

Bainite formation in the presence of martensite

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Advancing our understanding of the mechanisms of phase transformations is an efficient pathway to designing new steels with enhanced, tailor-made mechanical properties at minimal experimental cost. In this dissertation, a new analytical model of the kinetics of bainite formation based on the displacive-diffusionless theory is proposed. This new model can reproduce and offer insights into the effect of prior austenite grain size and prior martensite on the kinetics of bainite formation. Following the understanding achieved with the model, the accelerating effect that martensite has on bainite formation kinetics is used to develop novel advanced high strength steels for the automotive industry that can be manufactured in existing continuous annealing lines thanks to fast bainite formation. Finally, to better understand the nucleation and growth of bainite, a real time observation of bainite formation using in situ transmission electron microscopy is shown and discussed.

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