

The evolution of the Goss texture – is this mysterious texture problem finally solved?

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The origin of the Goss texture,  $\{110\}\langle 001\rangle$ , after cold rolling and primary and secondary recrystallization of Fe 3% Si electrical steel, has been one of the longest researched problems of texture research. This is all the more surprising since the formation of the Goss texture is a very obvious process where a weak recrystallization texture transforms during abnormal grain growth into an extremely sharp, almost single-crystal texture. One of the reasons for the long-lasting research efforts is certainly the rareness of the growth event: in the extreme case of high grain oriented (HGO) material only one grain out of 10 million recrystallized grains growth and develops into a centimetre large grain. What is the reason for this strong orientation selection and how is this related to the long and difficult processing schedule of grain oriented electrical steels?

Since about 20 years a group of researchers from the Max-Planck-Institute for Iron Research and from Thyssenkrupp Electrical steel has worked together to find answers to these questions. Based on our own work, and on work of other research groups, we recently proposed a new theory for the origin of the Goss grain growth, called “Dislocation-aided particle dissolution” which appears to explain the formation of Goss grains more consistently than theories that were proposed before. Basically, the theory explains that subgrain boundaries that are found in Goss grain nuclei in the recrystallized material lead to a quicker dissolution of the grain growth-inhibiting particles than it is the case around grains without these structures. Therefore, these grains experience lower pinning forces along their boundaries and thus quicker growth. The origin of the subgrain boundaries itself is explained by the particular deformation and recrystallization behaviour of Goss-oriented grains in the original hot-rolled material.

The talk will give an overview on the existing theories for abnormal grain growth in grain oriented electrical steel, describe the scientific challenges that needed to be overcome and present details of the new theory.