Study of TIG Welding Process with Different Type of Technique: A Review

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ABSTRACT
Tungsten inert gas welding (TIG) is joining process of two metals. This process is running from last 25years because of its benefits like less heat required, minimum arc, efficient production, low thermal effected area and atmosphere friendly. Tungsten inert gas welding is done to join different sorts of ferrous metals and non-ferrous metals which can't be welded by non-conventional welding process. Different welding methods were used while joining of metal and readings like current, voltage, wire feed rate, speed, nozzle distance, torch angle and gas flow rate. Results the different strategies were utilized in enhancement of welding readings, for example, regression methods, taguchi strategy and statistical procedure in this paper we investigation of all angles relative in progress for welding quality and strength.

Keywords: *TIG welding, taguchi method, mild steel, parameter, but joint, tensile test*

INTRODUCTION

Welding is a technique for joining two same or various metals by combination. TIG joins various metals/ alloys, with or without the utilization of pressure and heat or mix of both. This welding has minimal cost what's more, this procedure gives solid joints and utilized for doing permanent joints. Heat can be delivered either from ignition of gases or electric arc, electric obstruction or by chemical response. This welding is utilized as a fabrication and repairing process in ventures. Some other troublesome utilizations of welding incorporates the manufacture of boats, machine frame, automobile bodies and chassis, railway wagons, airplane and boats, welded pipes, and so forth.
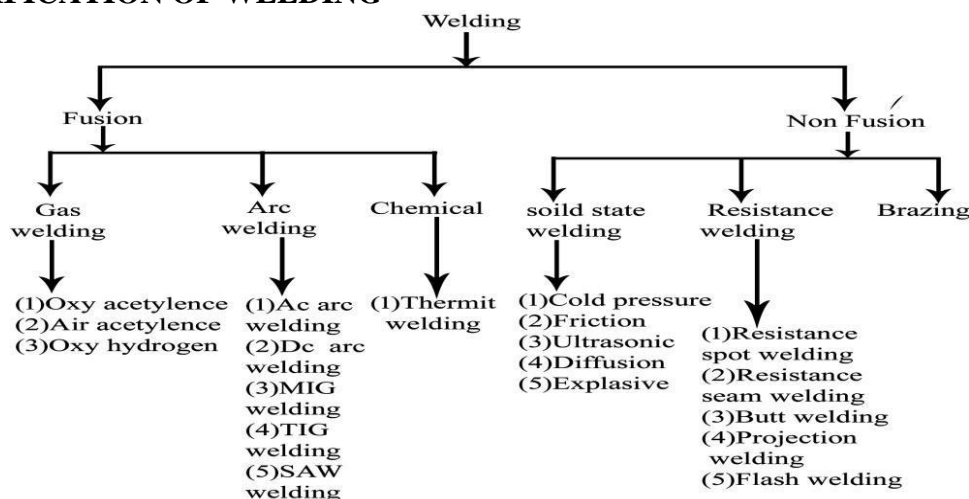
CLASSIFICATION OF WELDING

Fig. 1: *Type of Welding Process.*

Welding process can be defined according to the fusion process which is shown in figure 1.

TUNGSTEN INERT GAS WELDING (TIG)[6]

TIG welding is one of the very important arc welding methods which is used to fabricate the structure. Its improved information and input controller of the Tungsten inert gas welding method because of the good thermal input control, Tungsten Inert Gas can be utilized for non-ferrous welding. This is the semi-automatic process that is used for continuous welding with the help of wires, high metal high welding speed and testimonies rate. The important gases that have used in shielding the weld pool are CO_2, Helium (HE) and Argon (Ar). Shielding gases are utilized to cool down the gun. TIG welding method is shown in figure 2.[10]

MAIN COMPONENT OF TIG WELDING PROCESS

* Gas cylinder CO_2
* Filler wire
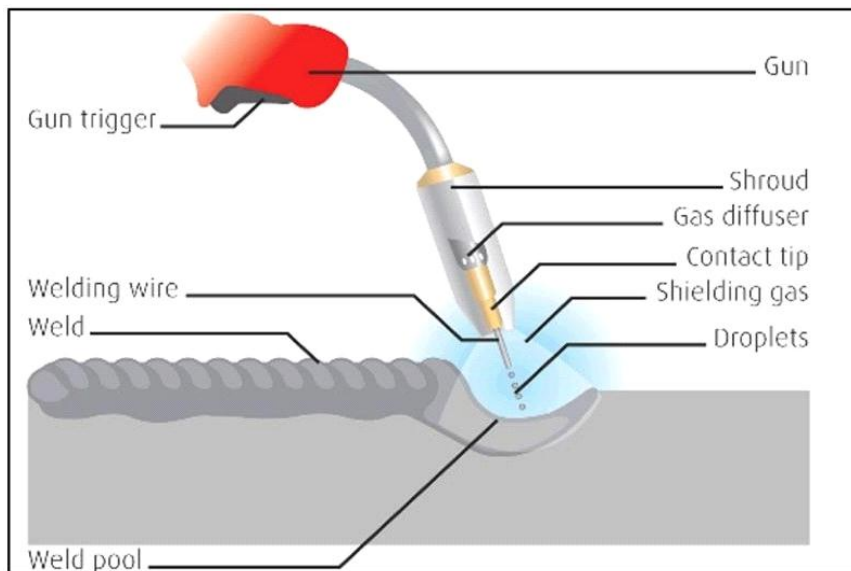* TIG Welding machine setup
* Negative cable
* Cable of wire feed

Fig. 2: *Tig Welding Process with Work Piece.*

LITERATURE REVIEW

Table 1:

S. No	Author Name	Material	Technique	Conclusion
1.	S. R. Patil, *et al.*	AISI 1030 mild steel	Taguchi method L9	This was observed that welding current and welding speed Are major parameters which influence on the tensile strength of welded joint?
2.	S. Utkarsh *et al.*	Low alloy steel material st-37	L9 orthogonal Array	It was found that an optimal rate of current, voltage speed and gas flow rate which is control the weld quality strength.
3.	Sindiri Mahesh *et al.*	AISI 1050 mild steel	L9 orthogonal Array	It have a worked on welding parameters like welding current Welding voltage, welding speed on ultimate tensile strength (UTS) .
4.	Pradip Kumar Pal *et al.*	Austenitic Stainless Steel AISI 316L	L9 Taguchi design	This was observed that influence of the process parameters Current, gas flow rate and nozzle to plate distance has

			been examined visually and also through X-ray radiographic tests.
5.	Vikas Chauhan *et al.*	Stainless steel (SS-304) and low carbon steel.	L9 Taguchi method	It have a worked on dissimilar metals are plates a joined by TIG welding successfully. Find out the analysis of signal-to-noise ratio was done using MINITAB-13 software for higher- the-better quality.
6.	Gaurav Kumar *et al.*	AISI Grade 304 Steel	L9 orthogonal array	It was found that An orthogonal array of Taguchi's design is used to find out the Signal to Noise ratio[15]
7.	A. Roy Choudhury *et al.*	Mild steel	statistical methods	In this paper, relationship between input–output in TIG welding process through regression analyses carried out both cluster-wise.[4]
8.	Amol Chavan *et al.*	Mild steel material	L9 Taguchi method	Presented on various response parameters like depth of penetration, bead width, bead height, micro-hardness, microstructural study.
9.	T. Anand kumar *et al*	Mild steel	L16Taguchi method	It was found that. TIG welding is performed on the different mild steel pieces are butt joint welded and check the tensile strength on workspaces
10.	Prof.S.D Ambekar *et al.*	Martensitic Stainless steel AISI 410	L16orthogonal array	It was found that the results closer to the optimize results.
11.	Jiahun Liu *et al.*	Aluminum alloy/stainless steel	Mathematical	It was found that. X-ray diffraction (XRD) analysis & Microstructure and with a tensile strength of the lap joint reaching.[7]
12.	M.suban *et al.*	----------------	Mathematical modal	It is type of sidling gas use MIG welding and it is found that TIME, RAPID,[2] LANFASTPROCESS from high productivity welding. And that the quality of welding joint does not become impaired.[11-13]
13.	Farhad Kolahan *et al.*	------------------	statistical method	The experiment design to Regression modelling and next stage selected model is implanted into a Simulated Annealing (SA)optimization algorithm.
14.	B. Mishra *et al.*	AISI 1020 steel	Taguchi's design of experiment (DOE)	It was found that optimal process parameters for effectiveness in the analysis of penetration & S/N ratio.
15.	P.Chavda *et al.*	medium carbon stee	Design of Experiment (DOE)	It have a technique use Finite Element Analysis and Design of experiment (DOE) method. from optimizing parameter.
16.	Priti Sonasale *et al.*	Mild steel	Taguchi method	It is fund that confirmation test is carried out to compare the predicated values with the experimental values confirm its Effectiveness in the analysis of bead width, dilution and depth of HAZ.
17.	G. Hargupal *et al.*	Aluminium alloy (Al65032)	Taguchi method L9	It was found that. Parameter optimizing with S/N ratio analysis and mean response analysis.
18.	E.Hayati *et al.*	Steel AISI 1020	Taguchi method DOE	It Have a work on Parameter optimizing Regression Analysis, Signal-to Noise Ratio(S/N).

PARAMETER OPTIMIZATION TECHNIQUES

The Optimization of Welding Process by Taguchi's Design Method[1,3,5,9,14]

Taguchi method knows the control factors to reduce the effect of Noise factors. Orthogonal array assists with lessening the expense of the test and time. The Signal-to-Noise (S/N) Ratio which is log capacity of basic yield which is the target capacity to be improved. Smaller is better Where,

$S/N = -10*\log(\sum(1/Y^2)/n)$ $S/N = -10*\log(\sum(Y^2)/n)$ y = responses for the given factor level combination n=no. of responses in the factor level combination.

Statically approaches-This is method step in depend following as
Method 1

In this method, response is expressed as a function of the main factors only (without considering their interaction terms).

Ŷ=f(S,V,F,G,D,A)

Ŷ=α0+α1S+α2V+α3F+α4G+ α5D+ α6A

Where is α1; α2; . . . . : α6 are the coefficients to be obtained by using a minimum-square technique discussed in the sub-section. Regression analysis is carried out for each response by considering only the main factors.

Method 2

Non-linear regression analysis is carried out to decide the responses weld bead height (BH),[8] penetration (BP) and bead width (BW),in case of the Tungsten Inert Gas welding process. Ŷ=f(S,V,F,G,D,A)

Ŷ=α0*Sa1*Va2 Fa3 Ga4 Da5 Aa6

After taking log on both the sides, we get *
    * * *

In(Y)=In(α0)+α1In(S)+   α2In(V)+ α3In(F)+ α4In(G)+ α5In(D)+ α5In(A).

Where - α0,α1,α2,α3,α4,α5,α6, are the coefficients of the non-linear model.

Method 3

Linear Regression study considering all terms.

A: Weld metal

B: Bead High (BH)

C: Base metal

D: Bead High (BH)

E: Bead Penetration

Ŷ=   f(x1,x2,x3,x4,x5,x6)
b0+b1x1+b2x2+b3x3+b4x4+   b5x5+
b6x6+b7x1x2+   b8x1x3+   b9x1x4+
b10x1x5+   b11x1x6+   b12x2x3+
b30x1x4x6+ b31x1x5x6+ b32x2x3x4+
b33x2x3x5+ b34x2x3x6+ b35x2x4x5+
b36x2x4x6+ b37x2x5x6+ b38x3x4x5+
b39x3x4x6+   b13x2x4+   b14x2x5+
b15x2x6+ b16x3x4+ b17x3x5+ b18x3x6+
b19x4x5+   b20x4x6+   b21x5x6+
b22x1x2x3+ b23x1x2x4+ b24x1x2x5+
b25x1x2x6+ b26x1x3x4+ b27x1x3x5+
b28x1x3x6+ b29x1x4x5+   b40x3x5x6+
b41x4x5x6+   b42x1x2x3x4+
b43x1x2x3x5+
b44x1x2x3x6+..................(1) equation.

Where is-

Xi is the coded value corresponding to with input parameters, and Ŷ is the estimated response (output) value. The coefficients (i.e., b0, b1, and b2... b44) of the above equation can be estimated by using a least-square technique.

Method 4:

The insignificant terms are dropped from Eq. (1). For each response, the significant and insignificant terms will be identified with the help of Pareto charts included in the next section. Regression analysis is carried out and predictions are attempted with the help of the resulting equations

CONCLUSIONS

The target of this examination was to build up the impact of the Tungsten Inert Gas welding strategy that is utilized for good quality of joints and high production rate. In light of this investigation of Tungsten Inert Gas welding the accompanying end might be watched.

- The optimization parameter is determined to the sake of various advancement procedures like Taguchi technique, statistical strategy, Mathematical strategy.
- The welding boundary is the input role of welding process which is control the weld quality and strength.
- Design of test con be utilized the significant programming situated in MINI TAB, MATA LAB, and ANSYS.
- Shielding gas is preventing the oxidization during the welding procedure

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