FINDINGS

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TITLE OF THESIS	:"EFFECT OF SHOT PEENING ON THE MECHANICAL PROPERTIES OF AUSTENITIC STAINLESS STEEL"

The aim of the work was to enhance the mechanical and surface properties of parent and welded austenitic stainless steel. To characterize the mechanical and surface properties of austenitic stainless steel statistical models were required. From this work, an optimal combination of shot peening parameters is generated by using a GRA with Taguchi analysis.
The significant findings that can be drawn from this investigation are summarized below.

1. Shot peening increases the surface hardness of AISI 304 austenitic stainless steel. The increase in surface hardness is due to the induction of CRSF. The surface hardness can be controlled by controlling the various shot peening parameters.
2. Endurance limit of austenitic stainless steel improves with shot peening. However the fatigue life remains unchanged for stress level higher than endurance limit.
3. Double shot peening reduces the surface roughness without significant change in residual stress. Further, increase in the fatigue strength of the material is noted with primary and secondary shot peening.
4. The CRSF relaxes due to fatigue loading. RCRSF due to fatigue loading must be considered for reliable fatigue design of AISI 304 austenitic stainless steel components.The improvement in stress to weight ratio is observed.
5. Shot peening increases the depth of deformed layer and magnitude of CRSF which directly affect the damping factor and fatigue strength of the component.
6. With the increase in thickness of layer removed from the surface, hardness of the surface increases but there is reduction in damping factor and CRSF of the specimen.
7. Damping factor is found to be important surface characteristic which increases with shot peening. A linear relationship is found between damping factor and CRSF.
8. It is not necessary that fatigue life increases with increase in shot peening intensity. Higher shot peening intensities results in reduction of fatigue life.
9. An increase in CRSF, and damping factor, is not necessary to increase the fatigue life.

10. Shot peening improves the tensile strength of the welded joint.
11. It is also found that double shot peening has a little effect on the tensile strength but it improves the surface finish of the specimen.
12. The yield and tensile strength of the investigated AISI 304 austenitic stainless steel is found to increase gradually with increasing shot peening intensity. The yield strength to tensile strength ratio is found to increase and the gap between the curve for yield strength and tensile strength gradually reduced with increasing intensity.
13. Double shot peening reduces the surface roughness without giving significant change in residual stress.
14. It also improves the fatigue strength of the welded joints. The fatigue strength of double shot peened specimens is more than the primary shot peened. This is due to enhancement of the surface finish of the double shot peened specimen.
15. The pressure, shot size, exposure time, nozzle distance and nozzle angle are the process parameters which significantly affecting the performance characteristics. All parameters affecting the performance characteristics are at 95% confidence level. The GRA with Taguchi analysis gives the optimal process parameters as P1S2T3D1E3. At this optimal codition the process parameters are set as: pressure 0.196 MPa, shot size 1.00 mm, exposure time 160 sec, nozzle distance 80 mm and nozzle angle 90^0. Similarly for welded austenitic stainless steel using GRA with Taguchi analysis gives the optimal process parameters as P1S2T3D1E3. In this all other parameters are same except nozzle distance i.e. 100mm.
16. The maximum grey relational grade for parent AISI 304 austenitic stainless steel is 0.8590 among the 27 experiments. The conformation experiments at optimal process parameters give a grey relation grade of 0.8713. It is higher than the grey relational grade among 27 experiments and near to the predicted value of optimal grey relational grade i.e. 0.9212. similarly for welded AISI 304 austenitic stainless steel the confirmation experiments gives a grey relational grade of 0.8973 which is higher than 0.8665 and near to the optimal grey relational grade i.e. 0.9165.
17. For parent material regression models are correlated for tensile strength, surface hardness and fatigue strength with process parameters. Similarly for welded material regression models are correlated tensile strength, surface hardness and impact strength with process parameters. They have obtained with R-sq and R-sq (adj) value more than 0.90. Hence equations provide a useful guide for setting proper values of process parameters.