Study of local microstructure and texture heterogeneities in hot rolled CGO Fe-3%Si sheets.

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Abstract. After secondary recrystallization, the Fe-3%Si alloys, grade Conventional Grain Oriented (C.G.O.), exhibit a Goss texture that is sought for minimizing watt losses in transformer cores. The mechanisms of Goss grain formation and their evolution during the processing route from hot rolling to decarburizing such as the early first steps of abnormal growth are not still well cleared up. This work deals with the influence of local microstructure and texture heterogeneities observed by X-ray diffraction (XRD) and Electron Back Scattered Diffraction (EBSD) at the hot rolling step. The present results complete those previously obtained by neutron diffraction [1]. Presence of Goss grain colonies at about the quarter of the hot rolled sheet is probably, as it has already been suggested, at the origin of the Goss grain presence at the primary recrystallized state.

Introduction

The Goss texture {110} <001> allows the watt losses in transformer cores to be minimized, when the induction lines are parallel to the rolling direction that is parallel to the easy magnetization direction <100>. Moreover it has been observed that, the smaller the dispersion of the directions <001> about the rolling direction, the smaller the watt losses.

Many authors [2-6] have studied the influence of texture heterogeneities, grain boundary energy, grain size of Goss grains,…, on the abnormal Goss grain growth from the primary recrystallized state. For this last state, the two main texture components of the γ fiber are {111} <121> and {111} <011>, their respective volume fraction varies according to the processing route. These two orientations form high angles and CSL grain boundaries with the Goss grains, which favors their abnormal growth [7-13].

However, only few studies have been devoted to the Goss grain formation from the hot rolled up step to the primary recrystallized state [14-19]. Deformation heterogeneities through the sheet thickness at the hot rolled step appear to be a key factor in the Goss grain formation.

The aim of this work is to characterize by X-ray diffraction (XRD), Electron Back Scattered Diffraction (EBSD) and Scanning Electron Microscopy (SEM) the textural and microstructural heterogeneities through the sheet thickness after hot rolling.

Material and Techniques

At the hot rolled state, the surface of the studied sheets displays alternation of grey and black zones, therefore texture and microstructure of these both zones have been studied at the surface, at quarter and half sheet thickness. The global texture was determined by X-ray diffraction (λ K(α) Co) using