The texture transition of shear bands in Goss grains during cold rolling in grain-oriented silicon steel

S.H. Chen,[1] X. Chen,[1] Y.H. Sha,[1] Z.H. He,[1,2] F. Zhang,[1] and L. Zuo[1]

[1]*Key Laboratory for Anisotropy and Texture of Materials (Ministry of Education), Northeastern University, Shenyang 110819, China*

[2]*School of Materials Science and Engineering, Shenyang University of Technology, Shenyang 110870, China*

Grain-oriented silicon steel is an important soft magnetic material for electromagnetic conversion and is widely used in transformers[1−2].The magnetic induction of grain-oriented silicon steel is determined by the sharpness of secondarily recrystallized Goss grains,which is originated from nucleation in the shear bands of cold rolled sheets[3].However,the microstructure and texture in shear bands is depended on the texture of deformed matrix and the rotation route of the deformed matrix[4−7].To clarify the formation mechanism of the shear band,the initial Goss grains with diffused angle along the ϕ_2 axis in the subsurface layer of the normalized sheet were selected to captured the microstructure evolution during the cold rolling.The quasi in-situ electron back-scatter diffraction(EBSD) method was used to track the texture transition of shear bands in Goss grains with different diffused angle along the ϕ_2 axis.It is found that the diffused angle along ϕ_2 axis of initial Goss grains decreased 1-3°during cold rolling, and ϕ_2 angle converged on 45°,which the grain orientation rotated towards {111}<112>. When {111}<112> deformed matrix texture was diffused along the ϕ_2 axis larger than 4°, the Goss orientation within the shear band was diffused along the ϕ_2 axis larger than 4°. The simulation of the rotation path and the shear band texture by the crystal plasticity simulation was consistent with the experiment.This study provides a beneficial guide to improve the sharpness of secondary recrystallization Goss texture and magnetic induction in the grain-oriented silicon steel.

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