Ulrich Prahl, Mingxuan Lin:

A multiscale perspective on bainite transformation in steel

Abstract:

The bainitic transformation in steel is a complex process including the displacive transformation of austenite into supersaturated bainite, the diffusion of carbon into austenite, and the diffusional formation of carbides. Large stress or pre-strain greatly influences the morphology and orientation of bainite due to the strong coupling between mechanical load, internal stresses induced by the displacive transformation. The phase field method (PFM) has been well established to model the diffusion-controlled phase transformation while the crystal plasticity (CP) model can predict the plastic behavior of the austenite matrix. The presented work couples the PFM with CP model to simulate the chemical and mechanical processes in bainitic transformation. The evolution of the phase field is simulated by the software package OPENPHASE and the evolution of stress- and strain field is calculated by the widely used CP software, Duesseldorf Advanced Material Simulation Kit (DAMASK). The growth of bainitic sheaves in an austenitic grain is simulated with various external strain boundary conditions. The influences of mechanical load on the bainitic transformation kinetics and the interoperability between both software packages are discussed.

Head of Department: Univ. Prof. Dr.-Ing. W. Bleck
E-Mail: bleck@iehk.rwth-aachen.de
Fon: +49 241 8095782
Fax: +49 241 8092224