

Microstructural Evolution in HSS Work Rolls During Thermal Processing



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Materials development for rolling applications has become multidisciplinary, integrating expertise from various fields. ESW adopts this approach in all shell material developments. This article outlines the framework of ongoing activities in high-speed steel (HSS) material development for hot strip mills. A European hot strip mill, R&D institutions and ESW collaborated to enhance HSS material performance, focusing on heat treatment. The project aims to develop a simulation model in Abaqus to identify critical times and predict alternative heat treatment routes. The model, validated with continuous cooling transformation, time-temperature-transformation diagrams and stress measurements, uses thermophysical data and temperature measurements from an instrumented work roll.

Introduction

Work rolls for hot rolling mills are primarily manufactured using the centrifugal casting process. In this method, the shell material is poured into a rotating mold, where centrifugal forces ensure an even distribution of the melt, forming a cylindrical layer. Once the shell has solidified, the core material is poured, creating

a permanent bond between the shell and the core.

The heat treatment of as-cast rolls is conducted in electrically heated bogie car furnaces, with the precise control of the temperature-time curve being crucial. Excessive heating or cooling rates can create significant thermal gradients within the roll, leading to high internal stresses. These stresses

Figure 1

Schematic drawings of the roll manufacturing process at ESW; 1: horizontal centrifugal casting, 2: assembly of the moulds, 3: pouring of the core material.

