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Texture simulation of cold-rolled F.C.C. metals by using Taylor model

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The orientation of grains plays a significant role in the anisotropy of mechanical properties. In the 1980s, Van Houtte proposed the revised model, as known as the relaxed constrained Taylor model, to predict the experimental rolling texture of high SFE metals. Until now, lots of researchers work on the evolution of the texture between experiment and simulation but are not able to simulate all the specific texture simultaneously, and the intensity of them are quite different as well. Thus, in this research, we combined the full constraints and relaxed constraints Taylor models to predict the texture of severely cold-rolled copper, and compare the difference of texture between experiment and simulation quantitatively. This study consists of a cold-rolling experiment and numerical simulation. In the cold-rolling experiment, copper was rolled and measured by XRD and EBSD to analyze the texture and microstructure respectively. In the numerical simulation, statistical 10,000 orientations were imported to the combined Taylor model to simulate the rolling texture measured by XRD. In an experiment, the 95% cold-rolled copper shows high Cu(16.2%), S(34.6%) and Bs(14.4%) orientations, which are the main components of rolling texture of high-stacking-fault-energy metals. In a simulation, the combined Taylor model successfully simulates high Cu(9.21%), S(23.24%) and Bs(13.81%) orientations. The results are shown for Cu, S, and Bs respectively. The combined Taylor model is able to predict the deformed texture. Not only the preferred orientations but the intensity are achieved.

Biography

Shih-Chieh Hsiao is a student in Laboratory for Materials Texture. With his expertise in material science, engineering and modeling, in the first year, he built the RC Taylor Model and used it to simulate the texture of deformed metals. Furthermore, in order to get better results, he combined the FC and RC model to simulate texture which is relatively close to the experimental results. As an engineer, he did the experiment to confirm the texture and microstructure as well. The fact that the similarity of textures in experiment and simulation enable researchers to understand how the textures form, and it also enables engineers to control the texture in an industry to reduce the cost. This research contributes to both academy and industry.

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