International Journal of Advanced Technology in Engineering and Science
Vol. No. 09, Issue No. 04, April 2021
www.ijates.com
ijates
ISSN 2348 - 7550

EXPERIMENTAL ANALYSIS TO IMPROVE EN8 AND OHNS WELDMENTS SURFACE QUALITY AND SAFETY ASPECTS BY USING MODIFIED FLUX CORE ARC WELDING (FCAW) PROCESSES

[1]P.Murugesan, [2]B.Ramkumar, [3]M.Naveen, [4]E.Pragatheewar, [5]M.Prathiyumanan

[1]*Professor and Director, Deportment of Mechanical Engineering,*
KSR Insitiute For Engineering And Technology, Tiruchengode,Tamil Nadu,India
[2-5]*UG Student , Deportment of Mechanical Engineering,*
KSR Institute For Engineering And Technology,Tiruchengode,Tamil Nadu,India.
MAIL ID : director-sd@ksriet.ac.in , prathiyumanan333@gmail.com

ABSTRACT

Quality and productivity play important role in today's manufacturing market. Now a day's due to very stiff and cut throat competitive market condition in manufacturing industries. The main objective of industries reveals with producing better quality product at minimum cost and increase productivity. Welding is the most vital and common operation use for joining of dissimilar parts.In the present research work an attempt is made to understand various welding techniques and to find the best welding technique for steel. Special focuses have been put FCAW-MIG welding. On hardness testing machine and Impact various characteristics such as strength and hardness were analyzed.Experimentallyfound out the input parameter value 140 AMPS VOLT-22 BEVEL-65 ºis the best value and it does not create any major changes and failures in the testing process. The toughness value of the FCAW welded dissimilar steel was comparatively higher value (140 AMPS VOLT-22 BEVEL-65 º) than other value. It also induces high tensile strength. Finally concluded that in this project investigation the 140 AMPS VOLT-22 BEVEL-65 º is the best parameter for Disimilar-6mm thickness plate for obtains the good weldment state dissimilar joints.

***Keywords:* Heat input mechanical properties, FCAW,EN8 &OHNS**

INDRODUCTION:

Flux Core Arc Welding (FCAW) uses a tubular wire that is filled with a flux. The arc is initiated between the continuous wire electrode and the work piece. The flux, which is contained within the core of the tubular electrode, melts during welding and shields the weld pool from the atmosphere. Direct current, electrode positive (DCEP) is commonly employed as in the FCAW process. There are two basic process variants; self shielded FCAW (without shielding gas) and gas shielded FCAW (with shielding gas). The difference in the two is due to different fluxing agents in the consumables, which provide different benefits to the user. Usually, self-shielded FCAW is used in outdoor conditions where wind would blow away a shielding gas. The fluxing agents in self shielded FCAW are designed to not only deoxidize the weld pool but also to allow for shielding of the weld pool and metal droplets from the atmosphere. The flux in gas-shielded FCAW provides for deoxidation of the weld pool and, to a smaller degree than in self-shielded FCAW, provides secondary shielding from the atmosphere. The flux is designed to support the weld pool for out-of position welds. This variation of the process is used for increasing productivity of out-of-position welds and for deeper penetration.

LITREATURE REVIEW:

Syarul Asraf Mohammad [1] et.al Flux Core Arc Welding (FCAW) is an arc welding process that using continuous flux-cored filler wire. The flux is used as a welding protection from the atmosphere environment. This project is study about the effect of FCAW process on different parameters by using robotic welding with the variables in welding current, speed and arc voltage. The effects are on welding penetration, micro structural and hardness measurement. Mild steel with 6mm thickness is used in this study as a base metal. For all experiments, the welding currents were chosen are 90A, 150A and 210A and the arc voltage is 22V, 26V and 30V respectively. 20, 40 and 60 cm/min were chosen for the welding speed. The effect will studied and measured on the penetration, microstructure and hardness for all specimens after FCAW process. From the study, the result shown increasing welding current will influenced the value depth of penetration increased. Other than that, the factors that can influence the value of depth of penetration are arc voltage and welding speed.

B. Senthilkumar [2] Weld surfacing with super duplex grade stainless steel found to improve corrosion resistance and functional life of the mild steel components used in the process industries. The properties of the deposited layer were influenced by the process variables that affect the heat input to the process. The influence exerted by the process variables on the responses of super duplex stainless steel claddings were modeled using the response surface models. The response surface models developed by the regression techniques using the data collected from central composite rotatable design of experiments. The data extracted from 32 single bead on the plate welds were deposited by flux cored arc welding process. The developed models can be used to predict and simulate the influence of the process variables on the responses. The insignificant variables found in the full models were removed by the backward elimination technique. Sensitivity analysis performed on the reduced models helps to identify and rank the process variables based on their extent of influence on the responses. Then the ranked variables are closely regulated to tailor the properties of the surfaced layer.

PROBLEM IDENTIFICATION

In many cases the welder needs only to know the techniques of actual welding and does not need to be concerned about the type or grade of steel being welded. This is because a large amount of steel used in fabricating a metal structure is low Carbon or plain carbon steel (also called mild steel). When welding these steels with any of the common arc welding processes like Stick Mig or Tig there are generally few precautions necessary to prevent changing the properties of the steel.

Steels that have higher amounts of Carbon or other alloys added may require special procedures such as preheating and slow cooling, to prevent cracking or changing the strength characteristics of the steel. The welder may be involved in following a specific welding procedure to ensure weld metal and base metal has the desired strength characteristics.

WORK MATERIAL DETAILS

Work material –OHNS

Work material size–100mm length, 10mm thickness

CHEMICAL PROPERTIES:

SL.NO	ELEMENT	COMPOSITION IN WEIGHT % MIN	MAX
1	Carbon, C	0.36	0.44
2	Manganese, Mn	0.45	0.70
3	Silicon, Si	0.10	0.35
4	Molybdenum, Mo	0.20	0.35
5	Chromium,Cr	1.00	1.40
6	Sulphur		0.04
7	Phosphorous		0.035

APPLICATIONS:

OHNS Material is used in tooling applications requiring a high degree of accuracy in hardening, such as draw dies, forming rolls, powder metal tooling and blanking and forming dies and bushes

PHYSICAL PROPERTIES:

Physical properties	Metric	Imperial
Density	7.85 g/cc	0.284 lb/in3
Melting point	1421°C	2590°F

INTRODUCTION OF EN8 STEEL:

Work material – EN 8 steel

Work material size–100X 100 mm Square plate 6 mm thickness

CHEMICAL PROPERTIES:

C%	Mn%	Si%	S%	P%	Mn%
0.44	0.70	0.40	0.05	0.05	1.00

PHYSICAL PROPERTIES:

SL.NO	PROPERTIES	VALUE
1.	Ultimate Tensile strength (Mpa)	224.07
2.	Yield Stress (Mpa)	2033.95
3.	Elongation (%)	5
4.	Density(Kg/m^3)	7833.413
5.	Hardness(HRC)	62

APPLICATIONS:

EN8 is suitable for the manufacture of parts such as general-purpose axles and shafts, gears, bolts and studs, stressed pins, keys etc. It can be further surface hardened by induction processes, producing components with enhanced wear resistance.

DESIGN OF EXPERIMENT

Process parameters and their levels responses

LEVELS	PROCESS PARAMETERS		
	PEAK CURRENT Amps	BASE CURRENT Amps	BEVEL ANGLE°
1	160	20	60
2	180	30	65

DESIGN OF ORTHOGONAL ARRAY

First Taguchi Orthogonal array is designed in minitab-17 to calculate S/N ratio and means which steps is given below.

Create Taguchi Design is selected as shown in figure. Then a window of Taguchi design is opened.

To start Minitab, click shortcut of Minitab on Desktop of computer.

Design Of Orthogonal L_4 Array:

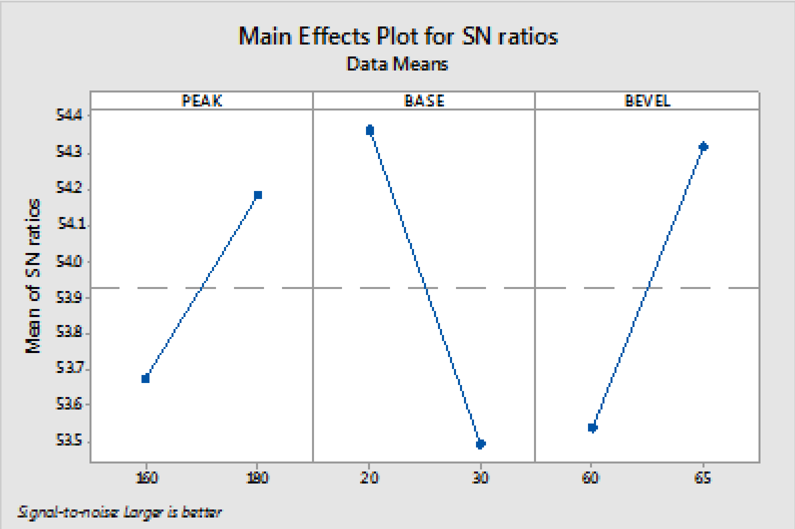
SL.NO	PEAK CURRENT	BASE CURRENT	BEVEL ANGLE°
1	160	20	60
2	160	30	65
3	180	20	65
4	180	30	60

TAGUCHI ANALYSIS RESULT-SN RATIO:

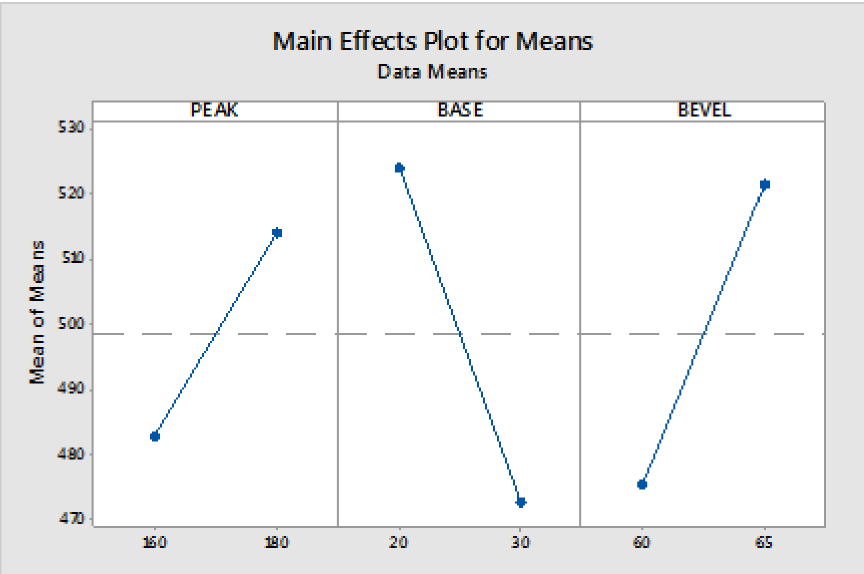
S-N Ratio table for Tensile strength

SL.NO	PEAK CURRENT	BASE CURRENT	BEVEL ANGLE	TENSILE STRENGTH	SNRA1
T_1	160	20	60	485.27	53.7197
T_2	160	30	65	480.06	53.6259
T_3	180	20	65	562.83	55.0075
T_4	180	30	60	465.47	53.3578

MAIN EFFECTS PLOT FOR SN RATIOS :



MAIN EFFECTS PLOT FOR MEANS:



3/29/2021 10:35:11 PM

Welcome to Minitab, press F1 for help.

Taguchi Design

Taguchi Orthogonal Array Design

L4(2^3)

Factors: 3
Runs: 4

Columns of L4(2^3) Array

1 2 3

Taguchi Analysis: TS versus PEAK, BASE, BEVEL

Response Table for Signal to Noise Ratios
Larger is better

Level	PEAK	BASE	BEVEL
1	53.67	54.36	53.54
2	54.18	53.49	54.32
Delta	0.51	0.87	0.78
Rank	3	1	2

Response Table for Means

Level	PEAK	BASE	BEVEL
1	482.7	524.0	475.4
2	514.2	472.8	521.4
Delta	31.5	51.3	46.1
Rank	3	1	2

General Linear Model: TS versus PEAK, BASE, BEVEL

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
PEAK	Fixed	2	160, 180
BASE	Fixed	2	20, 30
BEVEL	Fixed	2	60, 65

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
PEAK	1	991.3	991.3	*	*
BASE	1	2630.2	2630.2	*	*
BEVEL	1	2122.9	2122.9	*	*
Error	0	*	*		
Total	3	5744.4			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
*	100.00%	*	*

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	498.4	*	*	*	
PEAK					
160	-15.74	*	*	*	1.00
BASE					
20	25.64	*	*	*	1.00
BEVEL					
60	-23.04	*	*	*	1.00

NON-DESTRUCTIVE TESTING

INTRODUCTION:

Non-destructive Test and Evaluation is aimed at extracting information on the physical, chemical, mechanical or metallurgical state of materials or structures. This information is obtained through a process of interaction between the information generating device and the object under test. The information can be generated using X-rays, gamma rays, neutrons, ultrasonic methods, magnetic and electromagnetic methods, or any other established physical phenomenon.

APPLICATION OF NDT:

1. Nuclear, space, aircraft, defense, automobile, chemical and fertilizer industries.
2. Heat exchanger, Pressure vessels, electronic products and computer parts.
3. High reliable structures and thickness measurement.

TYPES OF NDT:

1. Visual Testing- Ultraviolet. Infrared and visible light
2. Penetrate testing
3. Electromagnetic testing
4. Magnetic particle Testing
5. Acoustic Emissions
6. Ultrasonic testing
7. Radiography (RT) – X rays , Gamma rays & Beta particles
8. Penetrant Test Report

RESULT &CONCLUSION

FCAW welding can be used successfully to join EN8 & OHNS. The processed joints exhibited better mechanical and metallurgical characteristics. The joints exhibited 90-95% of parent material's Hardness value. The specimen failures were associated depending upon the improper changes of heat value. It creates so many metallurgical defects. In our experiment practically we have found out the input parameter value 180 PEAK CURRENT -20 BASE CURRENT BEVEL ANGLE -65° is the best value. According to the Taguchi design and optimized parameter is tensile strength value for the 6 mm plate of EN8 & OHNS steel is 180amps -peak current, -base current -20, bevel angle-65° and mainly influenced with base current 46 % of EN8 & OHNS steel. Mild surface defect found through LPT test through non-destructive method.

REFERENCE

1. Syarul Asraf Mohammad, Izatul Aini Ibrahima, Amalina Amira, and Abdul Ghaliba the Effect of Flux Core Arc Welding (FCAW) processes on different Parameters University Teknologi Mara (UiTM), Faculty of Mechanical Engineering, 40450 Selangor

2. B. Senthilkumara and T.Kannanb Sensitivity analysis of flux cored arc welding process variables in super duplex stainless steel claddings. Assistant Professor, Department of Mechanical Engineeirng, Kumaraguru College of Technology, Coimbatore – 641 049, Tamilnadu, India.bPrincipal, SVS College of Engineering, J P Nagar,Arasampalayam, Coimbatore – 641 109

3. A. Aloraier a,*, R. Ibrahim a, P. Thomson FCAW process to avoid the use of post weld heat treatmenta Department of Mechanical Engineering, Monash University, P.O. Box 197, Caulfield East, Vic. 3145, Australia b School of Physics and Materials Engineering, Monash University, Box 69M, Clayton, Vic. 3800, Australia

4. N.B. Mostafa, M.N. Khajavi Optimization of welding parameters forweld penetration in FCAWMechanical Engineering Department, Shahid Rajaee University, and Tehran, Iran

5. J.S. Seo, H.J. Kim*, H.S. Ryoo Microstructural parameter controlling weld metal cold cracking, Korea Institute of Industrial Technology, 35-3 HongChonRi, IbJangMyun, ChanAnSi, 330-825, Korea

6. J. Dutta* and Narendranath S. Experimental and analytical investigation of thermal parameters developed in high carbon steel joints formed by gta welding department of mechanical engineering, national institute of technology karnataka, surathkal, india *corresponding e-mail: