Effect of Roller Burning Parameters on Roughness Surface and Hardness of Unalloyed S 355 J0 Steel by Using Response Surface Methodology

Tourab Mohamed1, Hamadache Hamid1, Aguib Salah2, Belhadi Salim3
1Laboratory of Advanced Technology in Research Production Mechanical, Badji Mokhtar University, P.O. Box 12, Annaba 23000, Algeria. E-mail:moh tou@yahoo.fr, hamham36@yahoo.fr
2Dynamic of Engines and Vibroacoustic Laboratory, F.S.I., M.B. Boumerdes University, 35000 Algeria. E-mail :salah.ldmv@gmail.com
3Mechanics and Structures Laboratory (LMS), 8 Mai 1945 University, P.O. Box 401, Guelma 24000, Algeria. E-mail:belhadi.salim@yahoo.fr

Burnishing is a cold working process with superficial plastic deformation, which is to exert an external pressure through a very hard and smooth roller or ball on a surface to occur a uniform and work-hardened surface, to make it possible to reduce roughness, to increase the hardness and to produce residual stresses of compression. The unalloyed S 355 J0 steel specimens were machined on a conventional lathe to the proper dimensions; these machined specimens were then burnished by a simple locally designed and fabricated roller-burnishing tool. The main objective in this work is to determine a mathematical models statistically based on experimental design (response surface methodology) using central composite second-order rotatable design which allows to give the relationship between the two out parameters surface roughness and hardness, representative of the superficial layer surface caused by the four internal roller-burnishing parameters called: burnishing speed, force, feed and number of passes of the tool. The experimental results indicate that feed, burnishing force and speed are the most important and significant parameters to improve roughness surface, and feed, speed, burnishing force and number of passes are the most important and significant parameters to improve superficial hardness of S 355 J0 steel specimens. The surface roughness and hardness were improved from about 2.5μm to 0.15μm and from 176 HV to 226 HV respectively. The validated models with coefficient of determination 2 = 93.1% for surface roughness and 2 = 89.8% for hardness, seem correlate well with the experimental results.

Keywords: roller-burning, unalloyed S355J0 steel, surface roughness, superficial hardness, response surface methodology

Acknowledgments

This work was carried out at the mechanical manufacturing workshop of the National Engineering Institute of Mechanics (INGM), Boumerdes, Algeria. I thank Mr. Salah AGUIB for having me in their workshop and to have allowed me to work under excellent conditions.

Thanks to Mechanics and Structures Laboratory (LMS), University of Gulema- Algeria, for providing various supports for this study. We are also grateful to Dr. Salim BELHADI of LMS, for their help.

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indexed on: http://www.scopus.com


Paper number: M2017109
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