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Opinion

Statistical Study of A 308l Austenitic Steel Deposit in Sae 1020 Steel

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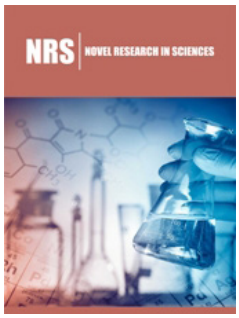

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Abstract

Welding coating of carbon steels with stainless steels allows surfaces with specific properties to be obtained from low cost materials. The quality of the coating is determined directly by the proper adjustment of the welding parameters. In this work, the MIG welding process was applied with the current imposition, the base metal was a SAE 1020 carbon steel and the addition metal were a 308L austenitic stainless steel of 1,00mm de diâmetro, with a single weld cord. The statistical method TAGUCHI "L9" was used in the experimental design and applied the Analysis of Variance of the obtained results.

Introduction

The welding processes with dissimilar metals are suitable for obtaining a surface suitable for wear or corrosion, and during welding there are variations in temperature and plastic deformations in the parts, resulting in changes in microstructure and its mechanical properties. However the welding coating process with stainless steel is defined as the deposition of a layer of stainless steel on carbon steel or low alloy steel surfaces to produce coatings with anti-corrosive properties and necessary strengths to cope with environments subject to wear due to corrosion or cavitation, and the results obtained using welding made this quite attractive [1].

Experimental procedure

For welding the weld bead, SAE 1020 (base metal) steels were taken with the composition: C-0.19%; Mn-0.52% and P-0.02%; S-0.05% and AISI 308L with composition: C-0.024%; S-0.005%; P-0.02%; Mn-1.12%; Si-0.75%; Cr-19.21%; Ni-10%, with dimensions of specimens of 150mm x 38mm x 8mm as shown in Figure 1.

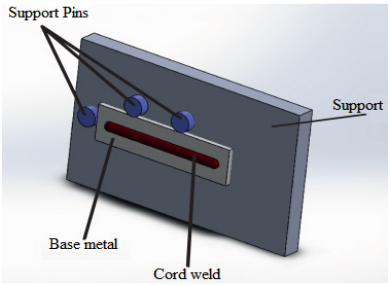

Figure 1: Fixing device for preparation of weld beads.

Experiment planning for TAGUCHI

When using the TAGUCHI method, one of the most important points is the correct choice of orthogonal arrangement. To generate the orthogonal matrix, orthogonal arrangement L9, with four factors and three levels each, the MINITAB software was used [2]. In the Figure 2 illustrates some important points: the yellow upper part is the base metal and the middle part is the ER308L deposition metal [3], above the red line is the metal that has penetrated in the base metal and the part below the red line is the weld reinforcement.

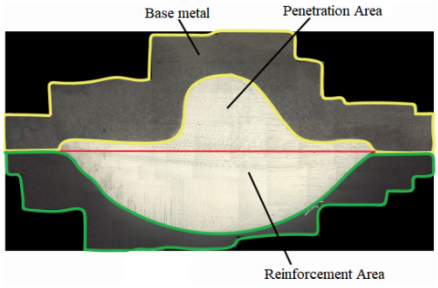

Figure 2: Scheme weld bead generated.

Results and Discussion

The response variables of this work were width, reinforcement, penetration and dilution [4]. The Table 1 show the average values for the determined and simulated results. Figure 3 shows a complete statistical lineation for the three fundamental welding parameters of the nine experiments, where for each of them we can individually relate them to the average, median and standard deviation.

Table 1: Results of weld bead morphology.

Experiments	Width (mm)	Reinforcement (mm)	Penetration (mm)
1	10.65	3.01	2.43
2	6.96	2.54	1.09
3	10.12	2.89	2.41
4	8.82	2.21	2.03
5	8.32	2.74	3.47
6	7.76	3.09	2.82
7	11.17	2.96	2.77
8	9.65	2.8	2.44
9	10.36	3.61	2.66
Average	9.31	2.86	2.46

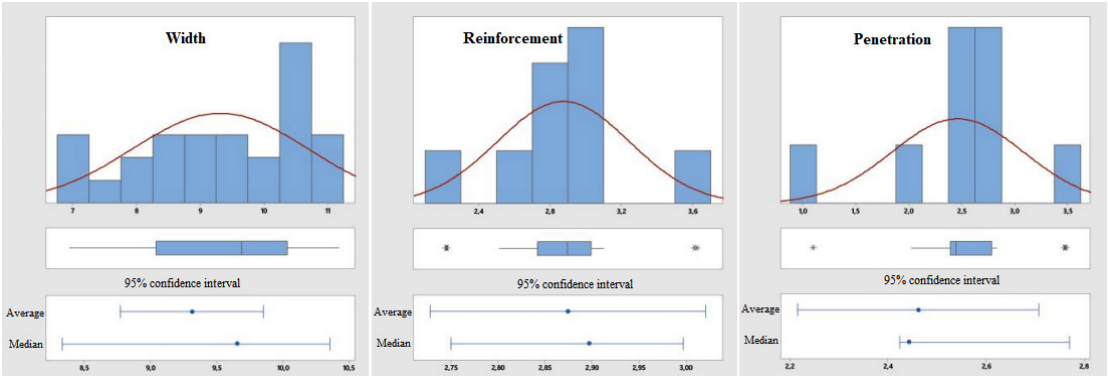

Figure 3: Anderson-Darling normality test for width, reinforcement and penetration.

Conclusion

The maximum value of the reinforcement was obtained in specimen number 9 with a value of 3.61mm, where the average value for this study variable was 2.86mm. It was also for experiment 9 wich presented a suboptimal deposit width value, 10.36mm, 11.3% above average. The average penetration of the specimens was 2.66mm, being the minimum value found in experiment 2. So, as the relationship width/reinforcement is a very significant factor, experiment 9 (~30%) was the one that behaved best in the present study.

References

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