3D Simulation of Static Recrystallization and Phase Transformation using Multi-phase-field and Crystal Plasticity Fast Fourier Transformation Methods

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ABSTRACT

Microstructure evolutions during static recrystallization in deformed aluminum alloy and austenite-to-ferrite transformation in deformed steel are simulated using multi-phase-field (MPF) method and crystal plasticity fast Fourier transformation (CPFFT) method. In order to evaluate distributions of stored energy and crystal orientation in the materials plastically deformed by rolling, CPFFT simulations of plane strain compression and shear deformatins are performed using the CPFFT method with the spectral solver implemented in the Düsseldorf Advanced Material Simulation Kit (DAMASK). The calculated stored energy and crystal orientation are used for the estimation of nucleation sites and nucleation rate of the recrystallized grains and the ferrite nuclei. The growth of the grains and the new phase in the deformed materials are simulated using the in-house MPF code. In this study, we systematically investigate the effects of the amount of plastic deformation applied to the material on the microstructure evolution.

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