PARAMETRIC OPTIMIZATION OF GMAW PROCESS ON MILD STEEL IS-2062

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Abstract: Quality of weld depends on a big extent on the ultimate tensile strength which is largely influenced by various process parameters in the process. This paper is a study of analysis and optimization of GMAW process parameters. Experiments were conducted based on full factorial method and correlating the important controllable

GMAW process parameters like travel speed, welding current and gas blend on extreme elasticity. Gas metal circular segment welding is a combination welding process having wide applications in enterprises. Gas metal circular segment welding is one of the customary and conventional techniques to join materials. The present examination is to explore the impact of welding parameters on a definitive elasticity and twisting quality. The improvement for Gas metal circular segment welding process parameters (GMAW) of Mild steelwork piece utilizing full factorial technique is finished. Twenty seven trial runs (L27) in view of an orthogonal exhibit full factorial strategies were performed. This paper exhibits the impact of welding parameters like travel speed, welding current and gas blend on extreme rigidity. The ANOVA is connected to distinguish the most critical factor and anticipated ideal parameter setting. Try different things with the advanced parameter setting, which have been acquired from the GRA strategy, are giving substantial outcomes. The affirmation test is led and found the outcomes nearer to the advance outcomes. These outcomes demonstrated the fruitful usage of strategy.

Keywords: GMAW, welding, Argon gas, ANOVA etc.

I. INTRODUCTION

Welding is an assembling procedure of making a changeless joint got by the combination of the surface of the parts to be consolidated, with or without the use of weight and a filler material. The materials to be joined might be comparable or not at all like each other. The warmth required for the combination of the material might be acquired by consuming of gas or by an electric curve. The last strategy is all the more broadly utilized in view of more prominent welding speed. Welding is widely utilized as a part of creation as an option strategy for giving or producing and a role as a swap for catapulted and bolted joints. It is likewise utilized as a repair medium e.g. to rejoin a metal at a make or to construct laugh hysterically a little part that has severed, for example, an apparatus tooth or to repair a well used surface, for example, a course surface.

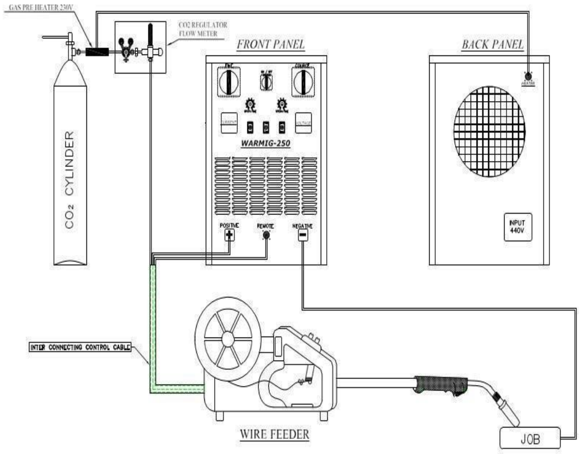

Figure1.1Gas Metal Arc Welding (GMAW or MIG)

II. METHODOLOGY

2.1 Experimental Setup

From the literature survey of past researchers it is shown-that the material selection in manufacturing process is most important thing as per process availability and customer’s requirement. There is number of material used in modern industry but steel have corrosion resistive property and high strength, so it is widely use in modern industry. The material used to carry out experiment is mild steel. The filler material use for the experiment is copper coated MS material electrodes with size of 1.20 mm diameter.

Shielding gas composition for experiment is as shown in table

Table 2.1shilding gas composition

Type of gases	CO_2	Argon
A	0%	100%
B	20%	80%
C	100%	0%

Mild steel plates with the dimensions of 150×200×8 mm are prepared with the bevel heights of 8 millimeter, bevel angle of 45. These specimens are then welded with a root gap distance 1 millimeter. Figure shows the single V groove butt joint preparations.

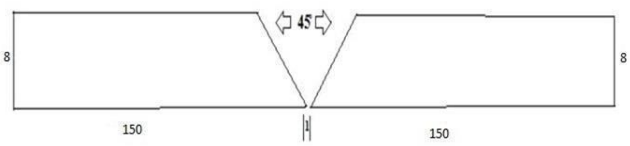

Figure 2.1 Sample specimen with bevel angle of 45°

After preparation, plates are placed on the workbench. In each placement, distance between the nozzle and work piece and the electrode extension were 20 and 10 millimeter, respectively. The welding electrode is held perpendicular to the welding surface. Welding is started and the flow rate of shielding gas is adjusted by using knob. The plates were welded at single pass.

Figure:2.2 Universal testing machineUTE-40

2.2 Taguchi method

Outline of analysis: Each experimenter may plan an alternate arrangement of partial factorial tests. Taguchi disentangled and institutionalized the partial factorial outlines in such an approach to engineers leading tests a large number of miles separated, will dependably utilize comparative plans and has a tendency to gets comparable outcomes. Taguchi built up a group of partial factorial examinations grids which can be uses in different circumstances. These networks lessen the analyses numbers yet get sensibly rich data. In Taguchi approach uniquely configuration table known as "orthogonal clusters" are utilized. The utilization of this table influences the outline of trials to shift simple and reliable.

Table2.2-ParameterandtheirLevels

Process parameter	Level1	Level2	Level3
Gas Mixture CO2&Argon	100%CO_2	80%Ar& 20%CO_2	100%Ar
Current (Amp)	120	150	180
Travel speed (mm/min)	130	150	170

III. RESULTS OF DOE –FULL FACTORIAL METHOD

Obtain results are shown in table 3.1.

Table3.1–Experimental Results of Full factorial Method

Sr No	Gas Mixture	Current	Travel speed	Ultimate Tensile strength	Breaking point
1	100 %CO2	120	130	513.316	BOW
2	100 %CO2	120	150	508.734	BOW
3	100 %CO2	120	170	496.364	BFW
4	100 %CO2	150	130	499.321	BOW
5	100 %CO2	150	150	487.604	BFW
6	100 %CO2	150	170	482.316	BFW
7	100 %CO2	180	130	492.584	BOW
8	100 %CO2	180	150	460.991	BFW
9	100 %CO2	180	170	496.735	BFW
10	80%Ar&20% CO_2	120	130	551.035	BOW
11	80%Ar&20% CO_2	120	150	545.027	BOW
12	80%Ar&20% CO_2	120	170	539.521	BOW
13	80%Ar&20% CO_2	150	130	537.016	BOW
14	80%Ar&20% CO_2	150	150	519.037	BFW
15	80%Ar&20% CO_2	150	170	526.038	BFW
16	80%Ar&20% CO_2	180	130	534.032	BOW
17	80%Ar&20% CO_2	180	150	522.631	BFW
18	80%Ar&20% CO_2	180	170	485.062	BFW
19	100 %Ar	120	130	492.069	BOW
20	100 %Ar	120	150	486.164	BFW
21	100 %Ar	120	170	481.742	BFW
22	100 %Ar	150	130	479.106	BOW
23	100 %Ar	150	150	460.035	BFW
24	100 %Ar	150	170	471.019	BFW
25	100 %Ar	180	130	475.368	BOW
26	100 %Ar	180	150	459.032	BFW
27	100 %Ar	180	170	463.025	BFW

For the same parametric values, root bend and face bends are checked for bending strength optimization.

Table3.2–Experimental Results of Bending strength test

Sr No.	Gas Mixture	Current	Travel speed	Root bend	Face bend
1	100 %CO_2	120	130	Satisfactory	Satisfactory
2	100 %CO_2	120	150	Satisfactory	Satisfactory
3	100 %CO_2	120	170	Not satisfactory	Not satisfactory
4	100 %CO_2	150	130	Satisfactory	Satisfactory
5	100 %CO_2	150	150	Satisfactory	Satisfactory
6	100 %CO_2	150	170	Not satisfactory	Not satisfactory
7	100 %CO_2	180	130	Satisfactory	Satisfactory
8	100 %CO_2	180	150	Satisfactory	Satisfactory
9	100 %CO_2	180	170	Not satisfactory	Not satisfactory
10	80%Ar&20 % CO_2	120	130	Satisfactory	Satisfactory
11	80%Ar&20 %CO_2	120	150	Satisfactory	Satisfactory
12	80%Ar&20 %CO_2	120	170	Satisfactory	Satisfactory
13	80%Ar&20 %CO_2	150	130	Satisfactory	Satisfactory
14	80%Ar&20 %CO_2	150	150	Not satisfactory	Not satisfactory
15	80%Ar&20 %CO_2	150	170	Satisfactory	Not satisfactory
16	80%Ar&20 %CO_2	180	130	Satisfactory	Satisfactory
17	80%Ar&20 %CO_2	180	150	Not satisfactory	Not satisfactory
18	80%Ar&20 %CO_2	180	170	Satisfactory	Not satisfactory
19	100%Ar	120	130	Satisfactory	Satisfactory
20	100 %Ar	120	150	Not satisfactory	Not satisfactory
21	100 %Ar	120	170	Satisfactory	Not satisfactory
22	100 %Ar	150	130	Satisfactory	Satisfactory
23	100 %Ar	150	150	Not satisfactory	Not satisfactory
24	100%Ar	150	170	Satisfactory	Not satisfactory
25	100 %Ar	180	130	Satisfactory	Satisfactory
26	100 %Ar	180	150	Not satisfactory	Not satisfactory
27	100 %Ar	180	170	Satisfactory	Not satisfactory

3.2Analysis of Variance (ANOVA)

ANOVA was used to determine the significant parameters influencing surface finish and wall thickness in the forming of AA1100. Table 4.3 shows summery of ANOVA results for ultimate tensile strength and wall angle. In this study analysis was level of significance as 5% and level of confidence as 95%.

Table3.3–ANOVA Results for ultimate tensile strength

Source of Variation	DOF	Sum of Squares (SS)	Mean Square (MS)	Variance Ratio (F)	Probability(P)	Percentage Contribution %C
Gas mixture	2	13862	6930.80	73.63	0.000	69.70%
Current	2	2920	1460.08	15.51	0.000	14.68%
Travel speed	2	1223	611.28	6.49	0.007	6.15%
Error	20	1883	94.14			9.47%
Total	26	19887				100%
S=9.70235	R-Sq =90.53%					

MAIN EFFECT PLOTS ANALYSIS

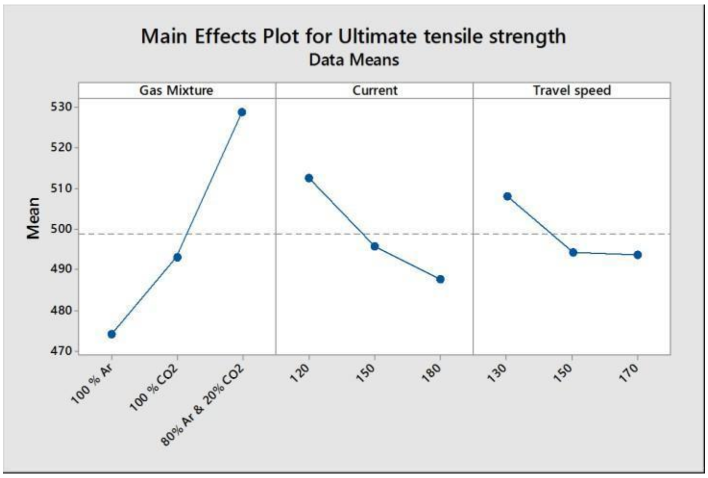

Figure 3.1 ANOVA results

From the above ANOVA comes about unmistakably extreme rigidity relies upon gas blend by 69.70% and current by 14.68%. For accomplishing better quality we have to control these two parameters as it were. Ideal esteems can be Gas blend at level 3 (80% Ar and 20% CO2), Current at level 1 (120 Amp) and Travel speed at level 1 (130 mm/min).

IV. CONCLUSIONS

From above investigations, its presumed that individual impact of gasses are not all that noteworthy contrasted with when they are utilized as a part of blend. For better outcomes, its upgraded that blend of both gasses ought to be all around kept up in endorsed proportion accomplished from said trial examination.

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