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AN INVESTIGATION ON EFFECT OF PROCESS PARAMETER ON BI-METALIC WELD JOINTS IN FCAW WITH TAGUCHI DESIGN

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ABSTRACT

In order to obtain a good quality weld and control weld The selection of improper FCAW process parameter increases the power consumption, material consumption, man power and cost of the product decreasing the weld quality. distortion, it is therefore, necessary to control the input welding parameters. In this experimental work, experiments has to be carried out on EN 8 & SS 304 steel of 6 mm thick using FCAW process. Bimetallic joints of medium carbon alloy steel and stainless steel are widely used in high temperature corrosive environments. In the present Experiments, has to be conducted on specimens of single butt joint having different amps, volts & gas flow rate. The strength of the welded joint has to be verified through tensile testing machine/Bead geometry and the results will be evaluated along with Rockwell Hardness Test. The input parameter selected through Taguchi design.

KeyWords = FCAW , EN8 and SS034, Taguchi design ,Welding Parameter, Bimetallic

I. INTRODUCTION OF FCAW

In a welding world, Flux-Cored Arc Welding (FCAW) process commonly used in different industries to join the metals and alloys. It has a few numbers of benefits such as high position rates, more tolerant of rust and mill scale than GMAW, simpler and more adaptable than SAW, less operator skill required than GMAW, high productivity than SMAW and good surface appearance.

II. EXPERIMENTAL METHODOLOGY

- Selection of base material.
- Identify the importance FCAW welding process parameters.
- Find the upper and lower limits (i.e. range) of the identified process parameters.
- Select the orthogonal array (design of matrix).
- Conduct the experiments as per the selected orthogonal array.
- Record the quality characteristics.
- Find the optimum condition for FCAW welding through TAGUCHI
- Result & conclusion

III . Modeling and analysis

TAGUCHI INTRODUCTION

Basically, experimental design methods were developed original fisher. However experimental design methods are too complex and not easy to use. Furthermore, a large number of experiments have to be carried out when the number of the process parameters increases, to solve this problem, the Taguchi method uses a special design of orthogonal arrays to study the entire parameter space with a small number of experiments only. The experimental results are then transformed into a signal– to – noise (S/N) ratio to measure the quality characteristics deviating from the desired values Usually, there are three categories of quality characteristics in the analysis of the S/N ratio, i.e., the–lower–better, the–higher–better, and the–nominal–better. Regardless of the category of the quality characteristic, a greater S/N ratio corresponds to better quality characteristics. Therefore, the optimal level of the process parameters is the level with the greatest S/N ratio Furthermore, a statistically significant with the S/N and ANOVA analyses, the optimal combination of the process parameters can be predicted. Finally, a confirmation experiment is conducted to verify the optimal process parameters obtained from the parameter design. There are 3Signal-to-Noise ratios of common interest for optimization of Static Problems. The formulae for signal to noise ratio are designed so that an experimenter can always select the largest factor level setting to optimize the quality characteristic of an experiment. Therefore a method of calculating the Signal-To-Noise ratio we had gone for quality characteristic. They are

1. Smaller-The-Better,
2. Larger-The-Better,
3. Nominal is Best**.**

SMALLER IS BETTER

The signal-to-noise (S/N) ratio is calculated for each factor level combination. The formula for the smaller-is-better S/N ratio using base 10 log is:

$$S/N = -10*\log(S (Y^2)/n)$$

Where Y = responses for the given factor level combination and n = number of responses in the factor level combination**.**

LARGER IS BETTER

The signal-to-noise (S/N) ratio is calculated for each factor level combination. The formula for the larger-is-better S/N ratio using base

10 log is: S/N = -10*log(S (1/Y 2)/n)

Where Y = responses for the given factor level combination and n = number of responses in the factor level combination.

NOMINAL IS BEST

The signal-to-noise (S/N) ratio is calculated for each factor level combination. The formula for the nominal-is-best I S/N ratio using base

10 log is: S/N = -10*log (s 2)

Where s = standard deviation of the responses for all noise factors for the given factor level combination.

INPUT PARAMETER- L9 ARRAY

Table3.1 L9 Array Formation

Current (amps)	Voltage(volts)	Gas flow rate(cc/min)
150	18	12
150	19	14
150	20	16
160	18	14
160	19	16
160	20	12
170	18	16
170	19	12
170	20	14

IV. Result and Discussion

From the investigation the mechanical property of FCAW butt welding of EN8 & SS304 steel welding conclusions were summarized as following the tensile strength value. FCAW process plate was comparatively satisfied value obtained at 3rd sample (150 AMPS VOLT-20 GAS FLOW 16) than other test plate. Finally we concluded that in this project investigation the 150 AMPS VOLT-20 GAS FLOW 16 is the best parameter for EN8 & SS304-6 mm thickness plate for obtain the good weldment state for the FCAW process. Generally bead geometry analysis through IMAGEJ software the test plate No -3 is achieved maximum depth of penetration and minimum bead width. Comparatively tensile strength obtained with maximum value than others. Through Taguchi design optimal control for tensile strength Amps 150 (A1) Volt 19(B2) and Gas flow is 16 (B3) and majorly tensile strength influenced with Amps is 50%.

Table: 4.1 Tensile strength

Test plate no	Current (I)amps	Voltage (V)volts	Gas Flow Rate (CC/Min)	Tensile Load (KN)	Tensile Strength (N/mm2)
1	150	18	12	26.61	485.27
3	150	19	14	23.61	480.06
5	150	20	16	33.95	562.83
2	160	18	14	28.04	465.47
4	160	19	16	26.57	433.60
6	160	20	12	32.56	458.64
7	170	18	16	29.72	478.38
8	170	19	12	33.59	469.72
9	170	20	14	18.67	459.52

VARIOUS SIZES OF BEAD WIDTH, DEPTH OF PENETRATION AND HEAT AFFECTED ZONE-EN8 & SS304 FCAW

Table: 4.2 Depth of Penetration

SAMPLES	Area	Mean	Min	Max	Angle	Length
1	0.211	93.939	32.333	142.774	0	6.394
	0.129	70.897	34.667	136	90	3.934
2	0.200	102.109	78.333	136.333	0	6.286
	0.103	80.474	49.333	92	90	3.238
3	0.285	71.551	38.667	103.667	0	8.276
	0.136	64.696	31	107	90	3.931
4	0.272	90.198	66.439	108.934	0	7.863
	0.144	68.327	32.467	105.183	90	4.139
5	0.279	90.261	72.667	108.333	0	8.237
	0.132	67.122	36.518	105.500	90	3.866
6	0.290	107.655	80.790	125.667	0	8.379
	0.139	70.840	48.333	91.333	90	4.034
7	0.220	85.277	62.333	102.333	0	7.031
	0.123	78.402	53	93.667	90	3.938
8	0.246	81.686	65.667	101.667	0	6.764
	0.128	80.740	61.312	117.562	90	3.493
9	0.355	77.204	58.333	94	0	8.880
	0.178	61.979	50	82	90	4.440

V. Conclusion

From the above literature survey it is found that the mechanical behavior analysis and microstructure analysis of dissimilar steels is not yet analyzed. Hence, in this investigation an attempt has been made to study the process parameter Analysis on medium and stainless steels during the Flux core arc welding. This Experimental study is very useful for carrying out further studies on dissimilar structure materials

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