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Effects of Welding Parameters on TIG Welding

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***Abstract* - In order to enhance the welding quality of Aluminum (Al) plate, the TIG welding system which operates automatically was developed, by what welding pace might be managed throughout the welding process. There are 2 phases were implemented for the welding of Al plate. At the initial stage of welding, individual aspect welding is done over Al plate and throughout second Phase all edge welding done for Al plate by altering various welding details. The impact of welding speed, as well as welding up on tensile sturdiness of weld joint, continues to be examined for equally kind of weld joint. The micro-hardness value of welded zone continues to be assessed at the cross area to recognize the switch in the mechanical properties of welded zone.**

***Keywords*- Automated TIG Welding System, Microhardness Test, Tensile Test**

I. INTRODUCTION

Welding is a joining procedure utilized to join various components forever such as metals, amalgams of metals or the plastics collectively at their reaching surfaces by use of warmth or weight. Welding capacity of materials relies upon several components including the metallurgical modifications which arise during welding procedure, change in hardness in welding zone due to fast cementing, amount of oxidation because of the response of materials with oxygen or different gases present in the climate and propensity of break arrangement in the welded zone. Several welding processes have been defined in [1]. But in this work, Tungsten Inert Gas (TIG) welding has been taken into account. Working and characteristics have been discussed by the authors in [2-4]. A robotized TIG welding system was rendered in this work to conduct 3 mm aluminum plate welding. Aluminum plate welding was completed by adjusting the welding current along with welding speed to achieve a high performance jointly. The effect of speed of welding as well as the current connection on the elastic nature of weld joint is that the macrostructure of the joint along with the miniaturized scale hardness of the pool of weld is broken down. Sanjeev Kumar et. al [5] tried his hands to examine welding on plates having higher thickness by the process of TIG welding. The procedure of pulsed Tungsten Inert Gas Welding was involved for plates of aluminum having a thickness of 3mm to 5mm and the rate of current was in limits of 48 An to 112 An, with steam rate of gas ranging between 7 l/min to 15 l/min. Indira Rani et.al [6] observed the materials that are mechanical 1 1of 1the 1weldments 1during the welding process on AA6351 during the welding process of GTAW/TIG with a beat and non-beat current at, unlike frequencies. Ahmed Khalid Hussain et. al [7] observed the effect of speed of "welding on the firmness of joint welded by process of TIG welding having Aluminum compound of AA6351 label and thickness of 4 mm. With the help of a tractable testing machine, the sturdiness of joint welded had been tested. Tseng et. al [8] examined the outcome of the triggered TIG procedure on delta ferrite material, angular distortion, weld morphology as well as hardness of 316 L stainless steel by employing various flux as TiO_2, MnO_2, MoO_3, Al2O3, and SiO_2. Naranget. al [9] done welding of the steel plates that are very basic and have a varied thickness along with the rate of welding 15-45 mm/sec, and the welding current ranges from 55 to 95 An. Karunakaranet. al [10] done TIG welding of the AISI 304L hardened steel. He observes the profiles of the weld dabs for the setting of the beat current and also for the steady present. Raveendra et. al [11] performed the test to see the effects of the beat current on the attributes of weldments by GTAW. For the purpose of welding 304 treated steel of the thickness 3 mm with the welding current rating of the order 80 A to 83, A along with the bend travel speed in between the range of 700 to 1230 mm/min is used. Sakthivel et.al [12] considered “killjoy crack conduct of 3 mm thick 316L austenitic tempered steel weld joints created by single-pass enacted TIG and multi-pass ordinary TIG welding forms. Welding was finished by utilizing the current in the scope of 160-280 An, and welding rate of 80-120 mm/min. Norman et. Al [13] had research on the structures that are in micros of autogenous TIG-welded composite of aluminum, magnesium, copper, and manganese in order to find out the wide scope under various conditions of the welding. Song et. al [14] joins the unique metal AISI 321 along with 2A06 aluminum compound which is being treated with the steel having a thickness of around 3mm with the use of the technique of TIG welding encompasses various materials of filing. Wang et. al [15] take into consideration the various impacts of the parameters of procedure of the TIG welding of the bend on the structure in the size of micros, the property of being converted into the sheets along with the breakage of the joints welded with the super combination of nickel base. As a result of the experiment, the heat data increases with rising welding current along with lowering of welding rate. Kumar and Sundarrajan [16] experimented with TIG welding of AA5456 aluminum having dimension 2.14 mm with the current of welding ranges from 40 A to 90 A along with the velocity of welding of between 210 mm/min to 230mm/min. Akbar Mousavi et.al [17] investigated the impact of geometry designs on the remaining pressure circulations in TIG weld from procrastinated data as well as compare with and data acquired by X-Ray diffraction technique. Ahmet Turgut et.al [18] observed various effects of the hydrogen as the gas for protecting in argon in the process of TIG welding of hardened steel valuing 316L.

II. EXPERIMENTAL WORK AND METHODOLOGY

A) Development of an automated TIG welding system

In-house mechanized welding arrangements have been established for legitimate welding, together with the control of the welding parameters for the most part on the speed of the welding.The computerized welding arrangement along with the principle segments has shown in fig.1. The arrangement of the welding mainly consists of speed control unit (movable tractor), Rail tracks, TIG welding torch, TIG welding machine, Gas cylinder, Work holding table.

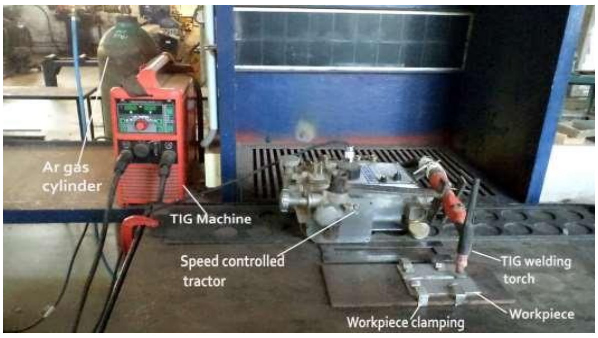

Fig.1. TIG Arrangement

B) Experimental Procedure

Experimentation was carried out in two phases for this work. With variant current ratings and the speed of the welding, the butt welding of the plate of the aluminium having thickness around 2.5mm is done at one side in the first phase while in the second phase butt welding of the plate is performed on both the sides in the same way at different current rating and the different speed of the welding. For the purpose of the present study workpiece of the business aluminium plate having a thickness of the order of 3mm is chosen. With the help of the band-saw this plate is cut into the plate having dimensions 120mm x 50 mm and after that for smoothing the surface which is to be joined pounding is performed. Subsequently, with the usage of the emery paper, the surface is cleaned to remove the irrelevant material attached from the outside. In the test TIG welding with the Alternate Current (AC) is utilized because it packs the warmth in the region of the welding. For the purpose of analysis, Zirconium tungsten anodes with a distance across 3.4 mm were taken as cathode. Table I represents the welding parameters used for the primary period of the analysis. Before playing out the real analyze various preliminary tests have to be conducted so as to get the suitable parameter to go where welding could be possible and no visual imperfections such as undermining as well as porosity happened.

Table I
Various Parameters for Experiments during Welding

Welding current	Voltage	Dimension	Speed
(100-140) A	55 v	125mm× 55mm×3mm	(3.5-4) mm/s

III. RESULT ANALYSIS

Welding width was estimated for each of an epitome as well as the normal welding width was determined as shown in table II. At that point, the usual profit of the welding width plotted against related welding current for various welding speeds which are visualized in Fig. 2. It is found from the plot that the increase in the welding width is linear with the welding current.

Table II
Weld Width

Sample No.	Reading 1 (mm)	Reading 2 (mm)	Reading 3 (mm)	Average width (mm)
1)	5.44	4.86	4.54	4.94
2)	7.36	6.85	7.24	7.15
3)	8.92	7.58	7.2	7.90
4)	7.22	7.84	7.82	7.626
5)	10.92	10.4	10.09	10.47
6)	5.03	5.12	4.98	5.042
7)	5.5	5.88	5.99	5.79
8)	8.58	8.06	7.84	8.16
9)	9.28	8.07	8.25	8.54
10)	9.11	10.08	8.58	9.256"

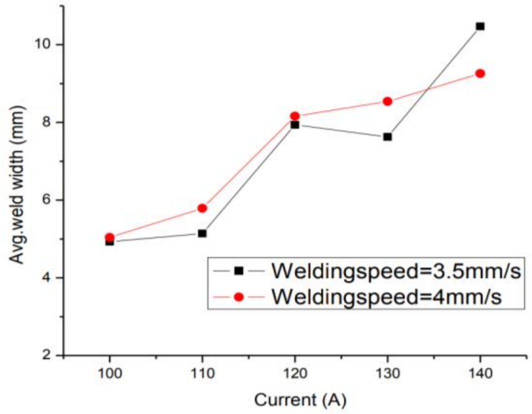

Fig 2. Welding width of a sample with different welding speed and different welding current condition

It is observed from the fig. 3 that the elasticity of the joint welded is much lower when the welding of the joint has been done with the speed of welding 4 mm/s in comparison to that of with the speed of around 3.5 mm/s at the existing setting of 120 amperes.

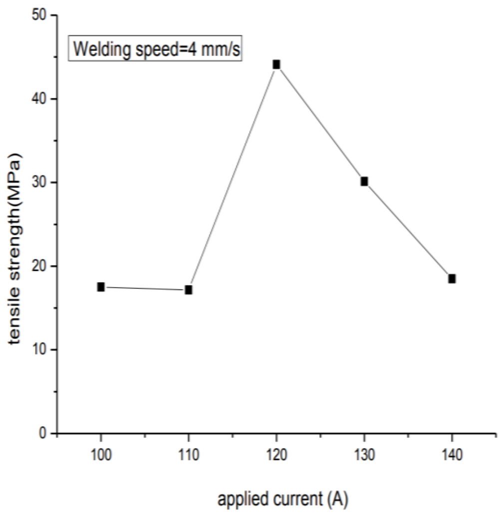

Fig.3. Tensile Strength of welded joint against applied current for welding speed of 4mm/sec.

IV. CONCLUSIONS

The below mention points are concluded from the welding of Aluminium plate by tungsten inert gas welding:

(a) There is a possibility that the welding of analuminium plate is uniform with the usage of the automated welding equipment.
(b) Various constraintslikewelding speed, welding current &many more decide the tensile strength of joint welded.
(c) The weld strength increases if the current increases during the process of welding.
(d) With the change of weld centre the solidity of the weld variants because of variations of microstructure
(e) As the welding strength is more with the high intensity of the current, hence at the low welding speed, welding strength is high

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