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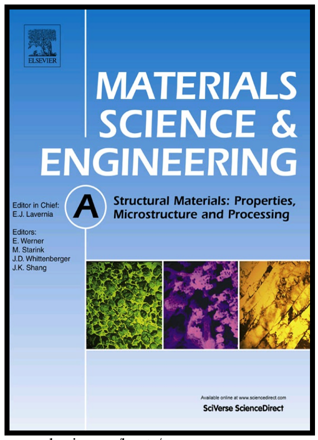

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Extending an empirical and a fundamental bainite start model to a continuously cooled microalloyed steel

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Abstract

The empirical model proposed by Lee and a fundamental model for the isothermal bainite start temperature (B_S) are applied in this work to a microalloyed steel undergoing continuous cooling transformation. The fundamental model for B_S is based on displacive transformation of bainite. The method proposed in this paper is termed the Bainite Intercept Temperature method (BIT). Using this method it is possible to determine the volume fraction of the phase that forms before bainite, i.e., quasi-polygonal ferrite. BIT analysis is applied to continuous cooling where a two phase microstructure is formed of quasi-polygonal ferrite and mixed bainitic ferrite and B/M. The estimated intrinsic hardness of the components based on BIT is compared with isothermal transformation results and the hardness is calculated based on the contribution of strengthening mechanisms.

Keywords: microalloyed steel bainite phase transformation CCT

1. Introduction

Microalloyed steel skelp often undergoes accelerated cooling after hot rolling. Accelerated cooling in thermo-mechanical processing of microalloyed steel is used to increase strength and toughness [1]. High cooling rates improve the mechanical properties by reducing the ferrite grain size and, more importantly, by increasing the volume fraction of the stronger microstructural constituents such as bainitic ferrite and acicular ferrite. Increasing cooling rate reduces the time that austenite spends in the temperature range that produces polygonal ferrite, which has good ductility but lower strength and toughness. As a result, more austenite is left to transform to lower temperature products that exhibit superior mechanical properties [2].