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"INVESTIGATION OF MIG WELDING PARAMETERS FOR HARDNESS AND WELD BEAD QUALITY"

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ABSTRACT: *In the futuristic epoch, in metal merge industries, the prerequisite of the metal merge is to manufacture preferable surface hardness and remarkable quality welds. The MIG welding machine is esoteric in merge complex shapes with remarkable various exemplar and check their hardness using Rockwell hardness tester and surface quality using the SEM.*

*For the analysis of the data I used taguchi approach. After this I performed a confirmation test to justify our calculated result. The experimental results concluded that hardness is mainly factors by welding voltage followed by welding current and least by welding speed. In the case of surface quality, it was found that each parameter has greater influence on the quality of surface produced. The size of work piece 130*50*5 mm.*

INTRODUCTION

The Procedure of MIG welding what on the precept of elaborate a joint onto meeting each laying layers of work- is not considered as ideal gas welding as a Spotless as TIG welding because there is different things in tolerable of cover up gas to save the weld pool.

In MIG welding procedure are comparatively longer in length and less contents as most widely using process in Enterprises and Other industries area and field.

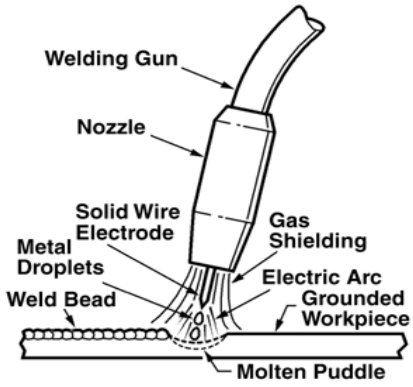


Figure 1 MIG Welding Process [1]

1.1 Metal Inert Gas Welding (MIG)

Metal-inert gas welding (MIG) is a procedure of merge metals by dissolving with the smooth created by round segment be viewed in

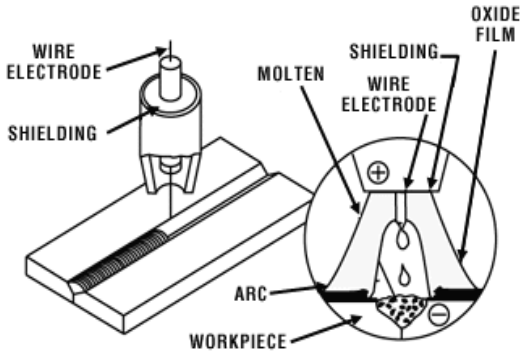


Figure 1.1 Enlarged vision of Weld Bead [2]

MIG welding known as metallic active gas welding and in the USA as (GMAW)gas metallic arc welding very popular in electrode and metal work piece in this welding using 80% Argon, 18% carbon dioxide ,2% oxygen was used as a steel. In this result process can produce quick and next weld over a widely range of joints.

2. LITERATURE REVIEW

Among all the welding process thee chief advantage the using gas metal arc welding for surfacing are highly reliable all robotic system MIG welding with its all position capabilities GMAW has been employed on MIG welding has been studies inspiration and simulation of the finding by the previous researcher are offer and discussed in this chapter.

A lots of studies have been well demented giving deep knowledge and insight on welding technology.

Nur Azhani Abd Razak et al. [1] through their exploration introduced the erosion conduct of low carbon steel while MIG welding at different welding voltages and filler materials. Butt joint were made on the examples materials considered for the examination were ER 304L and ER 70S-6 with 5 mm width.

Rakesh Kumar et al. [2] Investigation of mechanical property in mild steel utilizing metal idle gas welding. The point of the A), root hole on the mechanical property amid the Metal Inert Gas the more prominent effect on the hardness of the weld-pool and circular arc voltage (v). through their examination found that greatest hardness was seen at a welding current of 180 amp, circular segment voltage of 40 volt and root hole of 3 mm.

S.Utkarsh et al. [3] in their examination considered the impact of information parameter, for example, gas stream rate in l/min, welding current(A), voltage(V) and welding speed in mm/sec in order to ponder the "Ultimate Tensile Strength"(UTS) of 'ST—37' low amalgam mild steel materials in MIG Welding (GMAW). Tests were done by utilizing L9 orthogonal cluster.

Yugang Miao et al.[4] Impact of Heat Input on Microstructural and Mechanical Property of weld-Joints Made by Bypass-Current MIG Welding-Brazing of Magneseum Alloy to coated-Galvanized Steel.

Chandresh N. Patel et al. [6] in the researchs of plan of trial strategies received the dark social examination (GRA) execution measure was hardness. Another examination conveyed by.

3. EXPERIMENTATION SETUP

ESAB MIGMATIC MIG welding machine is utilized for the present thesis to weld the samples. The machine is as in form of wire he wire reel that is constantly fed for producing arc and also serve the purpose of filler metal. Inert gas provides an medium for sound weld. The machine was available at Punjab Body Builder, Sarojini Nagar Industrial Area Lucknow.

Figure3: ESAB MIGMATIC 250 MIG welding machine

4. STRUCTURE OF WELD

During welding process there is 9 work-piece to weld by MIG welding work-piece size is 130*50*5 mm show butt weld joint pieces below-

Figure 4. of structure of weld

5. Hardness Testing

Hardness(HRC) is defined as the resistance offered by any material to the applied load in the form of indentation/scratch cone "Indenter" and a load of 150Kg

was applied for 10 seconds before release. The scale of depth of tester indenter under a high loading as compared to the penetration make by a preload. The hardness obtained is a unit less number noted as HRC, here C is the variable scale.

Figure 5 Rockwell Hardness Tester for measuring specimen hardness

6. Analysis and optimization Technique

6.1TAGUCHI Method

If we are taking variant variable of output and input data's then we have best software of optimize method like taguchi software this technique base on sound and noise ratio .we are calculating data of 3 lavel and 3 factors of parameter.

6.2 TABLES FOR TAGUCHI's DESIGN OF EXPERIMENT

The tables for Taguchi DOE (design of experiment) for present work size are shown below:

Table (6.2): MIG welding process parameter with their stages

S.No.	Parameters	Units	Stage 1	Stage 2	Stage 3
1	Welding Current	A	190	240	290
2	Weld Speed	mm/sec	190	280	360
3	Welding Voltage	V	22	24	26

Table 6.2.2: Experimentation L9 Orthogonal Array

S.No.	Welding Current	Weld Speed	Welding Voltage
1	190	190	20
2	190	280	22
3	190	360	24
4	240	190	22
5	240	280	24
6	240	360	20
7	290	190	24
8	290	280	20
9	290	360	22

7. RESULT AND DISCUSSION

7.1CALCULATION FOR HARDNESS

In this investigation workstudy effect of greatest input wedding parameters on the hardness. Is property which is known as resistance to scratch. space hardness of the materials by calculating the appropriate of value in high stacking shows scale. The Hardness calculated for each specimen work –piece material is shown in Table 5.1 above.

Table 7.1: evaluation for Hardness

Exp. No	Welding Current	Weld Speed	Welding Voltage	Rockwell Hardness HRC
1	190	190	20	60
2	190	280	22	61.5
3	190	360	24	58
4	240	190	22	62
5	240	280	24	59.7
6	240	360	20	61.9
7	290	190	24	59
8	290	280	20	61
9	290	360	22	62

7.2 Calculation of S/N ratio for Hardness

The S/N ratio condenses the multiple data points of hardness tested during MIG welding within a trial, depends on the being of 'S/N' ratio for hardness LARGER IS BETTER situation is opted. The equation for the evaluating of 'S/N's ratio for hardness is:

$S/N_{LB} = -10 \log (\Sigma (1/yi^{2})$

Table 7.2Calculation of S/N ratio for Hardness

S.No	Rockwell Hardness HRC	'S/N' ratio (db)
1	60	35.5630
2	61.5	35.7478
3	58	35.2686
4	62	35.8478
5	59.7	35.5195
6	61.9	35.7278
7	59	35.4186
8	61	35.7066
9	62	35.8478

7.3 Calculation of Mean 'S/N' ratio for Hardness

Formula of Mean 'S/N' ratio is -

$nf_i = (nf_1+nf_2+nf_3)/3$

Where, nf is mean 'S/N' ratio for factor f at the stage amount i of the selective factor.

nf_1, nf_2, nf_3 are 'S/N' ratio for factor f at stage u.

The elements which the factor. welding current. Weld speed is minimum viable when contrasted with different parameters.

Table 7.3 Calculation of mean 'S/N' ratio for Hardness

Level	Welding Current	Weld Speed	Welding Voltage
1	35.73	35.56	35.72
2	35.75	35.68	35.76
3	35.50	35.72	35.51
Delta	0.25	0.16	0.25
Rank	2	3	1

Delta = (greatest mean S/N Ratio – Lesser mean S/N Ratio)

7.4 Analysis of Variance for Hardness

The following table shows ANOVA of Hardness conducted on MINITAB 16.0. The result showing here that the contribution of welding voltage is most and is 40.58%.

Table 7.4 ANOVA of Hardness

Source	DOF	SS	Adj MS	F Value	Contribution
Welding Current	2	4.702	2.351	1.94	33.45%
Weld Speed	2	1.214	0.620	0.51	8.82%
Welding Voltage	2	5.703	2.852	2.32	40.58%
Error	2	2.309	1.201		17.13%
Total	8	13.956			100%

At least 95% confidence

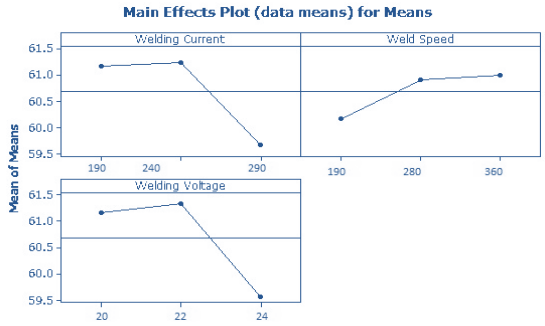
Investigation of change of hardness of MIG welded joint is appeared in the above table 5.4. It is obvious from the table parameter for hardness.

The second most ruling parameter for hardness with a commitment of 8.82%.

7.5 CALCULATIONS OF ANOVA

Table 7.5 Values of Hardness corresponding to different levels of Welding Current

Welding Current Stage	Stage 1	Stage 2	Stage 3
190	60	61.5	58
240	62	59.7	61.9
290	59	61	62



7.6 CONFIRMATION TEST

In authenticate test have been acting for Hardness with their optimum levels of process variables.

Table7.6: Confirmation of imagineries and actual values of Hardness.

Experiment No.	Optimum Machining Parameters			Hardness	
	Welding Current (A)	Welding Speed (mm/min)	Welding Voltage (V)	Actual	Expected
1	290	360	22	62	61.7
				Error (%)	0.48%

8. CONCLUSIONS

In this investigation for trial examination of parameters basis of MIG welding. Parameters on material mild steel by using significant result basis on the parameter like welding current welding voltage and welding a spade. And we are found for better hardness and better surface qualities.

We found some results as per investigation of work piece based.

When we saw change in microstructure of workplace during testing their heart and his property not initially increase hardness but extra increase welding is paid then decrease hardness.

For a some pattern increase welding voltage firstly increase hardness then decrease hardness.

Welding voltage is the mainly concerned restriction for hardness 40.58%.

Welding current is second most dominating factor because we found for hardness of the welded joint 33.45%.

We found some percentage of concern with third factor welding speed 8.82%.

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