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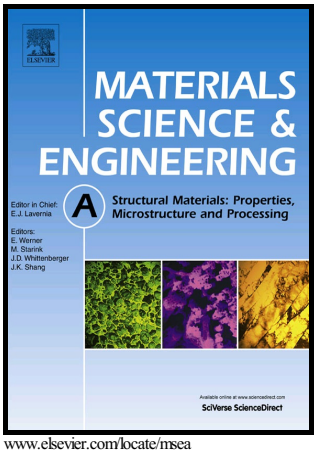

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Recrystallization Behavior and Texture of Non-Oriented Electrical Steels

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ABSTRACT

Five numbers of Si steels with different alloying elements, viz., 1.35 % Si, 2.2 % Si, 1.48% Si with 0.11 % Sn, 1.44 % Si with 0.05 % Sb and, 1.52 % Si with 0.11 % P (all are in wt.%), were made in laboratory. Hot bands of 2.2% Si and 1.52 % Si with 0.11 % P showed recovered grains of very coarse elongated ferrite while that of 1.35% Si steel showed fine ferrite grain of both elongated and fine equiaxed type similar to that of remaining two steels. Grain boundary misorientation and recrystallization study of hot bands before and after annealing indicated nearly complete recrystallization of 1.35 % Si and partial recrystallization of Sn and Sb added steels containing low Si. In the case of 2.2% Si and 1.52 % Si with 0.11 % P steels, the recovered grains were observed mostly containing substructures. The retardation to recrystallization in these two steels has been attributed to the elemental effect of P and high Si. The no-recrystallization temperature (Tnr) of only these two steels were noticed at $\leq 1000^0$C. The $\phi_2 = 45^0$ and $\phi_2 = 90^0$ ODF sections of hot bands indicated that all experimental steels except 1.35 % Si steel show magnetically favourable texture components of θ fiber (<001>//ND) and η fiber (<001>//RD) components. The beneficial θ fiber components were also further noticed in cold rolled and final annealed 2.2 % Si, 1.44 % Si with 0.05 % Sb and, 1.52 % Si with 0.11 % P steels. The presence of the magnetically favourable texture in these steels probably resulted in reduced core loss of these steels while the highest core loss was noticed in 1.35 % Si steel. The mechanical properties of final processed steels were also found to be suitable for cold forming and stamping operation during their electrical applications.

Key words: Recrystallization, recovery, CRNO steel, core loss, θ fiber, η fiber

1.0 INTRODUCTION

Electrical steels, popularly known as silicon steels, are one of the most important material used in lamination form to carry magnetic flux in a variety of energy- efficient alternating current electrical machinery such as generators, motors, lamp ballast, small and medium size transformers. These steels are further categorised into cold rolled grain oriented

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