Parametric Analysis of MIG Welding To Find The Welding Strength of Butt Joint

Radhakishan Kharwar[1], Asif Ahmad[2]
[1, 2] Dept of Mechanical Engineering
[1, 2] Shri Ram Murti Smarak College of Engg. &Technology, Lucknow, India

Abstract- *Metal Inert Gas (MIG) welding is the most popular gas shielding arc welding process used in many industrial fields. The material use for this purpose is mild steel having dimension (300mm×50mm×5mm). This paper is to evaluate the optimize tensile strength of butt weld joint. The welding speed, welding current, welding voltage are chosen as welding parameter. The distance between plate and torch's nozzle is fixed in this experiment. Strength of work piece was measured after the welding operation is over on close butt joint. The tensile strength after the effect of welding speed, welding current welding voltage are measured in Universal Testing Machine (UTM).*

Keywords- Metal inert Gas welding, Shielding gas, welding speed, welding voltage, welding current, torch angle.

I. INTRODUCTION

Welding is the process which is in full force used by most of industry now a day. As welding have enormous advantageous so its demand is continuously increasing to join two dissimilar metals. The Gas Metal Arc Welding (GMAW) process is also termed as MIG or MAG Welding. The Metal Inert Gas is abbreviate as MIG & Metal Active Gas is abbreviate as MAG Welding. In MIG welding process the arc is maintained between an electrode wire (consumable) and the job (work piece) in an inert gas atmosphere[1].It is used as a heat source which melts the electrode and thus supplies the filler metal to the joint. The essential feature of MIG Welding is the small diameter of electrode wire of 0.8mm-1.7mm which is fed continuously into the arc from a coil. As a result, this process can produce quick and neat weld over a wide range of joint. MIGwelding is a commonly used high deposition rate welding process. It is simple technique and easy to learn and use. The Primary purpose of the shielding gas in the MIG process is to protect the molten weld metal and heat affected zone from oxidation and other contamination by atmosphere. Now a day most of the welding is done by different arc welding processes. Therefore, it is essential to investigate the effects of welding parameters on strength of the weld joint of the materials. Mild steel is the most common steel that are acceptable for many applications in many industries.

II. METAL INTER GAS WELDING

The Gas Metal Arc Welding (GMAW) is also known as Metal Inert Gas (MIG) Welding.MIG welding is method of welding in which metal filler wire is used to supllies the electric cureent to maintain the arc, which is shielded from the access of air by an inert gas[2]. Most metals can be welded with this process and may be welded in all positions with the lower energy variations of the process. It is economical process that is not require cleaning of weld deposite. GMAW is a welding process which include automatic feeding of continuous consumable electrode wire[9]. The Shielding gas protect the weld area from atmospheric contamination by inert gas. A constant-current welding power supply produces energy which is conducted across the arc through a column of highly ionized gas and metal vapours known as a plasma.

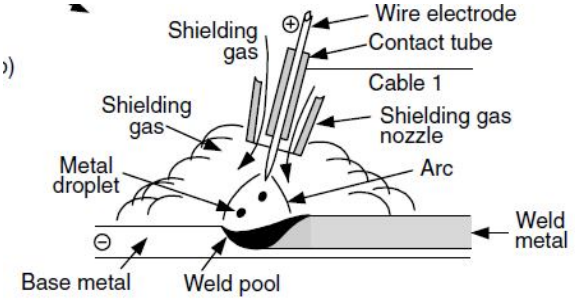

Fig. 1 MIG Welding Process[2]

III. WELDING TOURCH

GMAW welding torch are designed for manual operation or automatic operation. In general welding torch equipped with water cooled or air cooled. Air cooled welding torch are used for welding ordinary mild steel at higher current intensities and for all materials at low current intensities [4]. The power supply and hoses to the shielding gas source are connected with the torch by cables.

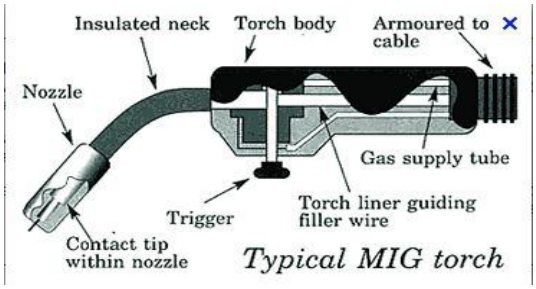

Fig.2 Typical MIG Torch [4]

IV. POWER SOURCE

A constant voltage direct current power source is most commonly used with GMAW but constant current system as well as alternating current can be used [5]. Direct Current Reverse Polarity (DCRP) system is used to weld the work piece [6]. In this welding process power source are used of mainly of two types Stationary Power Source and portable Power Source. During welding relatively constant voltage provided to the arc by MIG power source. When there is a radical change in wire feed rate the power supply change quickly increase or decrease the current depending on change in the arc length.

V. SHIELDING GAS

Various mixture was available at this complicated area. In MIG welding, the elementary purpose of shielding gas is to protect the molten weld pool and heat affected zone from oxidation and contamination by the atmosphere [11].

VI. PROCESS VARIABLES IN MIG WELDING

a. Wire feed rate
b. Welding Speed
c. Electrode Wire Diameter
d. Polarity (DCRP/DCSP)
e. Current
f. Voltage

VII. EXPERIMENTAL PROCEDURE

The Experimental data obtain from MIG welding experiment in which parameter were precisely controlled and strength measured. Mild steel work piece is used for experiment because it is most common form of steel used in many application. It contain 0.15% to 0.29% of carbon. The first step is to prepare the specimen of dimension 300mm×50mm×5mm. Then after V-groove was made of 45º bevel angle. This V- groove was filled by filler metal during welding. The Shielding gas is pure CO2.The Metal Inert Gas Welding machine are equipped with gas cylinder, torch(gun),power supply unit, wire feeder etc. as shown in figure

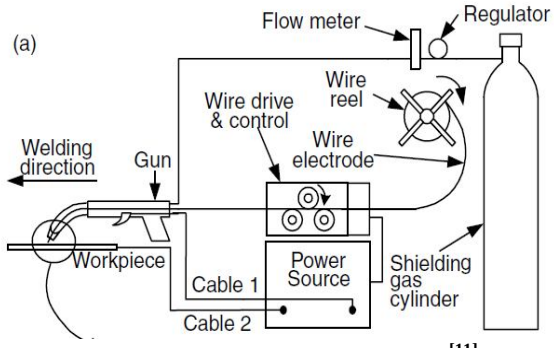

Fig. 3 MIG Welding Station Setup [11]

For testing the strength of weld bead Universal Testing Machine (UTM) is used, as the name indicate it is used for testing tensile as well as compressive strength as per desire. The work piece to be tested on UTM machine after welding get ruptured from three different position under different applied load.

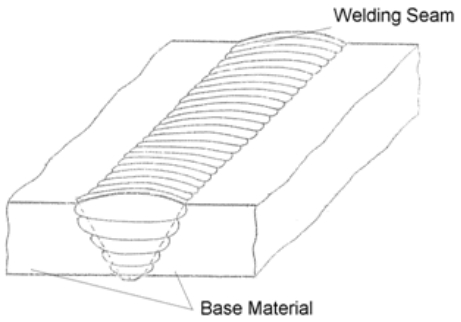

Fig.4 Weld Joint after Welding [10]

VIII. PERFORMED EXPERIMENT DATA

TABLE- 1 Strength on Different Welding parameter

Sl No.	Current (A)	Voltage (V)	Wire Feed Rate (inch/sec)	Strength (KN/m²)
1	70	23	5	40
2	120	21	6	96.16
3	140	20	7	110.4

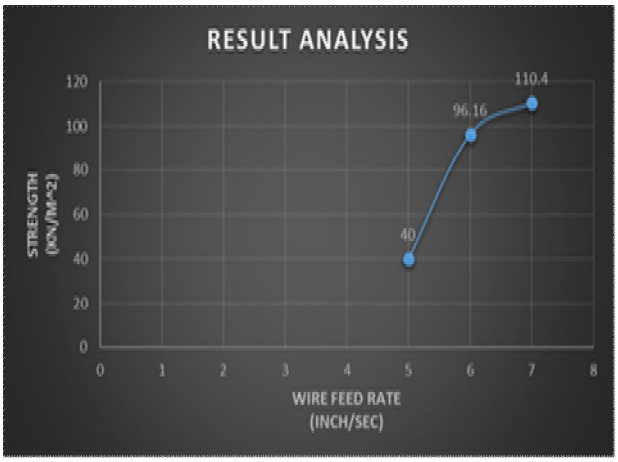

Fig.5 Strength Vs Wire Feed Rate

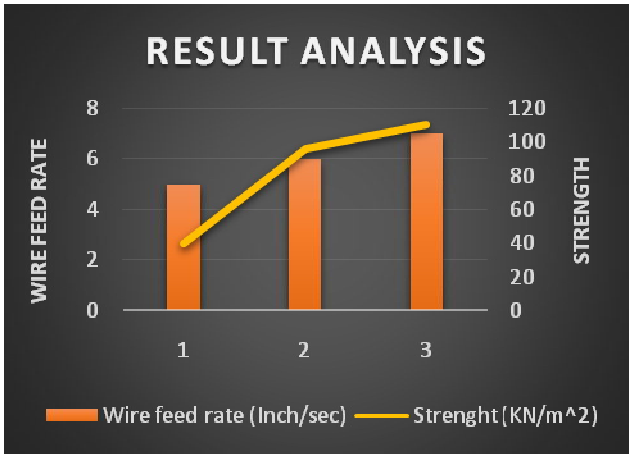

Fig.6 Show variation in strength under different feed rate

After the experiment the specification of each of the work piece under different load are as below table.

TABLE-2 Comparison in Change in Value before and after the Experiment.

	A		B		C	
	X	Y	X	Y	X	Y
Length(mm)	300	300	300	310.5	300	326.5
Width(mm)	50	50	50	48.3	50	47.8
Thickness(mm)	05	05	05	04.9	05	04.8
Strength(KN/m²)	40		96.16		110.4	

Where, X= Vale before the experiment, and
Y= Value after the experiment.

A, B and C are the three specimens which is used for the experiment.

Fig-7 Show the Specimen after welding & after testing

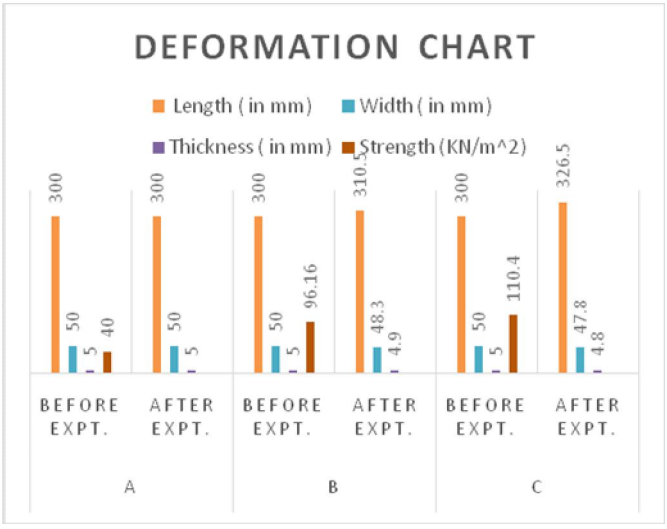

Fig-8 Bar chart compare the change in value before and after test.

IX. RESULTS

The work piece were prepared successfully at feed-rate of 5, 6 & 7 inch; voltage of 23, 21& 20 and current of 70, 120, & 140. The distance between the welding torch and work piece keep constant. The above experimental data show that welding strength depend upon welding parameter viz welding current, voltage, feed rate of electrode, speed etc. The variation in parameter affect the metal deposition rate or we can say the weld bead structure. The slow feed rate and low current result in weak weld joint whereas high current flow and feed rate result in strong weld joint. The feed rate of 7 inch result strongest weld joint mean weld bead has capacity to bear the maximum stress. Metal deposition rate is also high due to increase in current which provide good joint. Current and Voltage is inverse to itself so we conclude that higher the value of current and feed rate of electrode wire and lower value of voltage result in strong weld joint or maximum strength.

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