Metallurgical and Materials Engineering *Research paper*
Association of Metallurgical Engineers of Serbia AMES *https://doi.org/10.30544/753*

EFFECTS OF THE TEMPERING TEMPERATURE ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF X70 DUAL PHASE STEEL

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Received 24.10.2021
Accepted 25.04.2022

Abstract

This study uses direct quenching (DQ) heat treatment at an intercritical annealing temperature (IAT) of 800 °C to form a martensite-ferrite dual phase microstructure of X70 steel. The effects of tempering temperatures ranging from 200 to 500 °C on tensile properties in a dual-phase X70 steel are investigated. Carbon diffusion and redistribution in the microstructure are influenced by tempering. It was discovered that the amount of carbides increases with the tempered temperature, resulting in depleted carbon in martensite. Conversely, increasing the tempered temperature causes a decrease in ultimate tensile strength and yield strength while increasing elongation.

Keywords: dual phase steel; intercritical annealing; tempering; mechanical properties.

Introduction

Martensite-Ferrite Dual phase steel, which is interesting engineering steel due to their excellent mechanical properties is composed of a softer ferrite phase and the harder martensite phase [1–4]. Dual phase microstructures can be developed by heating in the austenite-ferrite region and by quick quenching to room temperature austenite changes to martensite. The formation of martensite leads to residual stresses and a high density of dislocations in ferrite which can be reduced by tempering treatment [5]. The martensitic transformation is the source of particular mechanical properties of dual phase (DP) steels, such as high tensile strength, continuous yielding behavior, low yield strength and high strain hardening rate [6-9]. The mechanical behavior of (DP) steel is affected by many factors, such as grain size [10, 11], dislocation density [12, 13], constituent phase properties [14], martensite volume fraction [15, 16], and martensite morphology [17]. To improve ductility and formability of high strength DP steels,

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