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Description

This invention relates to the processing of steels for electromagnetic applications. Such steels are styled electrical steels and may contain up to 3.25% silicon, e.g. non-oriented silicon steel, but the invention also embraces such steels having no added silicon, so called "non-silicon" steels which only contain silicon in very low concentrations, e.g. <0.05%.

Conventionally, such steels produced via either an ingot route or a continuously cast route are rolled into hot band, descaled by pickling, cold rolled, continuously annealed in a decarburising atmosphere and then cold rolled again into the final gauge. An optional further anneal may be made, e.g. by the customer to minimise deterioration of magnetic properties.

The cold reduction may be carried out in the presence of a lubricant, e.g. the oil-in-water emulsion as described in UK Patent No.1354480, which reduces the mill load and also acts as a mill coolant.

It is an object of this invention to provide a more economical process route for such steels whilst still maintaining an adequate degree of protection (against rusting) to the product during storage and despatch with an oil-free coating.

The present invention provides a method of processing electrical steel by hot rolling cast stock into strip and coiling same, descaling and then rolling the steel strip to its final gauge in a single stage cold rolling step, and continuously annealing said strip in a decarburising atmosphere, characterised by then coating the strip surface with a wholly organic water-borne oil-free corrosion inhibitor, and drying and coiling the strip for despatch.

This invention thus provides a "fully-processed" route as distinct from some "semi-processed" electrical steel routes adopted hitherto, see e.g. Journal of Metals (1986) pp 18-26 and further, as distinct from processes of this nature applied to "electrical" steels for electromagnetic applications which utilise cured insulating coatings, this invention does not embody such a hard surfacing treatment, e.g. as disclosed in BHP Technical Bulletin Vol. 25 No.2 1981 pp 25-30, but instead embodies a much simpler and cheaper coating step. Moreover, some processes utilise the adoption of a phosphatic protective coating or a varnish but the application of phosphates directly on to the steel surface suffers from drawbacks which, whilst they may be overcome, e.g. as in UK Patent No.1430692, rely then on an intermediate metal coating stage, such as copper plating.

Essentially, compared with the conventional process first described above, the second stage rolling, or extension pass, has been dispensed with

whereas the provision of a rust inhibiting coating stage downstream of the annealing furnace has preserved the "coil protection" aspect.

Further, by dispensing with the separate second stage cold roll a better surface finish is maintained on the strip and with the coating developed for this process this finish is preserved for a longer period than hitherto and the strip surface is much cleaner and brighter.

The slight reduction in hardness of the strip, occasioned by dispensing with the second stage rolling, may be compensated by the use of steel grades having a higher phosphorus and/or manganese content.

The coating is oil free; one example of such a coating comprises a 1% solution in water of dicyclohexylammonium nitrite (typically the product VP1260) together with 0.1% of a wetting agent of the alcohol alkoxylate family (typically the product Synperonic LF/RA 30) having low foaming properties, and which does not react with or adversely affect the solubility of VP1260. The solution is non-combustible and relatively non-toxic and cheap; further, it does not stain the strip.

It has been found that this solution readily wets the strip and has a relatively low temperature of evaporation thus leaving the VP1260 evenly distributed and bound to the strip surface by the "invisible" layer of Synperonic LF/RA 30.

The coating solution is applied to the strip in its dry state immediately on exiting from the continuous annealing furnace, via a pair of smooth coating rolls, whence it passes through a drying oven before coiling.

A typical rate of usage is 4.55 dm³ (one gallon) per tonne of steel strip of, say, 0.65 mm gauge. Tests on stored coils have shown that over 40 mg/sq.m of the residual corrosion inhibitor was still present after a storage period of six weeks. The silicon content of the steel may conveniently be <0.6%, preferably <0.05%.

Claims

1. A method of processing electrical steel by hot rolling cast stock into strip and coiling same, descaling and then rolling the steel strip to its final gauge in a single stage cold rolling step, and continuously annealing said strip in a decarburising atmosphere, characterised by then coating the steel strip surface with a wholly organic water-borne oil-free corrosion inhibitor, and drying and coiling same for despatch.
2. A method according to claim 1, characterised in that the corrosion inhibitor is applied to the strip in its dry state immediately on exiting the annealing furnace via a pair of smooth coating

rolls.

agent mouillant de la famille des alcoxyates.

3. A method according to claim 2, characterised in that the corrosion inhibitor includes a dicyclohexylammonium nitrite and a wetting agent of the alkoxyate family. 5

Patentansprüche

1. Verfahren zur Bearbeitung von Elektro Stahl durch Warmwalzen von Gußmaterial in Bandform und Aufwickeln desselben, Entzundern und anschließendes Walzen des Stahlbandes in einem einstufigen Kaltwalzschrift auf sein Endmaß und kontinuierliches Glühen des genannten Bandes in einer Entkohlungsatmosphäre, gekennzeichnet durch anschließendes Beschichten der Stahlbandoberfläche mit einem vollorganischen, ölfreien Korrosionsschutzmittel auf Wasserbasis und Trocknen und Aufwickeln des Bandes für den Transport. 10 15 20
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Auftrag des Korrosionsschutzmittel auf das Band in dessen trockenem Zustand unmittelbar nach Austritt aus dem Glühofen mittels eines Paares glatter Beschichtungswalzen erfolgt. 25
3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß das Korrosionsschutzmittel Dicyclohexylammoniumnitrit und ein Benetzungsmittel aus der Reihe der Alkoxyate enthält. 30

Revendications

1. Procédé pour la production d'acier électrique par laminage à chaud de matière coulée en feuillard et par bobinage du feuillard, décalaminage puis laminage du feuillard d'acier à son épaisseur définitive par une étape de laminage à froid à une seule passe, et par application en continu d'un recuit audit feuillard sous atmosphère décarburante, caractérisé par le fait que la surface du feuillard d'acier est alors revêtue d'un inhibiteur de corrosion entièrement organique non huileux à base d'eau, et séchée et bobinée en vue de son expédition. 35 40 45
2. Procédé selon la revendication 1, caractérisé en ce que l'inhibiteur de corrosion est appliqué au feuillard à l'état sec directement à sa sortie du four de recuit au moyen d'une paire de cylindres de revêtement lisses. 50 55
3. Procédé selon la revendication 2, caractérisé en ce que l'inhibiteur de corrosion comprend un nitrite de dicyclohexyl-ammonium et un