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Effect on Weld Pool Geometry using Tungten Inert Gas Welding on Stainless Steel 304

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Abstract: The TIG welding parameters of SS304 stainless steel of 5mm thickness specimens were investigated. The shielding gas used for welding of Stainless Steel SS304 is Argon Ar. The base currents and the gas flow rate were all along be kept in 3 levels in order to obtain the better results. The groves were also adjusted so as to reduce the penetration effect. Taguchi design of experiments and analysis of variance (ANNOVA) was used to optimize the process parameters.

Keywords: **TIG welding, Stainless Steel, Weld Pool, Optimization.**

I. INTRODUCTION

Stainless steel is a steel which does not readily corrode or stain with water as ordinary steel does, but despite the name it is not fully stain-proof, most notably under low oxygen, high salinity, or poor circulation environments. It is also called corrosion-resistant steel or CRES .Convective Current is produced on the surface of molten pool of specimen when welding of steel is done due to temperature gradients of surface tension. The shape of weld produced is controlled by the soluble surface-active elements present in the weld puddle. Some surface-active elements like S, O, Se, Te, etc, affects the penetration of the weld. The four main methods for stainless steel welding are I current use i.e. TIG Tungsten inert gas, MIG metal inert gas, MAG metal active gas and MMA manual metal arc methods. In this study the fabrication of SS304 was dne by TIG Welding method and the effect of current and groove angle on weld pool was evaluated.

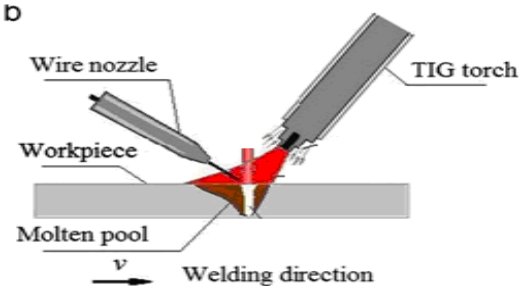

Figure1.gas tungsten arc welding(gtaw)

II. EXPERIMENTAL PROCEDURE

The chemical composition of Stainless Steel 304 sheet of 6 mm thickness is sown in Table I

TABLE I
The chemical composition of Stainless Steel 304 sheet of 6 mm thickness

SAE Designation	UNS Designation	%Cr	% Ni	% C	%Mn
304	S30400	18-20	8-10.50	0.08	2

SAE Designation	UNS Designation	%Si	% P	% S	%N
304	S30400	0.75	0.045	0.03	0.1

The graph showing the variation of weld bead width and weld bead height with reference to the number of experiment are shown below.

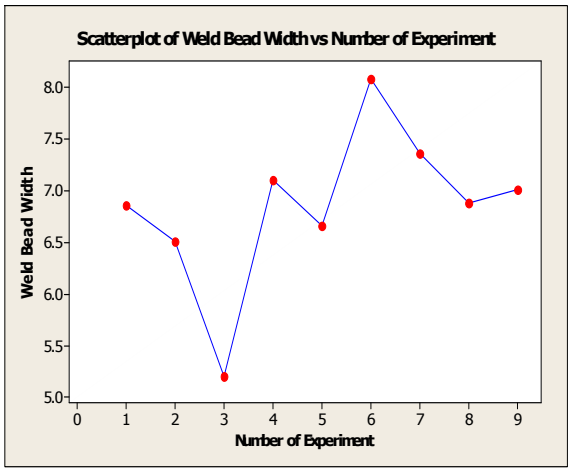

Figure 2. Scatter plot of Weld Bead Width vs Number of Experiment

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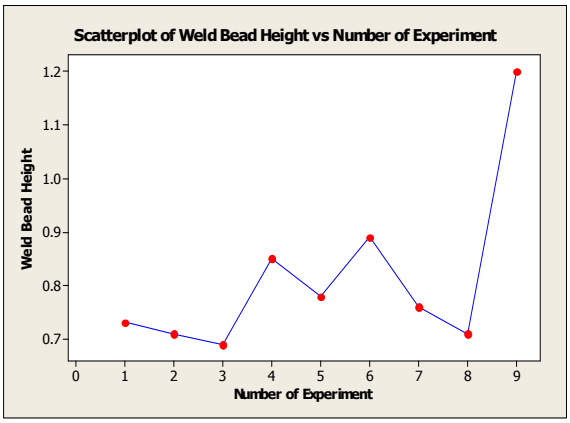

Figure 3. Scatter plot of Weld Bead Height vs Number of Experiment

The graph analysing the effect of varying current and groove angle on Weld bead Height and representing the effect on Signal-to-Noise ratio and Mean value of SS304 specimen (100*50*5).

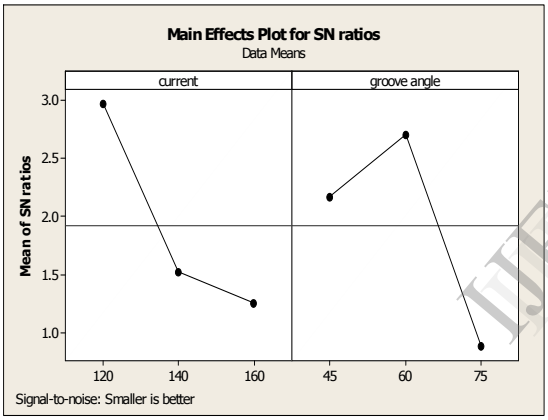

Figure 4. Main Effects Plot for SN ratios.

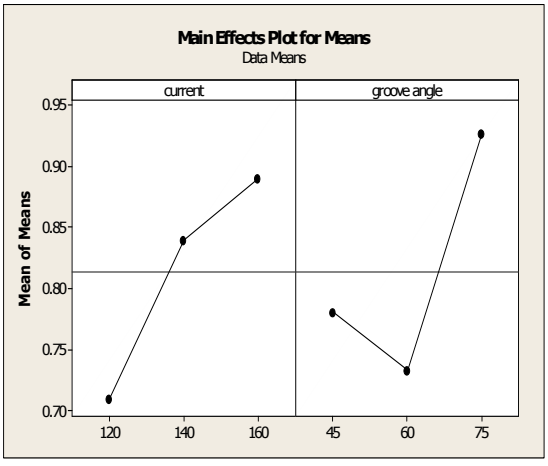

Figure 5.Main effects plot for Means

TABLE II

Current	Grove Angle	Weld bead height	SNRA1	Mean
120	40	0.732	2.70978	.732
120	60	0.710	2.97483	.710
120	75	0.690	3.22302	.690
140	45	0.850	1.41162	.850
140	60	0.780	2.15811	.780
140	75	0.890	1.01220	.890
160	45	0.760	2.38373	.760
160	60	0.710	2.97483	.710
160	75	1.200	-1.58362	1.200

The graph analysing the effect of varying current and groove angle on Weld bead Width and representing the effect on Signal-to-Noise ratio and Mean value of SS304 specimen (100*50*5).

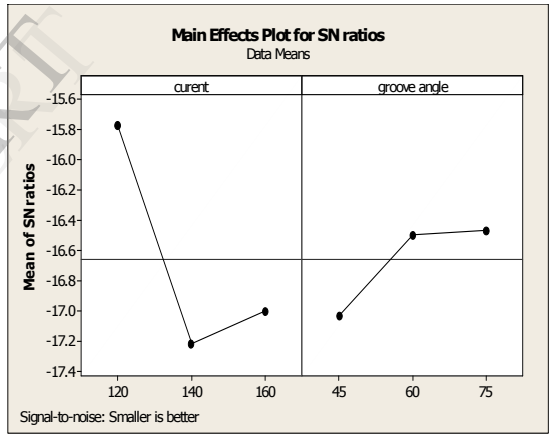

Figure 3. Main effects Plot for SN ratios

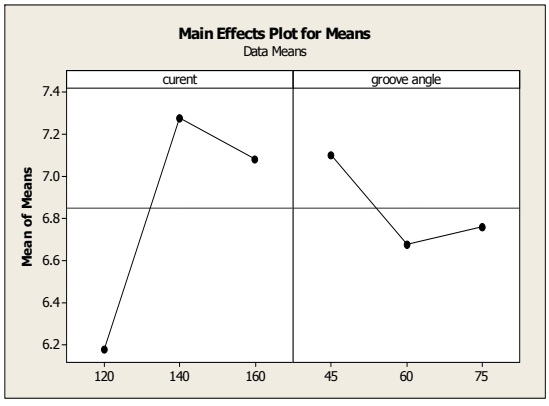

Figure 5.Main effects plot for Means

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TABLE III

Current	Groove angle	Weld Bead Width	SNRA1	MEAN1
120	45	6.85	-16.7138	6.85
120	60	6.5	-16.2583	6.5
120	75	5.2	-14.3201	5.2
140	45	7.1	-17.0252	7.1
140	60	6.66	-16.4695	6.66
140	75	8.08	-18.1482	8.08
160	45	7.36	-17.3376	7.36
160	60	6.88	-16.7518	6.88
160	75	7.01	-16.9144	7.01

III. RESULTS AND DISCUSSION

In this research it clearly brought the concept of of the effects of current and groove angle on weld pool geometry and also the graphs are plotted for weld bead height and weld bead width with reference to the number of experiments in order to find mean value for both the weld bead width and weld bead height . Although the effects of different groove angle and current values are being plotted in reference to the Signal-to-noise ratio and Mean values for SS304 .

IV. CONCLUSION

The appropriate TIG pulse welding parameters for SS304 Stainless Steel by varying the values of current and groove angle on the weld bead width and weld bead height were established. The current varies from 120-160 and the groove angle varies from45-75. This research is done in order to overcome the previous research that was made on SS304 other than this research

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