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A Review of an Investigation into the TIG Welding Process Using Several Varieties of Technique

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Abstract

Tungsten inert gas (TIG) welding is a metal joining procedure. This technique has been in use for over 25 years because of its advantages, such as less heat required, a small arc, efficient production, a small thermally affected area, and environmental friendliness. Tungsten inert gas welding is used to unite various ferrous and non-ferrous metals that cannot be welded using traditional welding methods. While joining metal, many welding procedures were employed, as well as readings such as current, voltage, wire feed rate, speed, nozzle distance, torch angle, and gas flow rate. Several strategies, including regression approaches, the Taguchi strategy, and statistical procedures, were used to improve welding readings, according to the findings. In this work, we investigated all aspects relating to progress in welding quality and strength.

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

INTRODUCTION

Welding is a process for uniting two metals that are either the same or different. TIG connects various metals/alloys using pressure, heat, or a combination of the two. This type of welding has a low cost, and it produces sturdy welds that may be used for permanent couplings. Heat can be provided by gas or electric arc igniting, electric blockage, or chemical reaction. This type of welding is used in projects as a fabrication and repair method. Other

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difficult applications of welding include the production of boats, machine frames, vehicle bodies and chassis, railway trains, aeroplanes and boats, welded pipes, and so on.

CLASSIFICATION OF WELDING

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

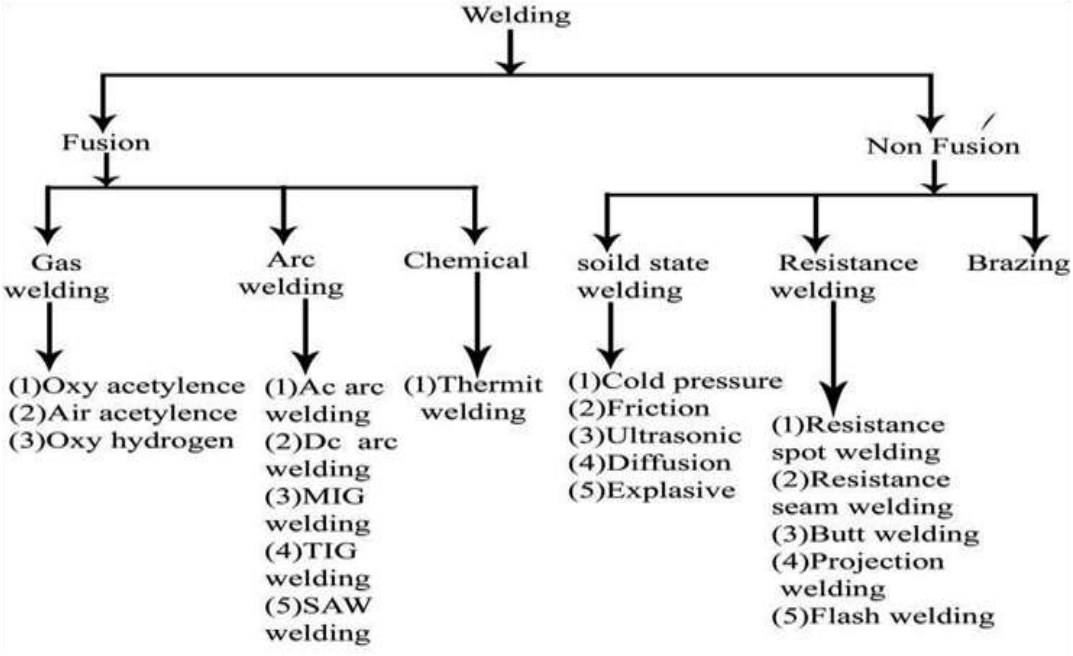


Fig. 1: Type of Welding Process

Main Component of TIG Welding Process

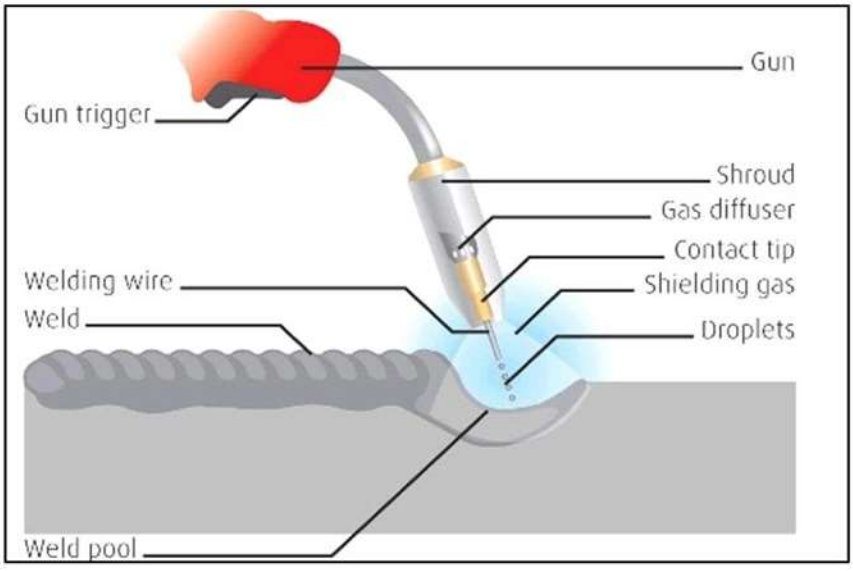


Fig. 2: TIG Welding Process with Work Piece.

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- Gas cylinder CO2
- Filler wire
- TIG Welding machine setup
- Negative cable
- Cable of wire feed

Tungsten Inert Gas Welding (TIG)[6]

TIG welding is one of the most essential arc welding processes used to construct the structure. Because of its better information and input controller than other welding technologies, tungsten inert gas may be used for non-ferrous welding. This is a semi-automatic procedure for continuous welding with wires, high metal welding speed, and testimony rate. CO2, helium (HE), and argon (Ar) are key gases used in welding pool shielding. To keep the cannon cool, shielding gases are used. Figure 2 depicts the TIG welding procedure. [10]

LITERATURE REVIEW

Table 1:

S. No	AuthorName	Material	Technique	Conclusion
1.	S.R.Patil, *etal.*	AISI1030 mildsteel	Taguchi method L9	This was observed that welding current and weldingspeed Are majorparameters whichinfluenceon thetensilestrength ofweldedjoint?
2.	S.Utkarsh *etal.*	Low alloy steelmaterialst-37	L9 orthogonalArray	It was found that an optimal rate of current, voltagespeedand gasflowrate which iscontroltheweld quality strength.
3.	SindiriMaheshetal.	AISI1050 mildsteel	L9 orthogonalArray	It have a worked on welding parameters like weldingcurrent Weldingvoltage,weldingspeedonultimatetensilestrength (UTS) .
4.	Pradip KumarPal *etal.*	AusteniticStainless SteelAISI316L	L9Taguchidesign	This was observed that influence of the processparameters Current,gasflowrate and nozzletoplatedistancehasbeen examined visually and also through X-ray radiographic tests.
5.	VikasChauhan *etal.*	Stainless steel(SS-304) and lowcarbonsteel.	L9 Taguchimethod	It have a worked on dissimilar metals are plates a joinedby TIG welding successfully. Find out the analysis ofsignal-to-noiseratiowas doneusingMINITAB-13 softwareforhigher-the-betterquality.
6.	GauravKumaretal.	AISI Grade304 Steel	L9 orthogonal array	It was found that An orthogonal array of Taguchi'sdesignisusedtofindouttheSignalto Noiseratio[15]
7.	A. RoyChoudhuryetal.	Mild steel	statisticalmethods	In this paper, relationship between input–output in TIGweldingprocessthroughregressionanalysescarriedoutboth cluster-wise.[4]

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8.	AmolChavan *etal.*	Mild steelmaterial	L9 Taguchi method	Presented on various response parameters like depth ofpenetration,beadwidth,beadheight, micro-hardness, microstructuralstudy.
9.	T. Anandkumar*etal*	Mildsteel	L16Taguchimethod	It was found that. TIG welding is performed on thedifferent mild steel pieces are butt joint welded andcheckthetensile strengthonworkspaces
10.	Prof. S.DAmbekar*etal.*	MartensiticStainlesssteel AISI410	L16orthogonalarray	Itwas foundthattheresultsclosertotheoptimizeresults.
11.	Jiahun Liu *etal.*	Aluminumalloy/ stainless steel	Mathematical	Itwasfound that.X-raydiffraction (XRD)analysis&Microstructureand with atensilestrength ofthelapjoint reaching.[7]
12.	M.suban *et al.*	----------	Mathematicalmodal	It is type of sidling gas use MIG welding and it is foundthatTIME,RAPID,[2] LANFASTPROCESSfromhigh productivitywelding.And thatthequalityofweldingjointdoes not becomeimpaired.[11-13]
13.	FarhadKolahan *et al.*	----------	statisticalmethod	TheexperimentdesigntoRegressionmodellingandnextstageselected modelisimplantedinto aSimulatedAnnealing(SA)optimizationalgorithm.
14.	B.Mishra *et al.*	AISI1020 steel	Taguchi's designofexperiment (DOE)	It was found that optimal process parameters foreffectivenessin theanalysisofpenetration&S/Nratio.
15.	P.Chavda *et al.*	mediumcarbon steel	Design ofExperiment(DOE)	It have a technique use Finite Element Analysis andDesignofexperiment(DOE)method.from optimizingparameter.
16.	PritiSonasale *et al.*	Mild steel	Taguchimethod	Itisfundthatconfirmationtestiscarried outto comparethe predicated values with the experimental valuesconfirmits Effectivenessintheanalysisofbeadwidth,dilutionanddepthofHAZ.
17.	G. Hargupal*e tal.*	Aluminium alloy (Al65032)	Taguchimeth odL9	Itwas foundthat.ParameteroptimizingwithS/Nratio analysisandmean responseanalysis.
18.	E.Hayati *etal.*	SteelAISI 1020	Taguchimethod DOE	ItHavea workonParameteroptimizingRegression Analysis,Signal-toNoiseRatio(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 (∑ (1/Y2)/n) S/N = -10*log (∑(Y2)/n)y = responses for the givenfactor level combination n=no. of responses in the factor level combination.

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Statically approaches-This is method step in depend following asMethod 1

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

$\hat{Y}=f(S,V,F,G,D,A)$

$\hat{Y}=\alpha0+\alpha1S+\alpha2V+\alpha3F+\alpha4G+\alpha5D+\alpha6A$

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. $\hat{Y}=f(S,V,F,G,D,A)$

$\hat{Y}=\alpha0*Sa1*Va2\ Fa3\ Ga4\ Da5\ Aa6$

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

$In(Y)=In(\alpha0)+\alpha1In(S)+\alpha2In(V)+\alpha3In(F)+\alpha4In(G)+\alpha5In(D)+\alpha5In(A).$

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

$\hat{Y}=f(x1,x2,x3,x4,x5,x6)$

$b0+b1x1+b2x2+b3x3+b4x4+\ b5x5+\ b6x6+b7x1x2+\ b8x1x3+\ b9x1x4+\ b10x1x5+\ b11x1x6+\ b12x2x3+\ b30x1x4x6+\ b31x1x5x6+\ b32x2x3x4+\ b33x2x3x5+\ b34x2x3x6+\ b35x2x4x5+\ b36x2x4x6+\ b37x2x5x6+\ b38x3x4x5+\ b39x3x4x6+\ b13x2x4+\ b14x2x5+\ b15x2x6+\ b16x3x4+\ b17x3x5+\ b18x3x6+\ b19x4x5+\ b20x4x6+\ b21x5x6+\ b22x1x2x3+\ b23x1x2x4+\ b24x1x2x5+\ b25x1x2x6+\ b26x1x3x4+\ b27x1x3x5+\ b28x1x3x6+\ b29x1x4x5+\ b40x3x5x6+\ b41x4x5x6+\ b42x1x2x3x4+\ b43x1x2x3x5+\ b44x1x2x3x6+$

(1) equation.

Where is-

Xi is the coded value corresponding to with input parameters, and $\hat{Y}$ 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.

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Method 4:

Insignificant terms are removed from Eq (1). The relevant and inconsequential terms for each response will be determined using the Pareto charts supplied in the next section. Regression analysis is performed, and predictions are made using the derived equations.

CONCLUSIONS

The goal of this investigation was to determine the influence of the tungsten inert gas (TIG) welding method, which is used for good joint quality and a high production rate. The accompanying movie may be seen in light of this examination of tungsten inert gas (TIG) welding.

- The optimization parameter is chosen for the benefit of numerous advancement procedures such as the Taguchi technique, statistical strategy, and mathematical strategy.
- The welding boundary is an input to the welding process that regulates weld quality and strength.
- The major programming found in MINI TAB, MATA LAB, and ANSYS will be used for test design.
- Shielding gas prevents oxidation during the welding process.

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