TEXTURE AND STRUCTURE OF ANISOTROPIC Fe-Si-Sb MATERIALS[1])

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In the paper presented the structure and texture of a 3 % Si steel sheet alloyed with Sb was studied and analysed after hot rolling. Measurements were performed on the surface of steel and then gradually after grind-off of the surface layer. From a metallographic analysis it results that after hot-rolling there exists a difference in the structure morphology across the thickness of the steel. Quantitative and qualitative texture analyses have shown that in surface zones the plane (110) is of maximum intensity, in the direction towards the centre the (200) and (111) planes prevail.

ТЕКСТУРА И СТРУКТУРА АНИЗОТРОПНЫХ МАТЕРИАЛОВ Fe-Si-Sb

В работе приводятся результаты исследований и анализа структуры и текстуры легированной сурьмой листовой стали с трехпроцентным содержанием Si после ее горячей прокатки. Измерения проводились на поверхности стального листа после его постепенной отшлифовки. Металлографический анализ показывает изменение морфологии вдоль толщины образца. На основе качественного и количественного анализа текстуры сделано заключение о том, что максимальной интенсивностью поверхности обладает плоскость (110), и по направлению к центру доминируют плоскости (200) и (111).

I. INTRODUCTION

In the research and development of oriented transformer steel efforts are aimed at decreasing core losses and increasing magnetic induction. Magnetic characteristics are directly connected with the Goss texture, i.e. with the grain growth preference (110) [001]. The aim of the present work was to study microstructure and texture changes in oriented anisotropic Fe-Si steels and to compare them with Sb microalloyed materials.

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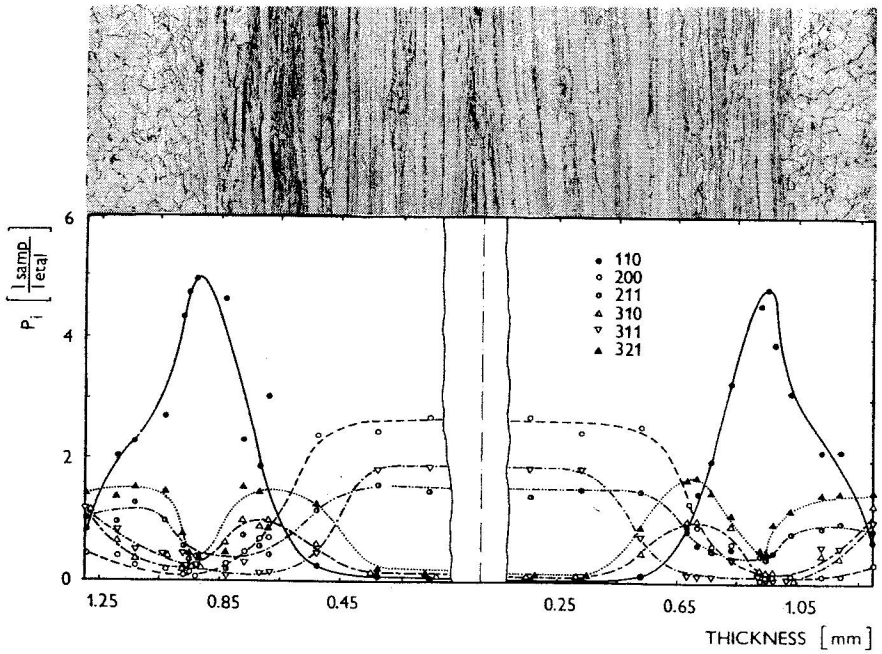

Fig. 1. Texture and microstructure across the sheet thickness of the Sb alloyed material.

II. EXPERIMENTAL METHODS AND ATTAINED RESULTS

For experiments samples 2.5 mm thick were used as hot-rolled sheet steel free of antimony and alloyed with 0.5 weight % Sb. Analyses upon microstructure and texture changes across the thickness of the examined steel were performed. The results in Fig. 1 and Fig. 2 show that the microstructure across the thickness is heterogeneous. The surface layer of the material consists of coarse unformed ferrite grain. The thickness of this layer varies in the range of 0.1—0.35 mm. In the middle part the structure consists of markedly elongated ferritic grain with a small proportion of fine recrystallized grain. Along the ferritic grain boundaries a small amount of fine pearlite has been identified. The metallographic analysis has not shown differences in the microstructure of the compared materials.

Texture measurements were performed on the surface of steel and then gradually after grind-off and etch-off of the affected layer in the inwards direction of the material. The analysis was carried out in six crystallographic planes: (110) (200) (211) (310) (111) (321). From the analysis it results that in the surface zones, among the compared series of samples, the plane (110) is of a maximum intensity, whereas the intensities of other planes are low. In the direction towards

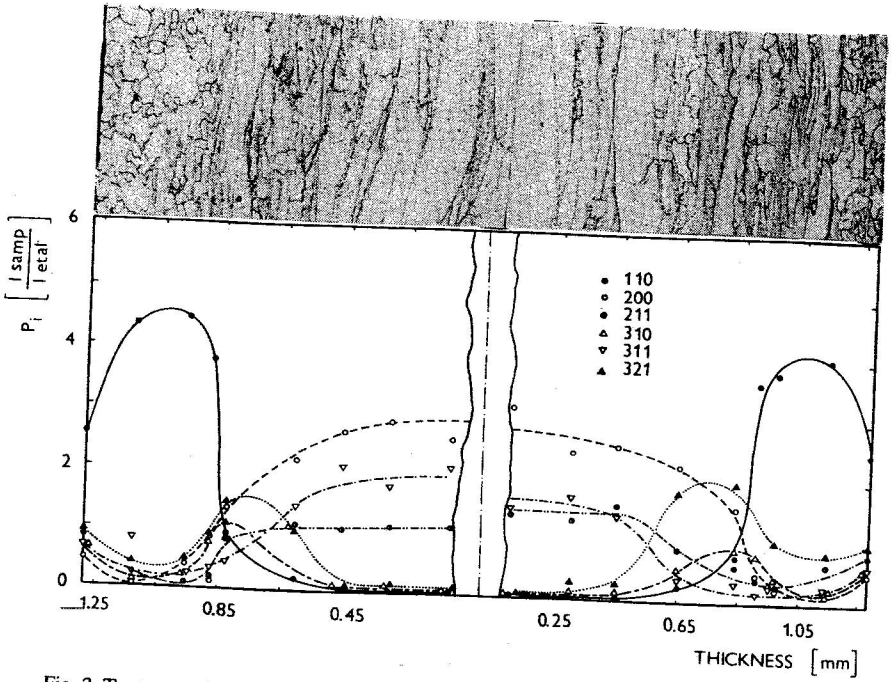

Fig. 2. Texture and microstructure across the sheet thickness of the antimony free material.

the centre the intensity of (200) and (111) planes increases and the reflection value of the (110) plane decreases. On the basis of the results in can be stated that in the subsurface layers there is a larger volume proportion of grains with a {110} orientation and in the centre of the thickness there prevails the proportion of grains with a {200} orientation.

III. DISCUSSION

The connection between the volume proportion of the Goss texture and the magnetic parameters has been confirmed in a number of special studies [1—4]. The mentioned studies give information about the positive effect of some surface-active elements on the Goss texture formation. Antimony also belongs to these elements [3, 4]. The authors assume that antimony affects the surface energy of crystallographic grains by the equilibrium segregation and the absorption mechanism and thus influences the formation of texture constituents in the course of recrystallization.

IV. CONCLUSIONS

Microstructure and texture of a Fe-3% Si steel sheet microalloyed with Sb, as hot-rolled has been studied and analysed. From the analyses the following results have been obtained: 1. After hot-rolling there exists a difference in the structure morphology across the thickness of the steel. 2. Quantitative and qualitative texture analyses have shown that in the surface zones the plane {110} is of maximum intensity, in the direction towards the centre there increase the intensities of the {200} and the {111} planes. 3. From comparisons of the drafted dependence of the relative intensity upon the sample thickness differences in distribution and intensity of the reflections of the analysed planes were found.

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