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The Investigation of Temperature and Time of Step-Annealing on Microstructures and Mechanical Properties of AISI3115 Steel

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Abstract
The aim of this study is to evaluate the effect of temperature and time step-annealing of the microstructures and mechanical properties of AISI 3115 steel with ferritic-martensitic dual phase (DP) in comparison with conventional quenched. For this purpose Prepartion of ferritic-martensitic dual phase specimens with different volume fractions of ferrite and martensite was performed using the method step-annealing at mohten salt buth 600 and 650°C for different times 5, 30, 60 and 120 minute. Mechanical tests hardness, elasticity with optical and electron metallographic examination was conducted. The results showed that as the volume fraction of ferrite in the step-annealed specimens at constant temperature Increased with increasing holding time. Ferritic-martensitic dual phase microstructures with 15% volume fraction of ferrite has the highest tensile strength and flexibility are forms that this phenomenon is caused by the interaction of ferritic and martensitic phases.

Keywords: Step-annealing, Steel AISI 3115, ferritic-martensitic dual phase microstructure, mechanical properties.

Introduction
Double-phase steels are a group of low-carbon low-alloy steels, the microstructure of which consists of two phases of ferrite and martensite and used as commonly used steels in the automotive industry. This is due to the presence of a soft ferrite phase, as a ductility-producing phase and a martensitic hard phase. This structure represents a kind of metal composite in which the strength and formability are simultaneously high[1 and 2].
Step-annealing thermal treatment is one of the developed methods for the design and production of low-alloy steels with high strength-ductile combination. In step-annealing, steel is first heated in the austenitic region (Y) to form a fully austenitic structure, then slowly cools down to the two-phase zone and after storage for a specified time and temperature, it quickly cools up to the ambient temperature. As a result, the austenite phase is transformed into martensite and the ferrite-martensite structure is created instead of the so-called ferrit-perlite microstructures. This improves the final properties of double-phase steels, including the possibility of cold deformation, length increase and formability. It is very important to choose the temperature and time of the heat treatment of the annealing staircase, which is determined by the use of the TTT phase diagrams for each steel[3].

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