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Study of the effect burnishing on superficial hardness and hardening of S355JR steel using experimental planning

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Abstract: Surface hardness plays an important role in lifetime of a mechanical piece subjected to friction and wear. Indeed, the hardness can be improved by superficial plastic deformation processes (SDP), such as mechanical surface treatment "MST", in particular the ball burnishing. However, the treatment result of is conditioned by mastery of operation thus ensuring treated piece good mechanical and geometric properties. Experimental work was carried out by applying the ball burnishing process on steel tensile specimens S355JR, in order to observe the influence of treatment parameters regime on surface hardness ‘Hv’ and the effect of latter on tensile behavior of this steel. Two parameters of regime were considered namely: burnishing force "Py" and number of passes "i". The relationship between these parameters and microhardness measured at "Hv" surface has been highlighting using factorial plans 22. Moreover a mathematical model has been obtained allowing prediction of response (Hv) as well as optimization of parameters of treatment regime. The experimental results showed that for surface hardness Hv it is possible to reach a 45% improvement rate for a burnishing force py = 20 Kgf and a number of passages i = 3 for this material. Regarding behavior of material during tensile test, for a low burnishing force (py = 10N) and a number of passes (i = 5), the section further weakening (S = 4.14), proof than ductility of material has decreased.

Keywords : Surface hardness, factorial designs, ball burnishing, Mathematical model, tensile behaviour