

## NON GRAIN ORIENTED ELECTRICAL STEEL (*CRNO*)

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### ABSTRACT

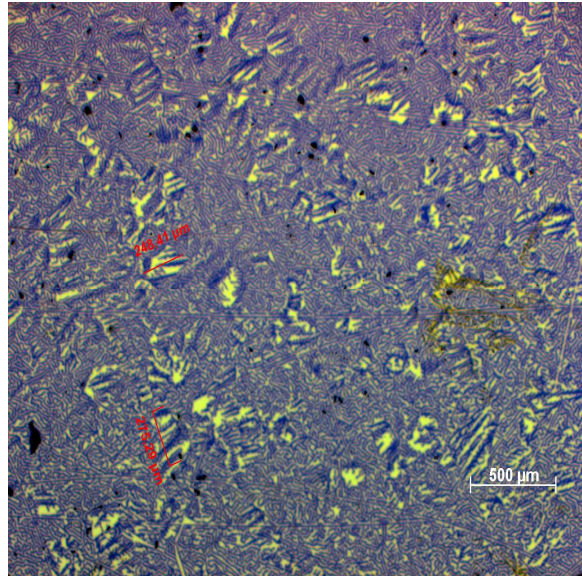
Non grain oriented (NGO) electrical steel is mainly characterized by its magnetic properties, i.e. the specific loss, the magnetic saturation polarization, and the magnetizability, i.e. the permeability. In addition, mechanical properties, e.g. manufacturability, yield strength as well as coatings strongly influence the performance, power density and the cost of the resulting electric machine. The upcoming market of electrical and electronics will openly related to non-grain oriented steel and there materials. The major Non-Grain Oriented Electrical Steel market (including USA, Europe, China, Japan, etc.) is analyzed, data including: market size, import and export, sale segment market by product type and application. Then we forecast the 2016-2021 market size of Non-Grain Oriented Electrical Steel.

**KEYWORDS:** Nonoriented Electrical Steel, Siliconsteel, Recrystallization,Textures

### INTRODUCTION

Non grain oriented steel is produce to specific properties and obtained from fe-si or fe-si-al alloys. ngo are adopted into a wide range of equipment's from simple domestic system to hybrid and pure electrical instruments in 20th century main effort and focus on controlling the residual elements in steel optimising both process hot and cold .electrical systems like transformer, motors and generator. Silicon bearing steel as soft magnetic in electrical appliances. The total amount of these steel is about 1.3% world production of steel. The main technology of production for non-oriented fully processed electrical steel has no modification significantly last decades.

Hot rolled low Si (silicon) non-grain oriented electrical steel was cold rolled to completely different reductions. Cold rolled material was later recrystallized, 650°C and a pair of h, then temper rolled (to seven-membered reduction) for the ultimate grain growth tempering and decarburization treatment at 850\_C for 2–24 h. the event of texture, grain size and magnetic properties were characterised at completely different stages of process. Reducing the main parameters and will increase grain size through the decarburisation grain growth tempering treatment in non-oriented type. Non-oriented electrical steels might contain up to 6.5% silicon, up to three atomic number 13, carbon below 0.10% (which is decarburized to below 0.005% throughout process to avoid magnetic aging) and balance iron with a tiny low quantity of impurities.



**Figure 1: Non Grain Oriented silicon Electrical steel**

## CLASSIFICATION

Non-oriented electrical steel sheets, commercially additionally referred to as lamination metallic, silicon electrical metal, silicon metal or transformer steel, are unique steel sheets tailored to supply sure magnetic properties. They may be used inside the form of lamination stacks, particularly in electric. Automobiles, transformers and alternators, depending on their properties. Non-oriented electric steel sheets can be divided into classes:

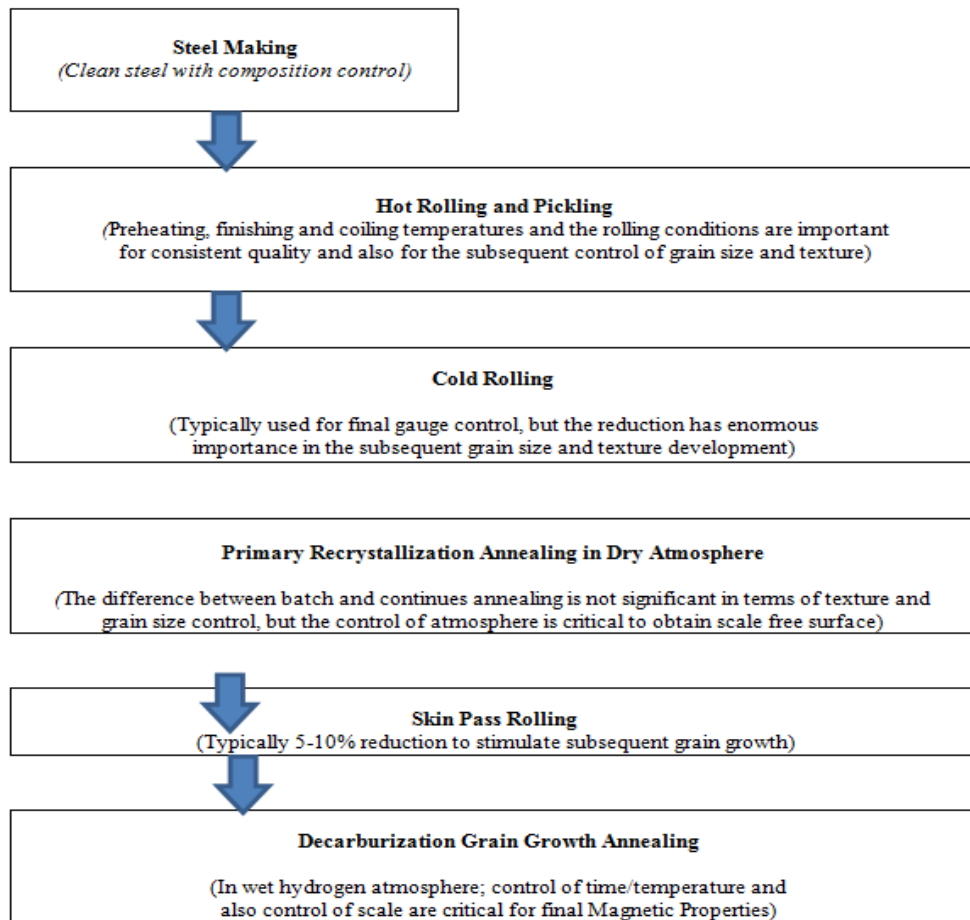
- Absolutely-processed grades that are delivered inside the completed condition constantly annealed and now and again varnished. They have guaranteed magnetic houses, in accordance with standards, e.g., EN 10106:2009.
- Semi-processed grades that are given the very last annealing remedy to broaden their magnetic residences through the consumer.

Synthetic within the form of bloodless-rolled sheets/strips with thicknesses of (0.35, 0.50, (65.10) mm and are classified according to the fee of the maximum particular general loss in W/kg. The non-orientated electric steel is provided in stacks within the case of sheets and in

Coils within the case of strips. The primary varieties of non-orientated electrical steels produced in Slovenia by using Acroni and Jesenice, are:

- Bloodless-rolled, fully-processed electrical steels –DINAMO.
- Bloodless-rolled, semi-processed electric steels –ELMAG.
- Bloodless-rolled, completely-processed, excessive-permeability electrical steels – PERMAG FP
- Semi-processed, excessive-permeability, electrical steels– PERMAG SP.5.

### Thermo-Mechanical Processing of Metallic Materials



**Figure 2: Typical Processing Stages of Non- Oriented Electrical Steel. The Main Issues Involved in Such Steps are Indicated**

### ORDINARY LAMINATION

Electrical steel is an iron alloy which may have from zero to 6.5% silicon (Si: 5Fe). Commercial alloys usually have silicon content up to 3.2% (higher concentrations usually provoke brittleness during cold rolling). However, the grain structure hardens and embrittles the metal, which adversely affects the workability of the material, especially when rolling it. When alloying, the concentration levels carbon, sulphur, oxygen and nitrogen must be kept low, as these elements indicate the presence carbides, sulphides, oxides and nitrides. These compounds, even in particles as small as one micrometre in diameter, increase hysteresis losses while decreasing magnetic permeability. The presence of carbon has a more detrimental effect than sulphur or oxygen. Carbon also causes magnetic aging when it slowly leaves the solid solution and precipitates as carbides, thus resulting in an increase in power loss over time. For these reasons, the carbon level is kept to 0.005% or lower. The carbon level can be reduced by annealing the steel in a decarburizing atmosphere, such as hydrogen.

### SILICON BEARING

The durable operation of an engine bearing is achieved if its materials combine high strength (load capacity, wear resistance, cavitation resistance) with softness (compatibility, conformability, embedability.) So the bearing materials

should be both strong and soft. It sounds paradoxical but all existing bearing materials are designed to combine those contradictory properties with a certain compromise. Silicon containing material for the medium load gasoline engines, particularly engines using nodular cast iron crankshafts.

### Comparison of Ordinary Lamination and Si-Bearing

- In ordinary Lamination the material is usually manufactured in the form of cold-rolled strips less than 2 mm thick. These strips are called laminations when stacked together to form a core. Lamination may be cut to their finished shape by a punch and die, or in smaller quantities may be cut by a laser, or by wire EDM.

While bearing grade silicon nitride, an engineered ceramic material, has a uniform and clean microstructure, which is extremely hard and tough. The material, which can be used as an insulator, is chemically inert. It is also dimensionally stable at higher operating temperatures.

- Ordinary lamination Manganese and aluminum can be added up to 0.5%. Silicon significantly increases the electrical resistivity of the steel, which decreases the induced eddy currents and narrows the hysteresis loop of the material, thus lowering the core loss.

While Si-Bearing, Effects of Fabrication Detrimental effects of stresses introduced into laminations by shearing or other fabricating operations can be eliminated by a suitable stress-relieving anneal of the core material after fabrication. When stress-relieving is impractical, design allowances must often compensate for magnetically harmful fabricating stresses.

- Cost per weight factor also affects the ordinary Lamination and Si-Bearing.

### CONCLUSIONS

Non-Grain oriented electrical steel enables higher power densities and also higher efficiencies of the motors. Based on this, it is possible to reduce the mass of the permanent magnets about 2 - 4% which reduces the total costs of a PMSM motor significantly. Non-oriented Electrical steel, which is used extensively where a low-cost, low-loss material is needed, particularly in rotating equipment. Mention should also be made of the relay steels, used widely in relays, armatures, and solenoids. Relay steels contain 1.25 to 2.5% Si, and are used in direct current applications because of better permeability, lower coercive force, and freedom from aging.

Grades with higher alloy content are harder and thus easier to punch. The Global Non-Grain Oriented Electrical Steel Industry Report 2015 is industry import/export consumption, supply and demand figures and cost price and production value gross margins are also provided.

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