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Study of tensile behavior of S355JR steel treated by burnishing -approach superficial hardness by experimental plans

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Abstract

Surface hardness plays an important role in lifetime of a mechanical part subjected to friction and wear. Indeed, the hardness can be improved by processes of superficial plastic deformation (DPS), such as the mechanical surface treatment "MST", in particular the ball burnishing. However, the result of treatment is conditioned by mastery of operation thus ensuring treated parts good mechanical and geometric properties. Experimental work was carried out by applying ball burnishing process on steel tensile specimens S355JR, in order to observe the influence of parameters of treatment 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 2^2. 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, it was noted that for a weaker burnishing force (py = 10N) and a large number of passes (i = 5), the section weakens further (S = 4.14), proof than the ductility of material has decreased.

Keywords: Surface hardness, factorial plans, ball burnishing, mathematical model, tensile behavior

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