



Austenitization mechanisms and modelling methods for steels

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Abstract

Information on the austenitization process of steels has been reviewed and analyzed. Based on available research results, a series of diagrams are designed to show the austenitization mechanisms and processes. Particular attention has been paid to the mechanisms of austenite nucleation, growth and homogenization. Based on the diffusion process in austenitization, the developed constitutive equations to model the evolution of carbon concentration are reviewed and discussed. The effect of alloy on the austenitization process is also included in this study.

Key words: *Micro-alloyed steel, Austenitization, Materials modelling, Hot stamping, Phase transformation*

1. Introduction

A process, in which heated boron steel sheet is formed and quenched between cold dies, to produce high strength parts for safety features in automobile structures, has been developed recently (Wilsius and Hein, 2006). This process enables components to be formed with the steel in the austenite state, which has high formability and to be transformed to martensite in their finished condition, with the highest possible strength of the steel. One of the key features of this process is austenitization during heating and soaking periods for the purpose of forming a single phase structure with a homogeneous microstructure

and small austenite grain size. The formation of austenite and the control of this phase transformation process are two of the aspects vital to obtaining the required high level mechanical properties, in addition to the quenching. The characteristics of the austenite, affect the microstructure and hence mechanical properties resulting from the forming/quenching operation. Theoretical and experimental studies on austenitization have been widely carried out, and materials modelling techniques of the process have attracted considerable interest from engineering researchers and have been greatly discussed in the literatures (Wilsius *et al.*, 2006)

Basically, austenitization process can be divided into three typical steps, nucleation of austenite, grain