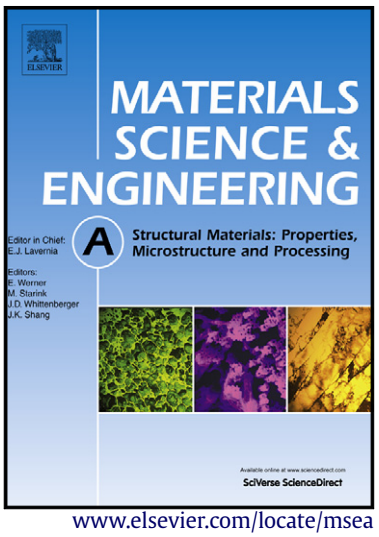

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Effect of microstructural constituents on strength-toughness combination in a low carbon bainitic steel

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ABSTRACT

A low carbon bainitic steel with varying strength was obtained through change in the thermo-mechanical processing parameters. In this regard, we elucidate the relationship between processing parameters, microstructure, and mechanical properties. The study underscores that the volume fraction of martensite-austenite (M-A) constituent is strongly governed by the rolling reduction ratio. The tensile strength was increased with increase in the volume fraction of lath bainite (LB) and M-A constituent, while the yield strength increased monotonically with increase in the volume fraction of LB, and was not sensitive to the volume fraction of M-A constituent. Acicular ferrite (AF) was responsible for high impact energy. Large blocky M-A constituent facilitated initiation of cracks at the M-A constituent/matrix interface, while small M-A constituent of size less than 1 μm was helpful in improving toughness. The volume fraction of retained austenite increased with increase in rolling reduction ratio, which neutralized the negative effect of the increase in the volume fraction of M-A constituent on impact toughness, contributing to improvement in toughness.

1. Introduction

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