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OPTIMIZATION OF PROCESS PARAMETERS IN WELDING

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ABSTRACT

Welding is a noteworthy joining process by the use of warmth and weight. MAG Welding is a standout amongst the most generally utilized procedure in numerous enterprises. In the present assembling situation, improvement of welding process is basic for an assembling unit to react viably to serve aggressiveness and expanding request of value, which must be accomplished at least expense. For this MAG Welding strategy, different procedure parameters and their communications are advanced utilizing Taguchi strategies to increase quality attributes.

Key Words: Welding, Process Parameters, ANOVA

I Introduction:

Welding which is the way toward joining two metallic parts for the ideal reason, can be characterized as the way toward joining two comparable or different metallic segments with the utilization of warmth, with or without the use of weight and with or without the utilization of filler metal. Warmth might be acquired by substance response, electric curve, electrical opposition, frictional warmth, sound and light vitality. There are many Welding forms accessible in market today, for example, Fusion welding and Pressure welding, In combination welding each one of those procedures are incorporated where liquid metal hardens unreservedly while in weight welding liquid metal if any is held in limited space under strain sets under strain or semisolid metal cools under strain. All welding procedures have an utmost on the sort and properties of material that can be welded.

Metal Active Gas welding from MIGMATIC 350 produces work pieces made out of mellow steel. K.Sivasakthivel, K.Janarthanan and R.Rajkumar, has taken the necessary steps on Optimizing welding parameter in MIG welding by taguchi technique. Milind M. Ghogale and Prof. S. A.Patil, made a work named enhancement of procedure parameters of mig welding to improve nature of weld by utilizing taguchi philosophy. S. V. Sapakal and M. T. Telsang led parametric streamlining of mig welding utilizing taguchi plan strategy. Accordingly in this work, the MAG welding, Process parameters like voltage, gas feed weight and wire feed rate their impact on physical properties like surface completion, thickness, hardness and weld fortification structure factor are considered. These procedure parameters are enhanced and the impact

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of every parameter on qualitycharacteristic are explored utilizing factual techniques.Thus,the commitment to this degree will help in improving the nature of Welded joints in MAG welding process just as disentangling the procedure parameters for wanted quality models.

II.Process Parameters in MAG welding process:

When getting ready to do MAG welding, numerous creation parameters are required. To accomplish ideal quality, these parameters are set diversely as indicated by necessities of uses. Along these lines, the initial phase in the examination was to recognize the procedure control parameters that are probably going to influence the nature of Welded workpieces. The chose parameters are recorded underneath.

Voltage:

The yield voltage of the Welding Machine.

Wire feed rate:

It is the measure of wire encouraged through the welding light amid the welding procedure. **Shielding gas pressure:**It is the weight at which the protecting gas provided amid the welding procedure.

III.Thaguchi Method:

Thaguchi structure of tests was utilized in this work so as to assess the general commitment of procedure parameter on different qualities likeSurface Roughness, Density, Hardness and Weld support structure factor. Thaguchi technique utilizes an uncommon arrangement of exhibits called symmetrical arrays.These standard clusters stipulate the method for leading the base number of examinations, which would give the full data of all factors that influence the execution parameters. The chose procedure parameters influencing the nature of Welded work pieces and their dimensions are referenced in the table 1.: L8 Orthogonal exhibit was utilized and it is appeared table 2.

Table 1:List of process parameters considered and their Levels

FACTOR	LEVEL1	LEVEL2
Voltage(A)	16.8	18.4
Wire feed rate(B)	250	270
Shielding gas pressure(C)	5	10

Table 2:L8 Orthogonal Array

Trial no	Dummy level	A	B	C	Ax B	Ax C	Bx C
1	0	1	1	1	1	1	1
2	0	1	1	2	1	2	2
3	0	1	2	1	2	1	2
4	0	1	2	2	2	2	1
5	0	2	1	1	2	2	1
6	0	2	1	2	2	1	2
7	0	2	2	1	1	2	2
8	0	2	2	2	1	1	1

IV Experimental Procedure:

A preliminary run was performed in which a progression of work pieces were welded on MAG welding machine. The components of the examples were as appeared. An aggregate of 8 tests were made utilizing MAG welding process as indicated by L8 symmetrical array.

Fig 1: Test Specimen

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Dimensions are as follows.(mm)
Length 45, Breadth 45 and Thickness 5.

A.MIG MATIC 250:
The hardware utilized for MAG welding is MIGMATIC 250. Which permits fast welding without trading off quality on slender sheets having the wire feeder as a distinguishable unit. It is Easy to set and work and has Digital Voltage and Ampere meter and 10 stage single handle voltage control, Heavy obligation worked in feed framework, step less speed control, Quick changeover wire feed instrument, Suitable for 0.8 – 1.2 mm wire, Spot, Stitch and ceaseless welding modes and has Thermal over-burden protection.MAG welding is completed on DC anode (welding wire) positive polarity(DCEP). DC yield control sources are of a transformer-rectifier plan, with a level trademark (steady voltage control source). The most well-known kind of intensity source utilized for this procedure is the exchanged essential change errectifier with steady voltage qualities from both 3-stage 415V and 1-stage 240V info supplies. MAG control sources have a contactor or hand-off used to switch the yield ON/OFF with tasks of the trigger on the MAG burn. The turn off task of this contactor isnormally postponed to permit the welding wire to Burn pull out of the liquid weld pool. An indoor regulator is fitted on the most sweltering point in the power source, in arrangement with the contactor loop to give warm security to the machine. Power source execution is estimated by its capacity to give a specific current to a level of a 10-minute time span before "Warm Cut-Out". This is the "Obligation Cycle".
Fig.2 shows the MIG MATIC 250 machine

Fig 2:MIG MATIC 250 Machine

B.Surface Roughness: Harshness esteems on the outside of the model were acquired utilizing surf test, a contact sort of estimating instrument and the Ra esteems are noted.
C.Density: Thickness of each model is determined utilizing weight and volume estimation. **D.Hardness:** Hardness of every single model is determined utilizing Rockwell hardness analyzer for hardness.
E.Weld Reinforcement Form Factor: WRFF are likewise called as coefficients of outer shape. The proportion of dot width to fortification are named as Weld Reinforcement Form Factor (WRFF). The smoothness of the weld increments with the expansion in WRFF.This is determined by methods for vernier calipers and screwgauge.

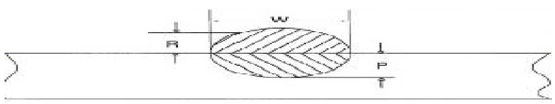

Fig3: Weld Reinforcement

Where P: height of penetration (mm); R: height of reinforcement (mm);
W: width of the bead (mm); WRFF: reinforcement form factor = W/R.

V Results And Discussion:
The study involved 8 samples produced MIG MATIC 250 machine.

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A. Signal to Noise Ratio:

The signal to commotion proportion estimates the affectability of the quality trademark being researched to those wild outside variables. To limit the issue, the administering connections for the S/N proportion regarding the tentatively estimated estimations of Ra, i.e., yi determined as pursues:

S/N ratio = – 10 log 10 MSD

Where MSD = □□$(y_i - \hat{y})^2/n$, $\hat{y}$ the target value that is to be achieved, the number of samples. The S/N ratio values obtained for the trials are listed in following tabl

Table 3 :S/N Ratio for Surface Roughness:

FACTOR	LEVEL 1	LEVEL 2	$L_2 - L_1$
Voltage	-0.40326	+1.68728	2.09054
Feed rate	1.2572	-0.1152	-1.37172
Gas pressure	1.9174	-0.5396	-2.457

Table 4 :S/N Ratio for Hardness:

FACTOR	LEVEL 1	LEVEL 2	$L_2 - L_1$
Voltage	47.29	47.11	-0.17
Feed rate	47.176	47.237	0.061
Gas pressure	47.162	47.249	0.087

Table 5 : S/N Ratio for Density:

FACTOR	LEVEL 1	LEVEL 2	$L_2 - L_1$
Voltage	16.304	17.022	0.718
Feed rate	15.467	18.276	2.809
Gas pressure	16.869	16.438	-0.431

Table 6: S/N Ratio for weld reinforcement form factor:

FACTOR	LEVEL 1	LEVEL 2	$L_2 - L_1$
Voltage	29.2	29.626	0.4264
Feed rate	28.02	30.480	2.460
Gas pressure	29.415	29.430	0.0154

B.ANOVA:

ANOVA investigation gives essentialness rating of the different elements dissected in this examination. In light of the above rating, factors, which impact the target work altogether, could be recognized and legitimate control estimates embraced. Additionally, those components with least impact could be reasonably altered to suit financial contemplations. A variable having the greatest estimation of fluctuation is said to have the most critical impact on the procedure under thought.

Table 7:ANOVA for Surface Roughness

Factor	d.o.f	Sum of squares	Variance	%contribution
A	0.1064	1	0.1064	15.88
B	0.060	1	0.060	8.95
C	0.085	1	0.085	12.68
A×B	0.148	1	0.148	22.09
A×C	0.180	1	0.180	26.86
B×C	0.083	1	0.083	12.38
Error	0.0075	1		
Total	0.6699	7		

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Table 8:ANOVA for Hardness:

Factor	d.o.f	Sum of squares	variance	%contribution
A	3.125	1	3.125	11.99
B	0.3444	1	0.3444	1.329
C	0.6728	1	0.6728	2.58
A×B	6.1237	1	6.1237	23.49
A×C	11.6646	1	11.6646	44.75
B×C	0.1252	1	0.1252	0.48
Error	4.0061	1		
Total	26.0614	7		

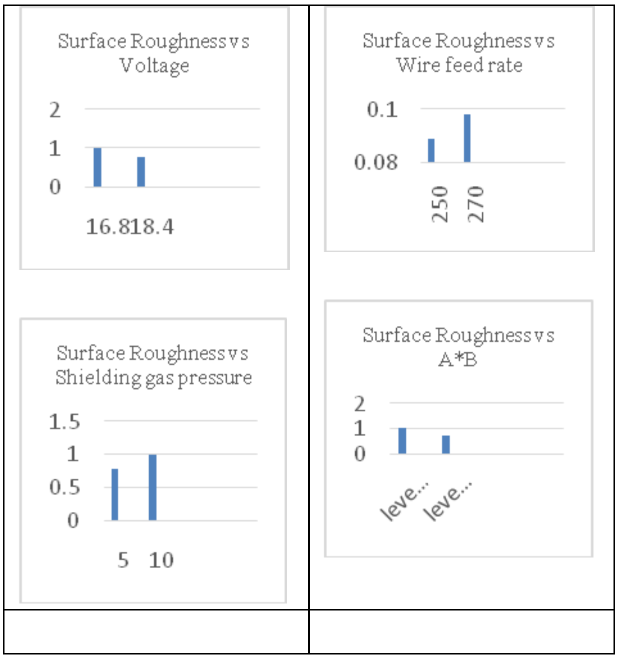
Table 9: ANOVA for Density

Factor	d.o.f	Sum of squares	variance	%contribution
A	0.3124	1	0.3124	2.02
B	8.90192	1	8.90192	56.005
C	0.006224	1	0.006224	0.039
A×B	0.058	1	0.058	0.364
A×C	6.495	1	6.495	40.862
B×C	0.02940	1	0.02940	0.18496
Error	0.09165	1		
Total	15.8946	7		

Table 10:ANOVA for WeldReinforcement form factor

Factor	d.o.f	Sum of squares	variance	%contribution
A	0.00263	1	0.00263	0.1087
B	0.0840	1	0.0840	3.472
C	1.356	1	1.356	56.0492
A×B	0.07667	1	0.07667	3.1690
A×C	0.14475	1	0.14475	5.98313
B×C	0.08927	1	0.08927	3.6899
Error	0.66598	1		
Total	2.4193	7		

Surface Roughness vs Parameters.



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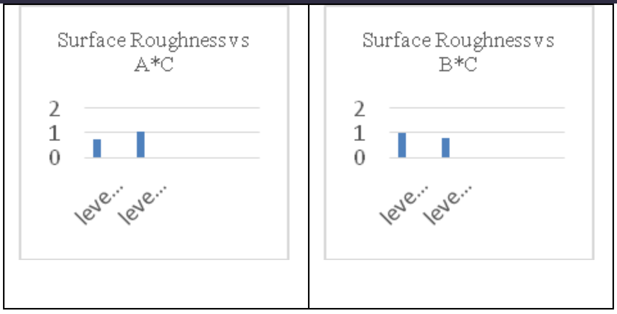
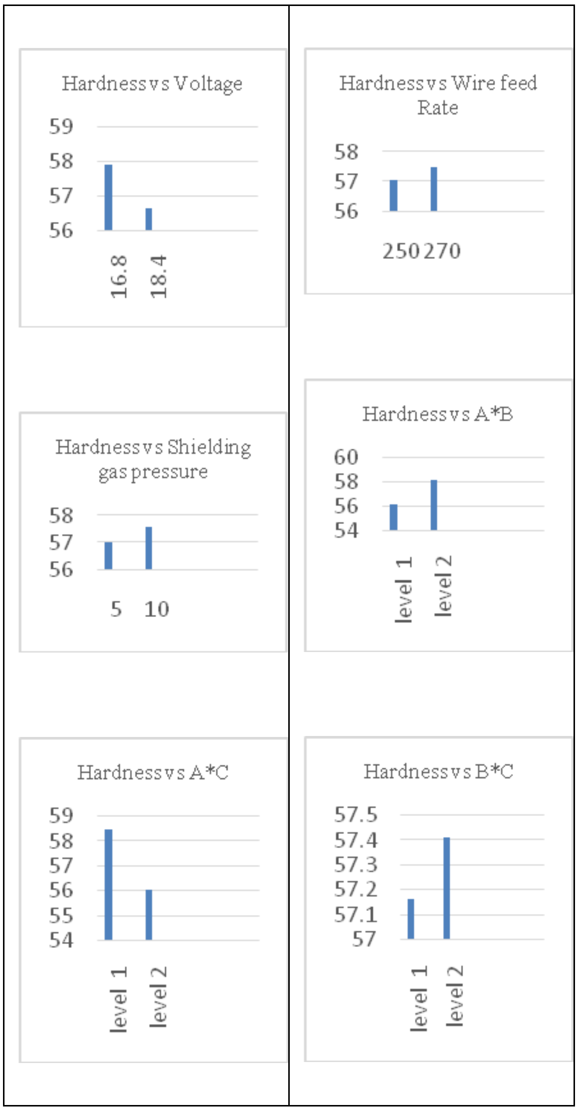
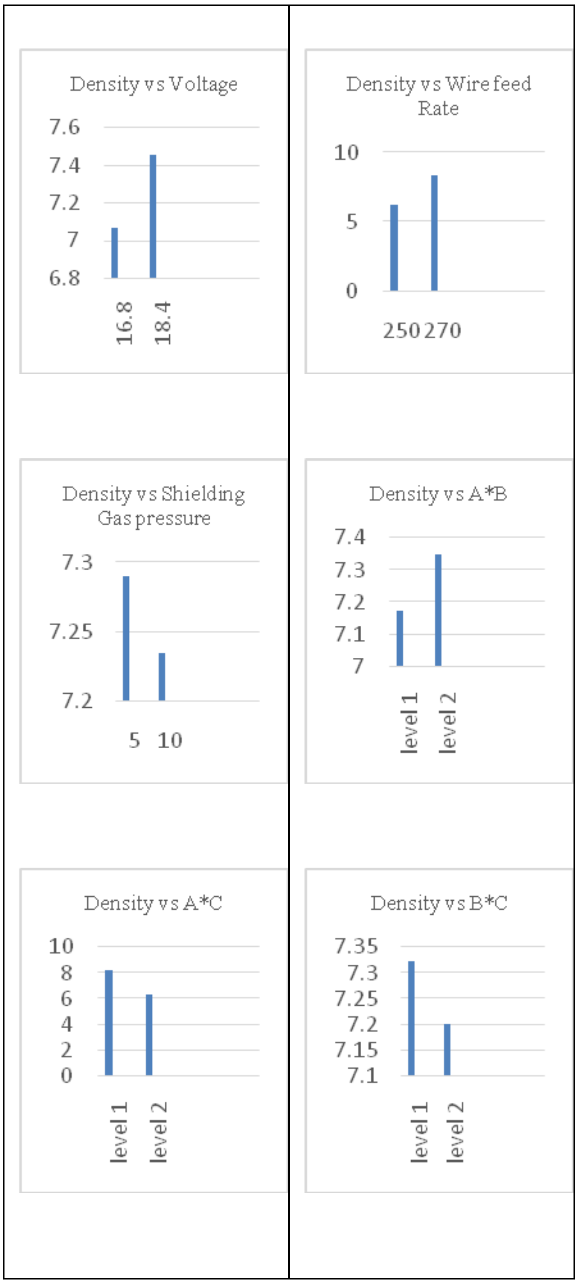


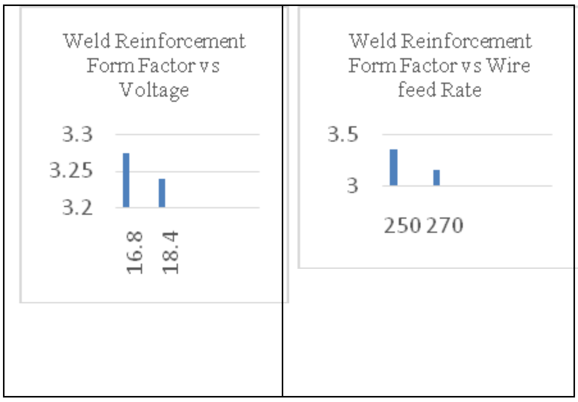
Hardness vs Parameters

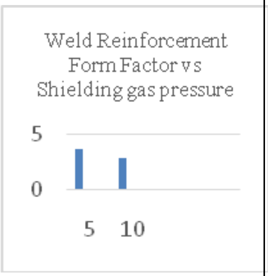


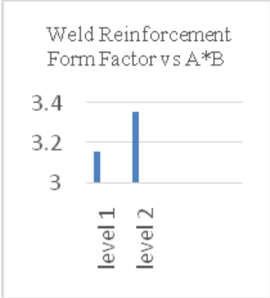
Density vs Parameters

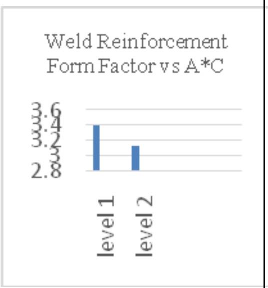


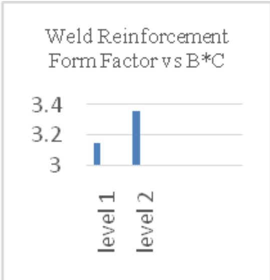
Weld Reinforcement Form Factor vs Parameters











VI.Conclusions

Surface Roughness:

ANOVA:

Voltage effects greatly on Surface Roughness, Wire feed rate has little effect. Gas pressure effect should be considered. Voltage and gas pressure combination effects greatly compared to that of other combinations.

S/N Ratio:

More voltage more will be the surface roughness, Less wire feed rate leads to goodsurface finish and Less gas pressure leads to good surface finish

Hardness:

ANOVA:

Voltage effects greatly on hardness, Wire feed rate has very little effect and Gas pressure effect should be considered. Voltage and gas pressure combination effects greatly compared to that of other Combinations

S/N Ratio:

Less voltage leads to more hardness, More wire feed rate leads to more hardness and More gas pressure leads to more hardness.

Density:

ANOVA:

Voltage effect should be considered on Density, wire feed rate effects greatly and Gas pressure has very little effect. Voltage and gas pressure combination effects greatly compared to that of other Combinations.

S/N Ratio:

More voltage leads to more density, More wire feed rate leads to more density and Less gas pressure leads to more density.

Weld Reinforcement Form Factor:

ANOVA:

Voltage has very little effect on Weld Reinforcement Form Factor, wire feed rate effect should be considered and Gas pressure effects greatly. Voltage and gas pressure combination effects greatly compared to that of other combinations.

S/N Ratio:

More voltage leads to better reinforcement, More wire feed rate leads to better reinforcement and More gas pressure leads to better reinforcement.

Finally,

A2 B1 C2 has least surface roughness

A2 B1 C2 has more hardness

A2 B2 C2 has more density

A1 B2 C2 has least Reinforcement Form Factor

VII Future Scope of work:

Further work can be extended by using various welding techniques, Other types of process parameters.With different types of material, Other Mechanical properties, Thermal Properties & Mechanical Properties, by using different OPTIMIZATION Techniques.

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