Title (en)

PROCESS FOR MANUFACTURING COLD-ROLLED AND ANNEALED STEEL SHEETS WITH VERY HIGH STRENGTH, AND SHEETS THUS PRODUCED

Title (de)

VERFAHREN ZUR HERSTELLUNG KALTGEWALZTER UND GEGLÜHTER STAHLBLECHE VON SEHR HOHER FESTIGKEIT UND IN DIESEM VERFAHREN HERGESTELLTE BLECHE

Title (fr)

PROCEDE DE FABRICATION DE TÔLES D'ACIER LAMINEES A FROID ET RECUITES A TRES HAUTE RESISTANCE, ET TÔLES AINSI PRODUITES

Publication

EP 2155915 A2 20100224 (FR)

Application

EP 08805523 A 20080428

Priority

- EP 07290598 A 20070511
- FR 2008000609 W 20080428

Abstract (en)

[origin: EP1990431A1] 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).

IPC 8 full level

C21D 8/02 (2006.01); **C21D 9/46** (2006.01); **C22C 38/02** (2006.01); **C22C 38/04** (2006.01); **C22C 38/06** (2006.01); **C22C 38/12** (2006.01)

CPC (source: EP KR US)

B22D 11/001 (2013.01 - EP US); **C21D 8/02** (2013.01 - EP KR US); **C21D 8/0205** (2013.01 - EP US); **C21D 8/0226** (2013.01 - EP US); **C21D 8/0236** (2013.01 - EP US); **C21D 9/46** (2013.01 - EP KR US); **C21D 9/52** (2013.01 - EP US); **C22C 38/001** (2013.01 - EP US); **C22C 38/002** (2013.01 - EP US); **C22C 38/02** (2013.01 - EP KR US); **C22C 38/04** (2013.01 - EP KR US); **C22C 38/06** (2013.01 - EP US); **C22C 38/12** (2013.01 - EP US); **C22C 38/14** (2013.01 - EP US); **C22C 38/22** (2013.01 - EP US); **C22C 38/28** (2013.01 - EP US); **C22C 38/32** (2013.01 - EP US); **C22C 38/38** (2013.01 - EP US); **C23G 1/00** (2013.01 - US); **C23G 1/08** (2013.01 - EP US)

Citation (search report)

See references of WO 2008145871A2

Designated contracting state (EPC)

AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR

Designated extension state (EPC)

AL BA 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

DOCDB simple family (application)

EP 07290598 A 20070511; AR P080101971 A 20080509; BR PI0821572 A 20080428; CA 2686940 A 20080428; CN 200880015380 A 20080428; EP 08805523 A 20080428; ES 08805523 T 20080428; FR 2008000609 W 20080428; HU E08805523 A 20080428; JP 2010506964 A 20080428; KR 20097023517 A 20080428; MA 32328 A 20091103; MX 2009011927 A 20080428; PL 08805523 T 20080428; RU 2009145940 A 20080428; US 201615243610 A 20160822; US 201916592341 A 20191003; US 202217575300 A 20220113; US 59916608 A 20080428; ZA 200907430 A 20091023