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# Modeling hot rolling: A study on the microstructural changes during the $\gamma - \alpha$ phase transformation in dual phase steels

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## ABSTRACT

Dual-phase steel are low-carbon micro-alloyed steels and consist of a ferritic multiphase structure composed of bainite and residual austenite in which martensite is dispersed. The properties derived from this microstructure give high performance to dual-phase steels in cold-forming applications for crash resistant and lightweight structures in automotive parts. The dual-phase structure depends on the chemical composition of the steel, and on thermo-mechanical treatment realized during rolling at lower temperatures in the region of no recrystallisation. During $\gamma - \alpha$ the phase transformation the stores dislocation pattern and the deformed austenite grain structure has a strong influence on the kinetics of the ferrite transformation.

In this work the authors focus on the modeling of microstructural changes during the $\gamma - \alpha$ phase transformation during the soaking period. The evolution of the microstructure is simulated by the use of a multi-phasefield model which is based on the diffuse interface theory [1]. The model combines the diffusion of the species which defines the time scale, the curvature of the interfaces which define the length scale and phase diagram information which represents the energy scale as well as the mechanical energy.

Using this model the influence of the plastic deformation applied during the hot rolling process and strain energy induced by the lattice mismatch during the $\gamma - \alpha$ transformation on the microstructure evolution in a low alloyed carbon steel is studied. We now expand a previously developed model [2,3] by the use of anisotropic plasticity models in order to take into account the effect of the crystallographic orientations of the different grains grains and the resulting inhomogeneous plastic deformation.

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