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Study and Comparison of Gas Metal Arc Welding & Gas Tungsten Arc Welding on Aluminium.

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Abstract - *In this revision work, we mainly focus on the study of the welding methodology GTAW, GMAW and its benefits, limitations and applications, therefore the comparison based on deposition rate, welding positions and the costing of the process.*

Keywords: *GTAW, GMAW, 5059-H321 Aluminium, Welding*

I. INTRODUCTION

The project is to study the variation of the properties of aluminium material grade 5059-H321. We will realize the GTAW and GMAW welding in 5059-H321 aluminium. The samples are prepared in accordance with the ASME codes. All welding samples must test tensile strength, hardness, microstructural changes, chemical composition and DPT for crack identification. In this review document, our main objective is the observation of welding technologies. We are studying what kind of welding rods, filler material, protective gas and flow have been used. We are studying the factor that influences the selection of the welding procedure.

Welding is the process of permanent bonding of similar or different metals with or without the application of heat and pressure.

These are the various factors that influence the selection of the welding process are listed below,
- Metal: thickness, melting point, thermal expansion
- Availability of consumables
- Terms of Service
- Precision required
- Economy

II. INTRODUCTION TO GMAW WELDING

This procedure is essentially based on the principle of developing from welding contact surfaces with the help of melting base metal with the heat produced by a welding arc established between the base metal and a consumable electrode. The welding arc and welding bath are well protected by an inert gas stream coming out of the nozzle and forming a shell around the arc and welding. GMAW welding is not considered as clean as GTAW welding. The difference in GMAW welding for cleaning and GTAW products is mainly attributed to the variation in the effectiveness of the shielding gas to protect the welding in the case of these two

welding processes. The shielding effectiveness of the two processes is mainly determined by two characteristics of arc welding, ie the arc welding stability and length arc and other welding related, such as the type of protection gas, a protective gas flow rate, the distance between the nozzle and the price of the working parameters. The GMAW arc is relatively higher and less stable than the GTAW arc. The difference in strength of the two welding edges is mainly due to the fact that the GMAW arc is established between the base metal and the consumption electrode(which is consumed continuously during welding) while the GTAW arc welding established between the electrode of the base the metal and tungsten not consumable. Consumption of the welding electrode during welding slightly reduce the stability of the arc. Therefore, shielding of the welding assembly in GMAW is not as effective as in GTAW.

The important elements of GMAW welding are,

1) Soldering coil
2) Protection gas
3) Welding Torch
4) base material
5) Source of welding
6) Consumption electrode.

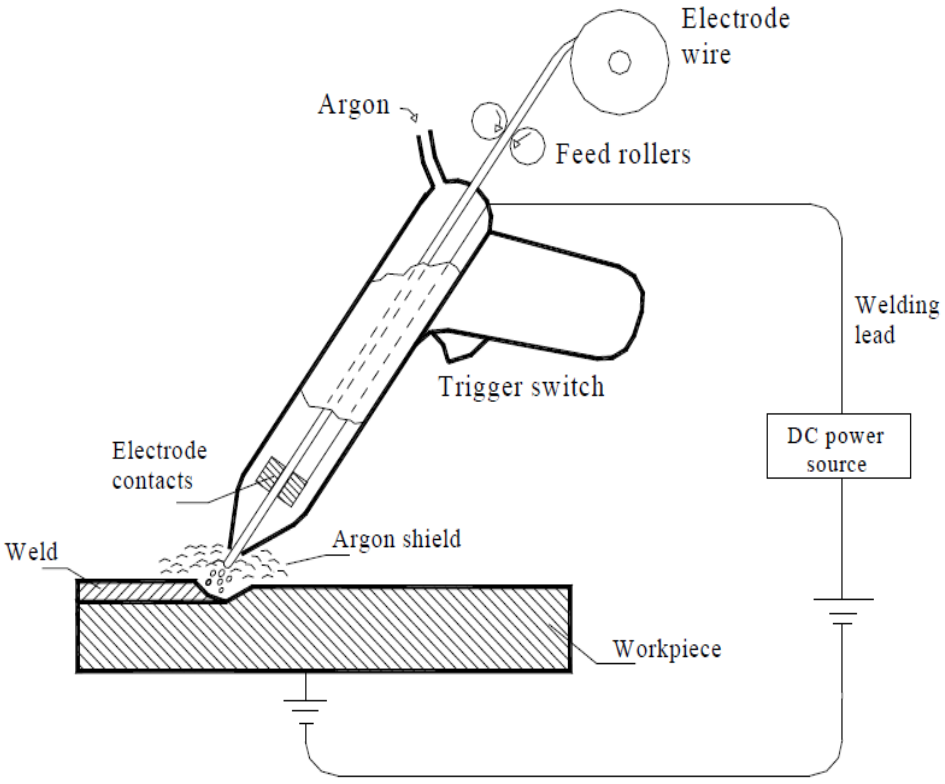

Fig. 1: Gas Metal Arc Welding Setup

A. Application

- Used for welding of stainless steels, aluminium, magnesium, Cu and Ni alloys in the aeronautics and automotive industries.
- By increasing the current, we can increase the penetration depth and we can also weld thick material.

B. Benefits

- The only consumer electrode process that can be used to weld most metals and commercial alloys.
- The deposit rate is higher than that obtained in SMAW.
- Minimum cleaning is required after welding due to the absence of slag.

C. Limitation

- DCSP will cause the unstable bow that produces large sketches.
- Welding equipment is more complex, more expensive and less portable than SMAW.
- The welding arc must be protected from the air currents that would disperse the protective gas.

III. EFFECT OF WELDING CURRENT ON ELECTRODE EXTENTION

Bonding of the electrode affects the penetration of the welding seam and the deposition rate of the metal because it changes the electrode heating due to the electrical resistance. If the arc length increases, the penetration decreases and if we increase the current, the electrode extension decreases and if the welding current decreases, the electrode extension must be increased. It is described in fig,

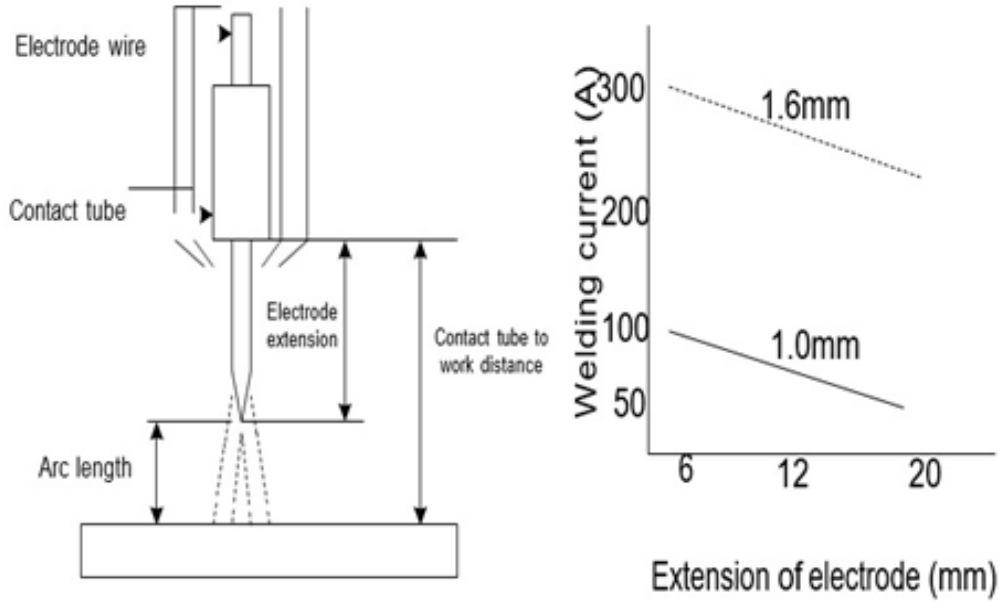

Fig. 2: diagram -a) electrode extension and b) effect of electrode extension on welding current for different electrode diameters

IV.INTRODUCTION OF TUNGSTEN INERT GAS WELDING

The tungsten inert gas welding process also called arc welding of tungsten gas is so called because it uses the following main components:

-The electrode composed mainly of tungsten
-Gas mirror to protect the welding bath to prevent contamination by atmospheric gases, especially when joining high strength reactive metals and alloys such as stainless steel, aluminium and magnesium alloys, where it is necessary to develop welding joints of high quality for critical applications such as nuclear reactors, aircraft, etc.

An important difference between the welding of steel and the GTAW welding of aluminium is the oxide film applied to the surface of aluminium which influences the behaviour of welding and has to do with this.

An invention of this process in the mid-twentieth century gave a great boost to the producers of these reactive metals because none of the processes available (SMAW welding and gas) at that time was able to successfully weld them mainly due to two limitations
a) Pollution of welding of atmospheric gases e
b) Poor control on the input of heat required for the melt. Furthermore, the welding of aluminium and its alloys with a protected SMAW (Shielded metal arc welding) process can be performed using electrodes coated with halide flow, overcoming the difficulties associated with Al2O3. however, the halides are very corrosive and therefore the welding of the aluminium is preferably carried out using Inert shield environment with the flow of processes such as GTAW and GMAW.

Despite numerous developments in the welding field, the GTAW process is always recommended for joining thin sheets of aluminium with a thickness of less than 1 mm.

The important elements of GTAW welding are,
1) tungsten electrode
2) Filler rod
3) protection gas
4) Supply of inert gas
5) contact tube

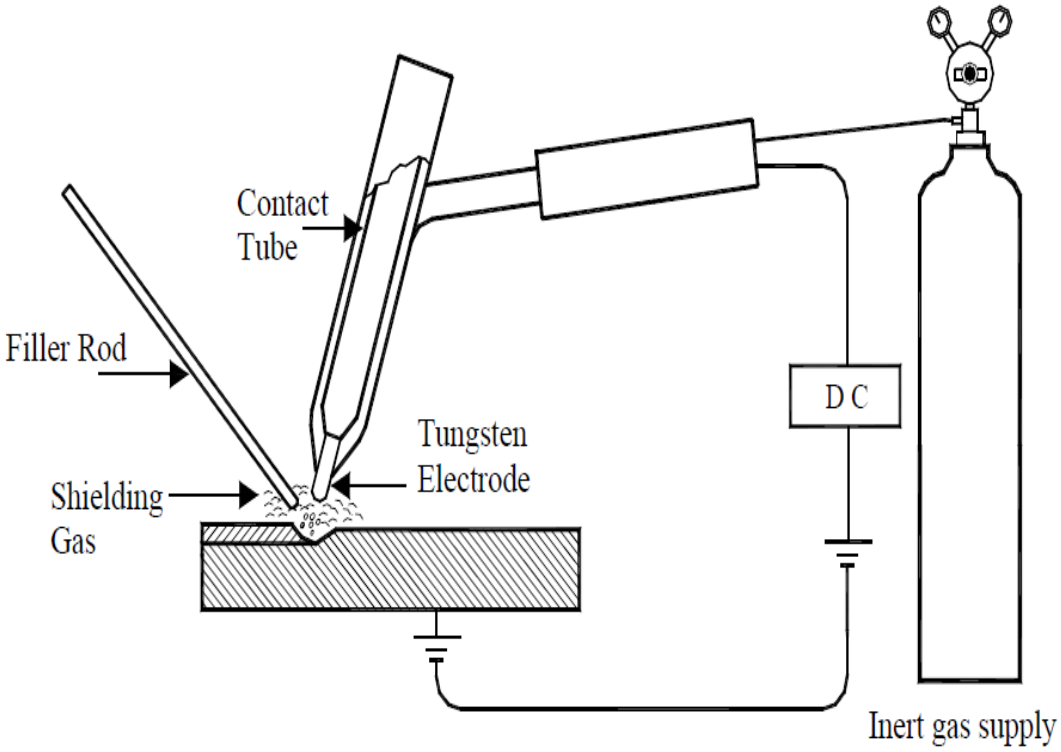

Fig. 3:Gas Tungsten Arc Welding Process

A. Application

- The GTAW welding is used to combine a wide range of metals. It can weld aluminium, magnesium, copper, nickel, etc. and its alloys
- GTAW can be used for welding in any flat, horizontal, vertical position, high position.
- It has been used when quality is critical. Forexample, Pipes, ships, aerospace industry.

B. Benefits

- Non-consumable electrodes
- High quality and robust welds made by GTAW.
- They are suitable for welding very thin sections.
- Joints Non-corrosive and ductile seals.

C. Limitation

- GTAW is a time-consuming process. They are slower than any other welding process. Lower deposit rate of the filler.
- More complicated: highly skilled and trained workers are required to performGTAW welding.
- Safety Issue: Workers are exposed to the high intensity of light that can damage the eye.
- High initial cost. Can not be used on a thicker plate

V. COMPARISON OF GTAW & GMAW

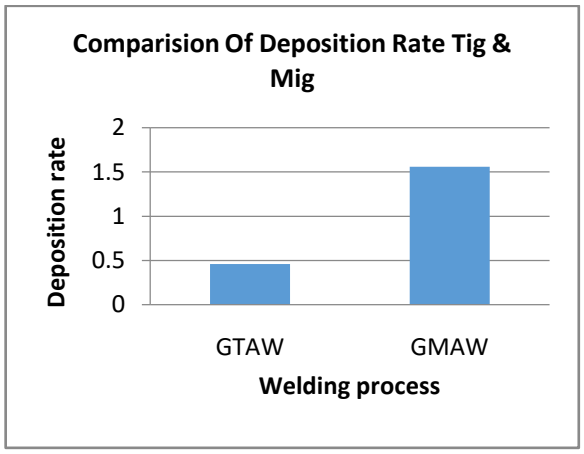

Fig. 4: From the above chart , its clearly shows that the deposition rate is low in GTAW.

Welding	Welding Positions			
	H	V	OH	F
GTAW	X	X	X	X
GMAW	X	X	-	-

Table 1: from the table, we get to know that GTAW is applicable in all welding position.

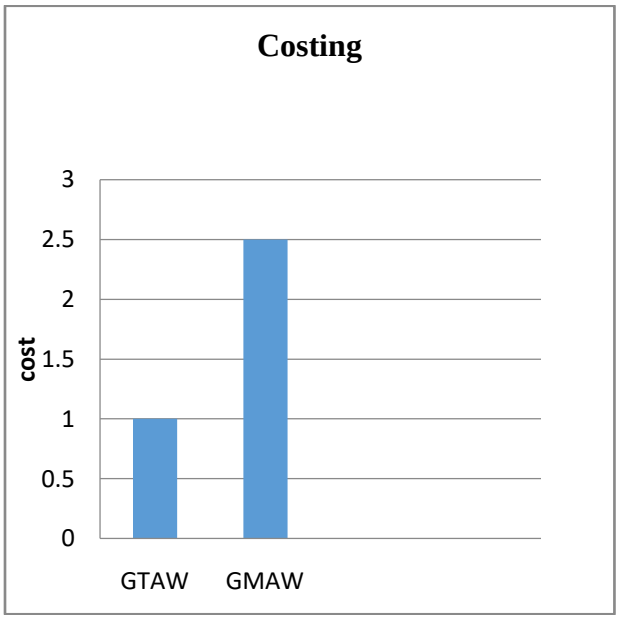

Fig. 5: From the above chart, we get to know that costing of machines of GTAW & GMAW Process.

VI. CONCLUSION

We have studied the GTAW & GMAW process. We differentiate & compare both the processes on different parameters.

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