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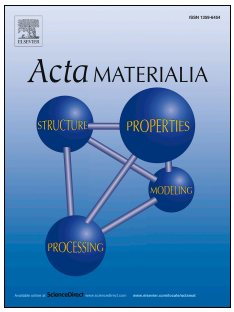

Analysis of the interaction between moving α/γ interfaces and interphase precipitated carbides during cyclic phase transformations in a Nb-containing Fe-C-Mn alloy

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Analysis of the interaction between moving α/γ interfaces and interphase precipitated carbides during cyclic phase transformations in a Nb-containing Fe-C-Mn alloy

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Abstract

The interaction between moving α/γ interfaces and interphase precipitated (IPd) carbides during the austenite (γ) to ferrite (α) and the ferrite (α) to austenite (γ) transformation has been systematically investigated through cyclic phase transformation experiments for a 0.1C-1.5Mn alloy containing 0.1wt% Niobium (Nb) and its Nb-free counterpart. Shifts in the critical reaction temperatures during continuous heating and cooling are observed, which are attributed to the pinning force (PF) originating from the IPd carbides present. By applying the Gibbs energy balance (GEB) model to analyze experimental results, the PF was derived to be about 15 J/mol for the α→γ transformation and about 5 J/mol for the γ→α transformation, respectively, both of which are quite small compared to chemical driving force of phase transformations. Moreover, various modified Zener pinning equations have also been used to predict the PF, and it was found that these values are comparable with those obtained from experiments, which suggests that the classical Zener theory still has promising potential for carbide-interface interaction analysis.

Keywords: Phase transformation; Interphase precipitation; Carbide; Pinning force; Interface migration

1. Introduction

The autonomous formation of dispersed nanosized second-phase particles at moving grain boundaries has been recognized as an important means to inhibit grain