

# REVIEW ON THE PARAMETRIC OPTIMIZATON OF TIG WELDING.

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**Abstract** - Welding is the process to join two or more similar or dissimilar metal with the application of heat and sometime pressure. Gas Tungsten Arc Welding (GTAW) is commonly known as Tungsten Inert Gas Welding (TIG Welding).The objective of this research is to study and understand the various equipment used and the effect of welding parameters such as welding current, gas flow rate, welding speed, electrode etc. are inputs which affect the output parameters such as tensile strength, hardness of weld.

**Key Words:** TIG welding, Welding Parameters, Tensile Strength, Hardness.

## 1.INTRODUCTION

Development of TIG welding occur during the SECOND WORLD WAR around 1940.Today TIG welding is one of the mostly used welding process in the various industries like aircraft, automobile industry, steam industry, nuclear reactors, food industry, ship industry, building and bridge structure etc. The term TIG welding is short of Tungsten Inert gas welding. In other welding processes metal gets oxidized in molten state but in TIG welding due to use of Inert gas which provide shield between molten metal and atmospheric air oxidation of metal is protected.

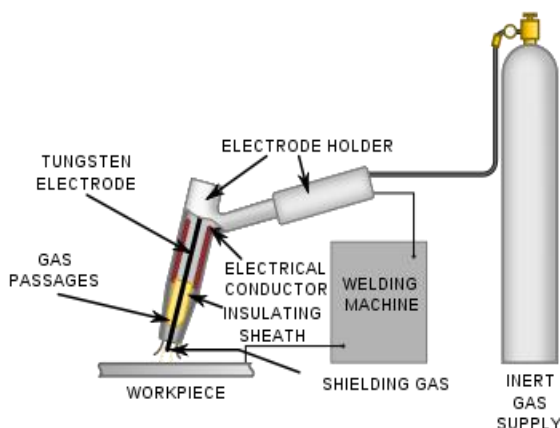


Figure 1. Diagram of TIG Welding Equipment.

## 1.1 Working of TIG Welding

A long tungsten electrode is used to produce arc between the electrode and base metal which are connected to the power supply. Since electrode is made up of tungsten so it is non-consumable though filler metal may or may not be used depending upon base metal. As the arc produce the metal started melting forming weld pool. However for the protection of weld formed from atmospheric air the inert gases like Helium, Argon or mixture of Helium-Argon is used to eliminate the possibility of weld contamination. The above figure also describes the same process of TIG welding.

## 1.2 Polarities

There are three types of polarities used for TIG welding.

- DCSP (Direct Current Straight Polarity):- In this tungsten electrode is attached to negative (-) terminal and work piece is attached to positive (+) terminal of power supply. It is used for deep penetration as 2/3 heat is at the work piece and 1/3 heat is at the tungsten electrode. Thus resulting weld will have good penetration and narrow profile.
- DCRP (Direct Current Reverse Polarity):- In this tungsten electrode is connected to positive(+) terminal and the work piece is connected to negative (-) terminal. It gives more heat on tungsten due to which tungsten electrode get over heated sometime burn away. This type of connection is very rarely used.
- ACHF (Alternating Current High Frequency) or AC (Alternating Current):- The heat input to the tungsten is average at both electrode and work piece as the AC wave passes from one side to

another. It is used for welding mostly for white metals such as aluminum and magnesium.

### 1.3 Electrode used in TIG welding

There are five types of electrode which are used in TIG welding and identified with their colour.

- 1).Pure Tungsten (W) (Green Colour).
- 2).1% Thoriated Tungsten (Yellow Colour).
- 3).2% Thoriated Tungsten (Red Colour).
- 4).Striped Tungsten (Blue Colour).
- 5).Zirconium Tungsten (Brown Colour).

### 1.4. Shielding Gases Used for TIG Welding

- 1) Argon.
- 2) Helium.
- 3) Mixture of Argon and Helium.

### 1.5. Advantages

- 1).It produces no noises or very less noises.
- 2).The quality of weld produced by the TIG welding is far superior than other welding process.
- 3).Low sparks produces as very less filler metal is added.
- 4).No flux is required or added.
- 5).Smoke or fumes is not produced.
- 6).Welding can be done in all positions.
- 7).Especially good for welding thin sections.

## 2.LITERATURE REVIEW

Sanjeev Gupta.2016[1] performed the experiment to optimize the condition for performing the welding on Utra-90 specimen in which he varies the current and voltage while keeping the gas flow rate constant and observed that welding joint not made properly below 50A and above 200A since then burning of specimen stated. Ravinder & S.K.Jarial [2016] studied the Parametric Optimization of TIG welding on stainless steel (202) and mild steel by using Taguchi method and found the control factor which had varying effect on the tensile strength, arc voltage having the highest effect and also found the optimum parameter for tensile strength current 80 A, Arc voltage 30 V and GFR 6 lt/min.

Dr.Simhachalam et al.[2015] carried on the effect of welding process parameters on the mechanical properties of stainless steel -316 (18Cr-8Ni) welded by TIG welding. The specimen size is 40x15x5mm for experimentation observed that the welding current has a significant effect though filler rod do have some effect similar to current but compared to current it is less significant. MINITAB software is used for

the prediction of the hardness, impact strength, depth of penetrations.

R.Ramchandran [2015] studied the various effect of the TIG welding on the Austenitic stainless steel 316L on micro structural changes through destructive and nondestructive method and various parameters such as tensile strength, hardness on varying the current, voltage and gas flow ratio respectively.

S.M.Ravi Kumar and DR.P.Vijian [2014] studied the weld bead geometry in shielded metal arc welding and that is of multiple performance characteristics into the optimization of the single performance characteristics called grey relational analysis and found the process parameters of welding current 140 A, welding speed 4 mm/sec and wind velocity 7m/s. Also found by ANOVA heat the most significant welding process parameter (47.71%) followed by welding speed (30.40%) and wind velocity (19.54%) respectively.

S.R.Patil and C.A.Waghmare [2013] carried out the welding parameter like current, voltage, speed on ultimate tensile strength (UTS) of AISI1030 mild steel material during welding. Taguchi method is used, an orthogonal array, signal to noise ratio and analysis of variance (ANOVA) are employed to study.

## 3. CONCLUSIONS

This paper gives the idea of the working of the TIG welding and from above literature reviews it is clear that various work have been done on TIG welding to study and optimized the welding output such as tensile strength, hardness of weld etc. on varying the input parameter such as welding current, voltage, gas flow, welding speed etc. TIG welding has been carried out on various material similar as well as dissimilar materials.

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