Numerical Simulation of Austempering Heat Treatment of a Ductile Cast Iron

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Abstract

This paper presents a coupled thermo-mechanical-metallurgical formulation to predict the dimensional changes and microstructure of a ductile cast iron part as a consequence of an austempering heat process. To take into account the different complex phenomena which are present in the process, the stress-strain law and plastic evolution equations are defined within the context of the associate rate-independent thermo-plasticity theory. The metallurgical model considers the reverse eutectoid, ausferritic, and martensitic transformations using macro- and micro-models. The resulting model is solved using the finite element method. The performance of this model is evaluated by comparison with experimental results of a dilatometric test. The results indicate that both the experimental evolution of deformation and temperature are well represented by the numerical model..

Keywords

Austenite, Cementite, Pearlite, Nodular Cast Iron, Austempering.