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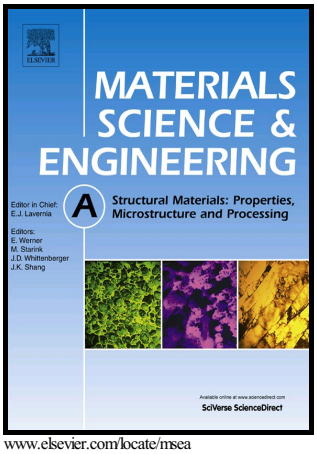

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Abstract

To analyze the influence of the initial microstructure in the production of a dual phase (DP) steel on the mechanical properties, a commercial DP steel was subjected to two heat treatments (HT): step quenching (SQ) and intermediate quenching (IQ). SQ samples were austenitized at 930°C for 20 minutes, then annealed at 830°C for 5, 15, 30, 60 and 120 minutes and finally water quenched. Shorter annealing times show allotriomorphic ferrite and martensite while at longer time polygonal ferrite is formed. Tensile tests showed that yield and tensile strength are higher than those of the commercial DP steel and besides, the uniform elongation is smaller. IQ samples were water quenched after austenitization and then annealed at 830°C for the same holding times and water quenched again. The microstructure consists of martensite dispersed in a ferrite matrix. The remarkable results are that these samples had similar tensile properties to that of the as-received DP steel. Tensile properties were analyzed as a function of the characteristic microstructure and the assessment of the alloying elements partition during the different HTs. Evaluation of the Kolmogorov-Johnson-Mehl-Avrami theory indicates that the transformation in SQ and in IQ samples corresponds to a diffusional process.

Keywords

Dual phase steels; Intercritical Heat treatments; Partitioning; Microstructure; Mechanical properties

1. Introduction

Dual-phase (DP) steels offer an outstanding combination of high strength and good ductility as a result of their microstructure, in which a hard martensitic phase is dispersed in a soft ferrite matrix. They are commonly used in industries, specially the automobile industry. Automobile components of DP steels include car body panels, wheels, bumpers [1, 2], etc. in which the current drive is to reduce weight (for improved fuel efficiency) and to achieve higher crash resistance [3] (making them safer for consumers).

Intercritical heat treatment is the simplest way to produce dual phase microstructure from low-alloyed steels. Before heat treatment at the (α+γ) region, the initial microstructure can