THE DUAL-PHASE STEELS HARDNESS PREDICTION ACCORDING TO THE STRUCTURE OBTAINED AFTER HEAT TREATMENT

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Abstract: *The article aims is a model data which predicts and optimize the dual-phase steels hardness according to the structure obtained after heat treatment. To study the combined effect of temperature T (ºC) and structure obtained after heat treatment were used a 2^3 orthogonal central composite experimental design for experiments design and Response Surface Methodology for analysis of experimental results. The maximum of hardness value were found to be at T = 810ºC; in this point the surface hardness is 2178.570 HM given by empirical model and 2191.207 HM confirmed experimentally.*

Keywords: *hardness, teat treatments, hardness tester, mathematic model.*

1. Introduction

Dual-phase steels are alloys with a low carbon content obtained as a result of thermal or thermo-mechanical processes and have in fact a structure composed of a matrix of soft and tenacious ferrite in which there is homogeneous dispersed martensite and a small amount of residual austenite. For dual-phase steels the stress-strain curve is continuous, without yield; their work hardening is very fast to small stress, have a low yield strength and a high tensile strength. [1, 2, 3, 4, 17].

Dual-phase steels products worldwide have, in general, a percentage of carbon less than 0.12 %, a content of manganese between 1.0 % and 3.5 %, and elements such as V, Cr, Mo and, Nb, are to be found in chemical composition in proportions situated below 1%; in the last few years there have been studies on steels in which the content of manganese has been less than 1 %. (0.5 - 1 % Mn), [2, 3, 5, 17].

The main beneficiary of dual-phase steels is the machine building industry, which uses sheets with R_m = 400 ÷ 500 MPa for the manufacturing of bodywork components and with R_m = 550 MPa used to make bumpers, shock absorbers, rims, stiffening elements etc. [2, 3, 5, 10, 11].

2. Equipment and materials used for the comparative study

For this study a commercial steel in the form of wire with a diameter of 5 mm was used; the chemical composition of the steel has been determined on "Polyvac 2000", and the result obtained is given in Table 1.

Table 1. *Chemical composition of the steel.*

Elements	C	Mn	Si	Cr	Ni	Mo	Al	Cu	P	S
[%]	0,094	0,53	0,085	0,029	0,042	0,005	0,003	0,065	0,003	0,004

In manufacturing technologies of the dual-phase steel by intercritical quenching, the temperatures of the critical points Ac1 and Ac3 are particularly important, the structure and properties of this steel depending on the accuracy of the data. Knowing the chemical composition of the steel and using the