The role of chemical interaction with recrystallization microstructure and texture evolution: Sn alloying in Fe-Si model alloys

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Abstract

Alloying elements are known for their ability to modify the microstructure during the thermomechanical process and greatly affect final material properties. Crystallographic texture development is no exception. Polycrystalline metals undergo crystal rotations during thermomechanical processing. For example, during the rolling of bcc metals the so-called rolling textures consisting of alpha and gamma fiber orientations form. These rolling textures are often inherited even after annealing and recrystallization of the microstructure, especially for larger geometric reductions applied during the rolling operation. In low-carbon steels, the final texture has a strong relationship to the rolling texture usually with a prominent {111}//ND fiber dominating the recrystallization texture. However, there can be an important chemical aspect in texture evolution. Alloying elements may influence the texture development by local solute drag effects during recrystallization. This study focuses on the effect of segregating elements in the course of static recrystallization; electron back-scatter diffraction data are complemented with site-specific chemical analysis by atom probe tomography to link crystallographic orientation preferences with local chemical information. High-stored energy nucleation of recrystallization is found to be greatly affected by segregation phenomena in the subgrain structure. Furthermore, an intriguing aspect of texture evolution with segregation is the rise of the {411}< 148> texture component intensity in the recrystallization texture. An alternative scope for future recrystallization studies will be given.

Keywords: recrystallization, solute, segregation, texture control

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