S # 0,015%, P# 0,1%, N#0,008%, étant entendu que 1% #Si+Al #3%, la composition comprenant éventuellement : 0,05% # V # 0,15%, B#0,005%, Mo # 0,25% Cr # 1,65% étant entendu que Cr+(3 x Mo) #¥0,3%, Ti en quantité telle que Ti/N#¥4 et que Ti#0,040%, le reste de la composition étant constitué de fer et d'impuretés inévitables résultant de l'élaboration, la microstructure de l'acier comprenant 15 à 90% de bainite, le solde étant constitué de martensite et d'austénite résiduelle

IPC 8 full level

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CPC (source: EP KR US)

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Designated extension state (EPC)

AL BA HR MK RS

DOCDB simple family (publication)

EP 1990431 A1 20081112; AR 066508 A1 20090826; BR PI0821572 A2 20150616; BR PI0821572 B1 20191001; CA 2686940 A1 20081204; CA 2686940 C 20140121; CN 101765668 A 20100630; CN 101765668 B 20111221; EP 2155915 A2 20100224; EP 2155915 B1 20171025; EP 2155915 B2 20220427; ES 2655476 T3 20180220; ES 2655476 T5 20220929; HU E035549 T2 20180528; JP 2010526935 A 20100805; JP 5398701 B2 20140129; KR 101523395 B1 20150527; KR 20100016438 A 20100212; MA 31555 B1 20100802; MX 2009011927 A 20091118; PL 2155915 T3 20180330; PL 2155915 T5 20220905; RU 2009145940 A 20110620; RU 2437945 C2 20111227; US 10612106 B2 20200407; US 11414722 B2 20220816; US 2010307644 A1 20101209; US 2016355900 A1 20161208; US 2020032366 A1 20200130; US 2022136078 A1 20220505; WO 2008145871 A2 20081204; WO 2008145871 A3 20090219; WO 2008145871 A8 20190906; ZA 200907430 B 20100728

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