International Journal For Technological Research In Engineering
Volume 2, Issue 3, November-2014 ISSN (Online): 2347 - 4718

EXPERIMENTAL & STATISTICAL ANALYSIS OF A WELDING STRENGTH AT VARIOUS TORCH ANGLES IN MIG WELDING OF EN-8 MATERIAL

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ABSTRACT: In this experiment works input variables taken as current, voltage, welding speed and throughout experiment works angle is taken as constant. The output parameters are taken as hardness and weld joint strength. Optimization of parameters used in MIG welding process based on maximizes the hardness at the welding joint. To perform statically analysis like TAGUCHI, ANOVA and REGRESSION to develop relationship & interrelationship between variables (INPUT & OUTPUT). Analysis of weld strength by using various torch angles. Low carbon steel material will be used for MIG weld because it wide variety of application in industry.

I. INTRODUCTION

The today manufacturing demands the joining or welding of materials that are capable of withstanding ever increasing stresses and temperatures Unfortunately, weld quality problems arising due to poor joint strength are generally faced by the manufacturers which limit the application of welding The welding current, arc voltage and table speed are the major parameters in MIG. The welding torch angle, its position with respect to base Plate as well as the direction of welding also influences …

Weld quality, Weld penetration, Heat affected zone (HAZ), Mode of current, Weld microstructure, Metal droplet size, Transfer velocity from electrode to weld pool, Thermal cycle and arc characteristics in welding.

II. LITERATURE REVIEW

Kamal pal(2010) and other worked on Study of weld joint strength using sensor signals for various torch angles in pulsed MIG welding. The sound sensor along with arc sensors can be used to monitor the joint quality the variation of grain morphology and ferrite content, insufficient fusion at the interface of weld zone and heat affected zone was found to be the primary reasons for joint failure. The peak voltage and pulse on-time are the dominant pulse parameters on joint strength. The average joint strength was higher in perpendicular welding. However, the joint efficiency can be improved significantly in both backhand as well as forehand welding by proper selection of pulse parameters. The area of weld joint, weld dilution, weld toe angle, bead width ratio and hardness variation strongly influenced the weld joint strength for all torch angles. The arc sound kurtosis, arc power and weld peak temperature were found to be useful to monitor weld joint quality. However, these sensors' outputs are highly torch angle dependent.

III. EXPERIMENTAL SET UP

This experimental set up was available from 2, Meldi Estate, Nr.Railway Crossing, Gota, Ahmedabad-382481,india
Company Name: Keepsake Engineering Consultancy Pvt Ltd.

Figure 1: Metal Inert Gas Welding Equipment

IV. RESULT & ANALYSIS

90 degree torch angle reading shown below

Table 1.1 90 degree torch angle reading

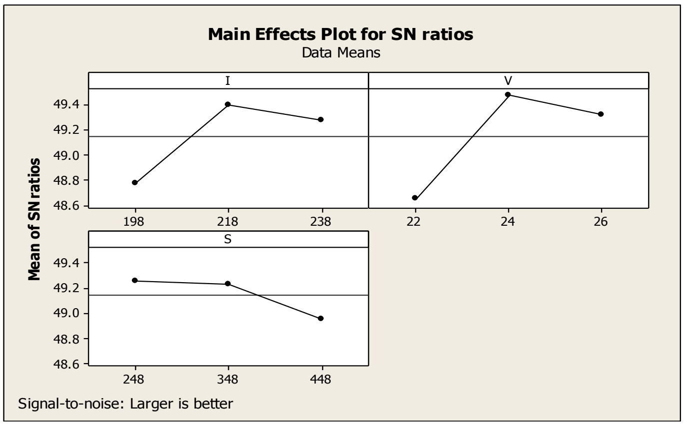
Test no:	A(C) (amp)	B(V) (v)	C(W S) (mm/min)	HARDNESS (BHN)	UTS(MPA)	SNRA1
1	198	22	248	268	223	47.6914
2	198	24	348	230	483.2	49.3579
3	198	26	448	228	476.4	49.2733
4	218	22	348	231	517.4	49.4932
5	218	24	448	214	480.2	48.8318
6	218	26	248	243	518	49.8586
7	238	22	448	222	399.2	48.7671
8	238	24	248	261	490.2	50.2332

9	238	26	348	223	406.2	48.83 23

Above UTS & BHN average reading will be a 443.77 & 235.55

Table 1.2 Response Table for Signal to Noise Ratios Larger is better (90 degree)

LEVEL	I	V	S
1	48.77	48.65	49.26
2	49.39	49.47	49.23
3	49.28	49.32	49.96
DELTA	0.62	0.82	0.30
RANK	2	3	1



V. REGRESSION ANALYSIS

Table 1.3 Regression analysis for 90 degree BHN

Regression Equation

BHN = 429.892 - 0.208333 I(amp) - 4.75 V(v) - 0.123333 S(mm)

Coefficients

Term	Coef	SE Coef	T	P
Constant	429.892	74.1104	5.80070	0.002
I	-0.208	0.2232	-0.93334	0.393
V	-4.750	2.2321	-2.12801	0.087
S	-0.123	0.0446	-2.76268	0.040

Summary of Model

S = 10.9352 R-Sq = 72.27% R-Sq(adj) = 55.63%
PRESS = 2377.21 R-Sq(pred) = -10.25%

Analysis of Variance

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	3	1558.33	1558.33	519.444	4.34399	0.073813
I	1	104.17	104.17	104.167	0.87112	0.393489
V	1	541.50	541.50	541.500	4.52843	0.086622
S	1	912.67	912.67	912.667	7.63241	0.039708
Error	5	597.89	597.89	119.578		
Total	8	2156.22				

Table 1.4 Regression analysis for 90 degree UTS

Regression Equation

UTS = -592.173 + 0.433333 I(amp) + 23.55 V(v) + 0.966333 S(mm)

Coefficients

Term	Coef	SE Coef	T	P
Constant	-592.173	596.990	-0.99193	0.367
I	0.433	1.798	0.24100	0.819
V	23.550	17.981	1.30974	0.247
S	0.966	0.360	2.68714	0.043

Summary of Model

S = 88.0873 R-Sq = 64.27% R-Sq(adj) = 42.83%
PRESS = 152290 R-Sq(pred) = -40.25%

Analysis of Variance

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	3	69789	69789.1	23263.0	2.99806	0.133984
I	1	451	450.7	450.7	0.05808	0.819127
V	1	13310	13310.5	13310.5	1.71541	0.247233
S	1	56028	56028.0	56028.0	7.22070	0.043447
Error	5	38797	38796.8	7759.4		
Total	8	108586				

VI. CONCLUSION

- The optimum welding condition was found of EN-8 material at 90 degree torch angle. It was, current=218(amp), voltage=24(v), welding speed=248(mm) and also a average reading of BHN=235.55 and UTS=443.77.
- Maximum hardness and ultimate tensile strength are found at 90 degree torch angle.
- This work provides various regression equations which show relationship and inter-relationship between input and output variables and its prediction which will be helpful to the industries.

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