

A review on “Effect of welding parameters on mechanical properties for Aluminum alloys using MIG welding”

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Abstract - Welding is the manufacturing method, which is carried out by joining two similar and dissimilar metals. One of the method is Metal inert gas (MIG) welding, in which argon, helium Co₂ are used as shielding gas. MIG welding is versatile and having less loss of alloying elements and can be operated as semi automatic and fully automatic welding. We studied input parameters of welding such as welding current, arc voltage, welding speed and output parameter are hardness, tensile strength, impact energy, and microstructure. We considered aluminum alloys which widely used in marine, aerospace, pipe industries etc. Aluminium alloys are light in weight comparably less density with better mechanical properties with mild steel .So we considered Aluminum alloys for study.

Keywords – MIG welding, Parameters of welding, mechanical properties, Shielding gas, non consumable Electrode

I. INTRODUCTION

The traditional method of joining mechanical components in structural applications through fasteners, rivet joints etc .These methods can be replaced by welding process in considerable reducing time for manufacturing, weight reduction and improvement in mechanical properties. The process is finds to be more efficient, economical and dependable.

As per American Welding Society (AWS)

Welding is a process of joining of two similar and non similar metals through coalescence resulting from a suitable combination of temperature, pressure and metallurgical conditions using filler material

1.1 Various methods of welding processes

- Arc Welding
- Gas Welding
- Resistance welding
- Solid state welding
- Fusion welding

- MIG welding
- TIG welding
- FSW welding

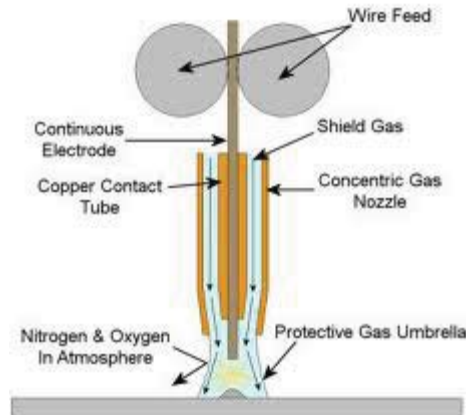


Figure 1 Working principle of MIG welding

In gas metal arc welding an arc is generated between solid or flux cored wire electrodes and the base metal along with the protected shielding gas or gas mixture around a welding spot. The shielding gas protects from contaminated atmosphere which is going to increase properties of weld bed. This process is also known as CO₂ welding, metal active gas (MAG) welding or metal inert gas (MIG) welding. Sometimes a mixture of Ar + CO₂ gas mixture is used. The wire electrode is fed through the rollers which are acting like guides. The variable rate of electrode wire supply can be done.

1.2 Advantages of mig weelding

- Weld bead is free from contaminated atmosphere which could vary the properties of weld metal
- There is no formation of slag since no flux is used
- It produces high quality weld and almost clean weld zone
- No possibility of crack and more economical

1.3 Disadvantages of mig welding

- Surface of weld metal to be welded must be free from oil, paint or rust because inert gas may react with these materials and create impurity in the welded zone
- Maintaining gas flow rate at constant pressure is difficult
- Welding equipment is costly, more complicated, less portable and skilled labor is required

II. LITERATURE SURVEY

Many investigators have suggested various methods to explain the process parameters affecting the mechanical properties of weld metal of aluminum alloys.

Sivashanmugam M, Manoharan N, Anantha padmanaban D, Ravikumar .S[1] was worked on Aluminum alloy 7075 by the process of GTAW using argon as metal inert gas and Tungsten was used as electrode. The Butt joint was made of 300 x 150mm using 99.99% argon as a shielding gas .The parameters considered for investigation are tensile strength, hardness and impact test. The tensile strength get decreased with respect to parent metal. Hardness is get increased at weld metal. From impact load it was found that absorption of energy is less from charpy & Izod test

I .O.Oladele Msc, J.A Omotoyimbo Phd,B.O.Adewuyi Phd[2] worked on Wrought (6063) aluminum alloy for investigation using MIG welding .The current and voltage is used as parameters current and voltage on microstructure, tensile strength, toughness and impact strength. Since in arc welding is directly related voltage and current, the two conditions are applied i.e. at constant voltage the current was $I_1=75A$ & $I_2=100A$ and at constant current the welding voltage was varied as $V_1=25V$ & $V_2=30V$.Tensile strength is more when current is at 100A.Toughness property is found to be good at $V_1=25V$ and other are nearer to it. Hardness is more at $I_1=75A$ & at $V_2=30V$.The micro structure of $I_1= 75A$ shows that the constant Mg_2Si precipitation surrounding aluminum matrix led to fine particles are more responsible for high ultimate tensile strength & Hardness. From this it can be concluded that as current get increased heat input get increases & leads to better fusion of grains which give best possible mechanical properties (Ultimate tensile strength & hardness) and Change in current or voltage doesn't effect more on impact strength

A.R.Yazdipour, A shafiei M ,H. Jamshidi Aval[3] Aluminum alloy 5083 is used as investigating material and welding methods used are MIG and FSW. The parameters considered are microstructure and mechanical properties The MIG welding was carried at different speed, with varying wire feed diameter .The voltage, current and heat input also varied FSW carried using H13 steel tool .The microstructure by FSW was found to be less porosity, good quality weld, fine equiaxed and recrystallized grain comparing with MIG welding . The microstructures get varied at different zones of welded joint. But Hardness was found to be more in FSW samples with irrespective of weld zones. In MIG welding it was found that formation of dendrites during solidification decreases hardness. Tensile strength greater in FSW comparing to MIG welding

Abbasi..K, Alam S Khan .M.J[4] MIG is carried on 144mm long x 31mm wide & 10mm thick bright drawn, mild steel .Increase in pressure of shielding gas is studied through variation of welding parameters like feed rate and arc voltage on penetration. The vessel was pressurized with argon-carbon dioxide mixture to an absolute pressure of 7, 14, 29, 58, 115, & 230bars.The metal transfer modes were controlled by changing the wire feed rates in the range of 3.81m/Min to 6.1mm/min. The result was found that along with increase in pressure the arc voltage must be increased in order to get good weld bead. Higher the pressure, density of fumes gets increases. MIG welding can be carried up to pressure of gas 230bar

Rajesh P Verna ,K.N Pandey [5] Investigation of fatigue property was done on aluminum alloy 6061 – T_6 and 5083-0 aluminum alloy by welding through manual arc welding and metal inert gas welding .In order to check fatigue two type of loads was taken i.e. constant amplitude loading and with one intermediated single overload (OC) by adopting block loading Method. The dimension of materials was taken 250 x 1000 x 8mm.Fatigue crack was initiated in the HAZ and fails in case of MIG welding .And in Metal arc welding specimen fails at weld region. Fatigue life of 5083-0 alloy is more comparing AA6061- T_6 at same loading conditions of Manual arc welding .AA 6061- T_6 fatigue life is more in MIG welding. From this it can be concluded that composition of alloy and method of welding also affects the properties of material.

Y.Ruan,X.M.Qui,W.BGong,D.Q.Sun,Y.P.Li[6] The authors investigated on mechanical properties and microstructure of AA 6082-T6 joint welding done by twin wire metal inert gas arc welding with SiO_2 as flux The thickness of metal taken was 6mm with partially SiO_2 flux. The parameters considered are Micro hardness and tensile strength. The result showed that there is no obvious difference in microstructure with or without flux. The HAZ was found that slightly wider with flux comparing to without flux. The penetration with SiO_2 flux was about 26% deeper than that of without flux .It is mainly due to high arc temperature on twin wire MIG weld joint

Anjanaya Prasad B, Prassana P [7] The author has made comparison of mechanical properties on AA6061 by undergoing MIG and FSW processes. MIG welding produces more porosity due to solubility of hydrogen in the molten aluminum pool. The surface of MIG welding is same on both surface where it is Different in FSW .MIG welded element formed by columnar crystalline structure & FSW welded elements gives a fine microstructure at Nugget zone. And size of the weld nugget would generally be considered beneficial to the mechanical properties.

Tensile strength of welded element is less in case of both welding comparing to base metal .But FSW shows stronger than MIG. Hardness property of FSW weld metal depends upon Shoulder diameter and heat input .Hardness of heat affected zone (HAZ) of FSW is found to be narrower than the MIG welded joints.

III.CONCLUSION

From the above literature survey we find that there are much investigation is done on effect of welding parameters on mechanical properties by using MIG welding and others on aluminum alloys. But we found that there is only few research is done on mechanical properties by varying various parameters of MIG welding such as gap between metal and torch, welding speed ,angle of torch ,feed wire diameter and Gas flow rate on aluminum alloys .

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