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Characterization of microstructural evolutions and mechanical properties during the thermal treatments of cold rolled Dual-Phase steels

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In recent years Dual-Phase steels seem to be promising for lightweighting the body-in-white of vehicles and thus reducing their environmental footprint. Although the phenomena involved in their manufacture are well known (recrystallization, phase transformation, tempering, etc.), it is still impossible to predict accurately the mechanical properties of these steels according to the thermal cycle, the chemical composition and the rate of reduction during hot rolling.

The aim of this study was to develop physically-based models for the different phenomena occurring during the thermal cycle below:

- **Part 1** presents a recrystallization model based on the microstructure and coupled with a precipitation model (MiReX). The prediction of experimental kinetics is coupled to physical parameters (chemical composition, thermal cycle and reduction ratio).
- **Part 2** focuses on the development of a model for the prediction of the ferrite-to-austenite phase transformation kinetics driven by Gibbs energy minimization (GEM). An experimental comparison both with complex industrial thermal cycles and with DICTRA has been performed.

- **Part 3** deals with the prediction of the martensitic transformation start temperature (Ms) in the case of two-phase steels.
- **Part 4** proposes improvements to the models for predicting the mechanical properties of dual-phase steels in the literature.
- **Part5** investigates the phenomena involved in tempering and a means of taking it into account in the prediction of the mechanical properties of DP steels.