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Experimental and Investigation of Process Parameters of TIG Welding

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ABSTRACT

The purpose of this study is to finding the optimized process parameters for GTAW welding which effects on weld quality. There are various process parameters like Voltage, Gas flow rate, Current, Welding speed etc. The properties of the welded joints are affected by a large number of welding parameters. Properties include Tensile strength, Impact force, Hardness etc. By mechanical testing we can get the tensile strength, hardness strength. By using Taguchi and ANNOVA technique an optimal solution is find out, which provides us an optimal results of the varying condition. So this paper review the different scientific research in TIG welding to find the best parameters.

Keywords: Tig welding, current, voltage, gas flow rate, Taguchi method, optimization

I. INTRODUCTION

There are number of welding methods available for welding materials such as shielding metal arc welding, gas metal arc welding, flux cored arc welding, submerged arc welding, electron beam welding, and gas tungsten arc welding methods. The choice of welding depends on several factors, primarily among them are the compositional range of materials to be welded. The thickness of the base materials and the type of current. Tungsten inert gas welding is the most popular gas shielding arc welding process is used. Shielding gas in TIG welding is desirable for protection of atmospheric contamination.

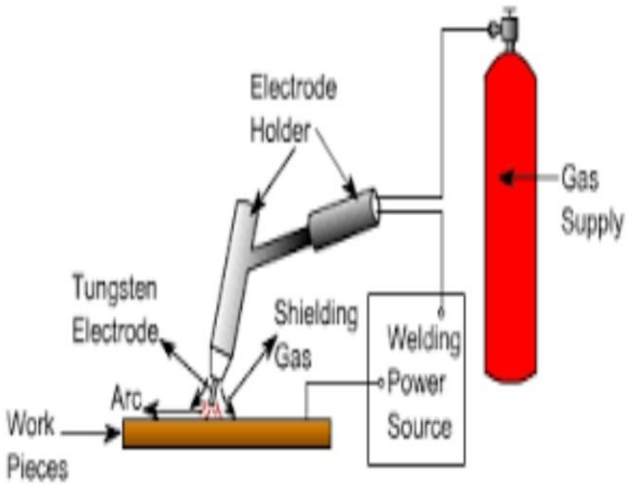

Fig: - TIG WELDING [1]

We discuss the influence of the power source, type of current, gas flow rate, electrodes, filler wire, TIG machines settings and shielding gases which are the most important in determine arc stability, arc penetration and defect free welds. We have to identify the suitable range of current, the thickness of the base metal, the diameter of electrode, the

composition of electrode and filler wire, the gas flow rate required for high quality welding process.

Under the correct welding condition tungsten electrode does not melt and it's consider to be non consumable. To make a weld, either the edge of the metal must melt and flow together by themselves or filler metal must be added directly into the molten metal pool. Filler metal is added by dipping the end of the filler rod into the leading edge of the molten weld pool.

II. RELATED WORKS (LITERATURE REVIEW)

In the paper [1] SHEKHAR RAJENDRA GULWADE, they have used taguchi optimization method and analysis of variance to find optimal process parameters for hardness analysis. The improvement of S/N ratio is 0.04 the experiment value observed from optimal welding parameters, the hardness is 188.70 BHN and S/N ratio is 45.51.

In the paper [2] PRASHANT KUMAR SINGH, they proposed that in gas tungsten arc welding process parameters like welding speed, welding voltage, welding current, gas flow rate, electrode diameter, distance between TIG torch and work piece etc.are important control on welding materials. This approach is mostly
used in fabrication and other industries to join either similar and dissimilar material.

In the paper [3] AJIT KHATTAR, they proposed a method to decides near optimal setting of the welding process parameters. Taguchi and ANOVA methods are used for experiment and analysing the result, increasing effect as current, gas flow rate and no. Of passes affects deposition rate significantly.

In the paper [4] A. DEVARAJU, they have conducted X-ray test, tensile test, impact test, hardness test and bend test to evaluate the mechanical properties of welded joints. The test results the X-ray test found no defects. The impact test reveals that weld is in acceptable level. Tensile test found that improved mechanical properties such as tensile strength and yield strength. Hardness test reveals that improved value compared to 316L SS. Bending test conclude that welding quality is acceptable. It is concluded that the selected dissimilar metal is suitable to do TIG welding and recommended for real time applications.

In the paper [5] RAVINDER S.K. JARIAL, they have proposed a method to decide near optimal settings of process parameters of the TIG welding. They have used ANOVA analysis method, with the help of tensile and hardness testing the study found that the control factors and varying effects on tensile strength, arc voltage having the highest effect.

In the paper [6] SWAPNIL K. GUNDEWAR, they have proposed the extent of improvement in the manual TIG by supplanting with automated gas tungsten circular segment welding. They finish up by using parameters like current, voltage, circular segment gas flow, and welding speed. With the automation quality and quantity of the production also increases which is much higher than the manual TIG so the scrap get reduced and productivity improved.

In the paper [7] ER. BHAWANDEEP SINGH, they conducted an experiment showed that activating flux aided TIG welding has increased the wild penetration, tending to reduce with of weld bead. Also on increasing penetration by applying the flux on mild steel its hardness get reduce and their subsequently increased in depth to with ratio.

In the paper [8] NIRMALENDHU CHAUDHARY, they have conducted experiment by using taguchi method in which several levels of current, gas flow rate and filler rod

diameter. From the ANOVA results, has found that none of the welding parameters effecting the ultimate load main effect plot level that current and gas flow rate which has considerable influence on ultimate load. Filler rod has less influence.

In the paper [9] PARVINDER SINGH, they have used taguchi's DOE approach plan and design the experiment to study the effect of welding process parameters on metal deposition rate and hardness of the weld bead. The result shows that the current and no. of Passes affect the
deposition rate affect vary significantly. In this study they conclude that optimal input parameters setting for current is 140 amp, 10 lpm, 1 no. Of pass while welding the stainless steel 304 on TIG welding as far the deposition rate is concern.

In the paper [10] NAITAK S. PATEL, they have made an attempt to understand the TIG welding parameters such as welding current, gas flow rate, welding speed, that are influence on responsive output parameters such as hardness of welding, tensile strength of welding, by using optimization philosophy. The effect of investigation optimal machining parameters and their contribution on producing better quality and high productivity.

III. METHODS AND MATERIAL

- Selection of base metals.

Mild steel (IS 2062)

Carbon %	Sulphur %	Phosphorus%	Manganese%	Silicon %
0.204	0.024	0.038	0.570	0.199

- Selection of process parameters.

Welding Current - 30-220A
Voltage – 220V Max.
Flow Rate – 10 To 8 lpm
Speed – 160-200mm/min

- Preparation of samples for welding.
- Welding of samples.
- Specimen for tensile test & hardness test.

The main motive behind Taguchi method is to reduce variation in a process through robust design of experiment. The overall motive of the method is to give high quality product at low cost to the manufacturer. The experimental design given by Taguchi involves implying orthogonal arrays to organize the parameters affecting the process and the levels at which they give different values. In the place of having to test all possible combinations like the factorial
design, the Taguchi technique tests pairs of combinations.

This allows for the collection of the important data to find out which factors most affect product quality with a less amount of experimentation, thus saving time and resources. Study of ANOVA table for a given analysis helps to determine which of the parameters need control.

- **Selection of orthogonal array**

SR. NO	CONTROL FACTORS		
	A	B	C
1	1	1	1
2	1	2	2
3	1	3	3
4	2	1	2
5	2	2	3
6	2	3	1
7	3	1	3
8	3	2	1
9	3	3	2

Whereas, A, B, C are process parameters and 1, 2, 3 are levels of parameters.

IV. RESULTS AND DISCUSSION

- **Tensile test**

The tensile test was done on UTM 400KN. A tensile test is also known as tension test & it is probably the most common type of mechanical test you can perform on material. Tensile tests are simple, less expensive, and fully standardized. By pulling on something, you will very quickly determine how the material will react to forces being applied in tension. By pulling material, you will find its strength along with how much it will elongate. One of the properties you can determine about a material is its ultimate tensile strength. This is the maximum load the specimen sustains during the test. The ultimate tensile strength may or may not equate to the strength at break. This all depends on what type of material you are testing brittle, ductile or a substance that even carries both properties. The test process involves placing the test specimen in the machine and applying tension to it until it fractures. During the application of tension, the elongation of the gauge section is recorded against the applied force.

- **Hardness test**

This term may also refer to stiffness or temper or to resistance to scratch, abrasion, or cutting. It is property of
a metal, which gives it the ability to resist being permanently deformed (bent, broken, or have its shape changed), when a load is applied. The metal with greater hardness it has greater resistance to deformation. In metallurgy hardness is defined as the ability of a material to resist plastic deformation.

V. CONCLUSION

The present paper give a study of optimization on the parameters on TIG welding. From the literature, it observed that there are lot of work have done for parameters like current, voltage, gas flow and speed to find out the tensile strength, hardness and heat effected zone. From above papers study some conclusions came outside which is given below.

Different parameters (current, voltage, welding speed, electrode diameter, gas flow rate) of process can be taken for welding IS2062 mild steel with Taguchi and ANOVA method.

1. To study the effects of parameters on impact strength of butt weld joint on different grove angles.
2. To find out the residual stress on different parameters during the welding process.
3. To find out the best suitable parameters for maximum tensile strength, fatigue strength, hardness and heat effected zone.

VI. REFERENCES

[1]. Shekhar Rajendra Gulwade, R.R.Arakerimath, “Parameter Optimization of TIG Welding Using Austenitic Stainless Steel”, International Journal of Innovative and Emerging Research in Engineering, Volume 2, p-ISSN: 2394 – 5494.

[2]. Prashant Kumar Singh, Pankaj Kumar, Baljeet Singh, Rahul Kumar Singh, “International Journal of Engineering Research and Application”, ISSN: 2248-9622, Volume 5, February 2015, pp.125-128.

[3]. Ajit Khatter, Pawan Kumaj, Manish Kumar, “Optimization of Process Parameter in TIG Welding Using Taguchi of Stainless Steel-304”, International Journal of Research in

Mechanical Engineering and Technology, ISSN: 2249 – 5770, Volume 4, Issue 1, November 2013 – April 2014.

[4]. A. Devaraju, " An Experimental study on TIG Welded joint between Duplex Stainless Steel and 316L Austenitic Stainless Steel", SSRG International Journal of Mechanical Engineering, ISSN: 2348 – 8360, Volume 2, Issue 10, October 2015.

[5]. Ravinder , S.K. Jarial, "Parametric Optimization of TIG Welding on Stainless Steel (202) and Mild Steel by Using Taguchi Method", International Journal of Enhanced Research in Science Technology and Engineering, ISSN: 2319-7463, Volume 4, Issue 6, June-2015,pp: (484-494).

[6]. Swapnil K. Gundewar, M.R. Nagare, "Automation of Gas Tungsten Arc Welding and Parameter of Auto-TIG for SS304L", International Journal of Science Technology and Engineering, ISSN: 2349-784X, Volume 2, Issue 2, August 2015.

[7]. Er Bhawandeep Singh, Er Avtar Singh, "Performance of Activated TIG Process in Mild Steel Welds", International Journal of Mechanical and Civil Engineering, e-ISSN: 2278-1684, p-ISSN: 2320-334X, Volume 12, Issue 2, (Mar – Apr. 2015).

[8]. Nirmalendhu Choudhury, Ramesh Rudrapati, Asish Bandyopadhyay, "Design Optimization of Process Parameter for TIG Welding based on Taguchi Method", International Journal of Current Engineering and Technology, e-ISSN 2277-4106, p-ISSN 2347-5161,Issue-2, February 2014.

[9]. Pavinder Singh, Rajinder Singh, "Experimental Investigation of Deposition Rate in TIG Welding of Grade 304 Stainless Steel", International Journal of Advanced Engineering Technology, e-ISSN 0976-3945, Volume 5,Issue 2,April-june 2014.

[10]. Naitik S Patel, Rahul B Patel, "A Review on Parametric Optimization of TIG Welding", International Journal of Computational Engineering Research, ISSN 2250-3005, volume 4, Issue 1, January 2014.