International Journal of Advanced Manufacturing Technology

Volume 116, Issue 3, 2021, Pages 1373-1384

Effect of ball burnishing process on mechanical propertiesand impact behavior of S355JR steel

Mounira Bourebia, Hamid Hamadache, Laouar Lakhdar, Zoheir MENTOURI, Djemili Kamila, Hazem Tarek, Taleb Ahlem

Abstract: Often, surface mechanical treatment (SMT) or heat (quenching, tempering) is used to improve the surface condition andmechanical characteristics such as impact resistance and tensile strength. Hence the objective of this experimental work, whereball burnishing (BB) as well as quenching and tempering were applied on S355 JR steel specimens, is to evaluate the surfacehardness Hv, the rupture strength Rm, the energy absorbed W during the impact test, and the work-hardened thickness e after theburnishing operation. Factorial designs were used for the test organization and mathematical models were established for theprediction of Hv, Rm, W, and “e” in function on treatment parameters considered: number of tool passes (i) and the pressure force(Py). The results show that the surface hardness increases by 30.46%. The high levels of Py and i were allowed to improve Rm by30.8% as well as an increase in tenacity of only 3.6%. Increasing the force to 20kgf promotes mixed rupture under the effect ofimpact to shock. The quenching and tempering improve the Rupture strength Rm by 183% and 119%, respectively, while theeffect of burnishing was limited to a rate of increase of this property of 28% compared to machining.

Keywords : Tensile resistance . Burnishing . Heat treatment . Superficial hardness . Absorbed energy . Penetration depth . Ruptures facies