«A multi-scale study of the interaction of Sn solutes with dislocations during recovery in Fe-Si alloys»

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Metals are sensitive to chemical effects and even small alloying contents in solution can drastically alter microstructure development during the thermomechanical processing and final material properties. The effect of solute elements on the recrystallization and related annealing phenomena is clearly a key factor with scientific and industrial interest. Here, we present an overview of how Sn solute addition may affect recovery and recrystallization in a cold rolled Fe-Si model alloy. A multiscale approach is employed combining different characterization techniques at length scales that go from mesoscale to nanoscale. Observations have shown that during annealing, Sn addition can influence the recrystallization behavior from the onset onwards and retard the recrystallization kinetics [1]. Whereas, prior to the onset of recrystallization, at lower annealing temperatures, Sn is observed to also affect the softening behavior during the recovery phenomena [2]. These observations are linked to local segregation tendencies, the interaction of solute atoms with dislocation assemblies and the subgrain structure. Dark field X-ray microscopy (DFXM) can be a very powerful technique to observe microstructural features at the subgrain level beyond surface observations. Results from DFXM sequential annealing experiments revealed information about defect structures and subgrain networks within the bulk of the material, examples of how DFXM can potentially provide a completely novel perspective for studying recrystallization.

References

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