Transformation induced plasticity effect under tensile and compression stresses in nanostructured bainite

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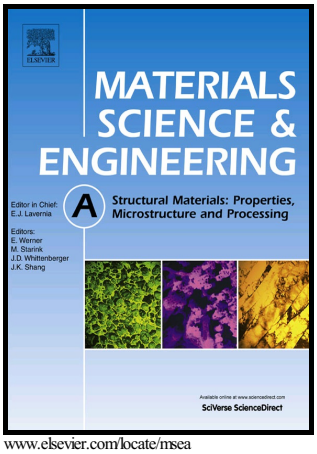

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Transformation induced plasticity effect under tensile and compression stresses in nanostructured bainite

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Abstract

TRIP effect and mechanical stability of retained austenite are important factors which must be considered when talking about the ductility in nanostructured bainite. Meanwhile, different parameters affect austenite mechanical stability among those the deformation mode is of considerable importance. This article aims to compare the capability of high carbon retained austenite to transform to martensite when being subjected to external tensile and compressive mechanical loads in those materials. Scanning electron microscopy were used to investigate the microstructural features and interrupted tensile and compression tests were implemented to evaluate austenite stability. X-ray analyses were carried out to evaluate the austenite to martensite evolution during straining the samples and three different mathematical approaches were also implemented to express the austenite mechanical stability by mathematical constants. Results indicated that higher yield strength, enhanced true plastic strength and higher ductility could be obtained in compression deformation state. Moreover, tensile tests strongly simulated the martensite formation while compressive deformation mode opposed the volume expansion associated with austenite to martensite transformation. Accordingly, austenite was mechanically more stable during compression and it transformed to martensite more gradually comparing to that of tension.

Keywords

Steel; Bainite; Phase transformation; TRIP; SEM; XRD

1. Introduction

Multiphase steels with microstructural constituents of different morphologies and volume fractions, enable achieving enhanced comprehensive mechanical properties. Among those, TRIP assisted dual phase steels containing bainitic ferrites and retained austenite are of great interest in which thermally stable high carbon retained austenite presents within the microstructure at room temperature and affects the mechanical properties by transforming to martensite during applying stress or strain [1]. The expectation is to be able to further

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