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IMPORTANCE OF TIG WELDING SPECIFICATIONS ON ALUMINUM ALLOY JOINTS: A REVIEW

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Abstract - Aluminum is a non-magnetic, ductile metal. *It also makes its existence in the form of its alloys in which aluminum is predominant metal. Copper, magnesium, tin are the typical alloying metals. Aluminum alloys are widely used in engineering structure and manufacturing of aerospace components where light weight is required.TIG welding is a high efficiency welding technique to weld ferrous and non-ferrous metals. Generally we know that the welding of aluminum is very difficult with conventional arc welding processes. This particular work deals with the identification of the suitable combination of welding specification for TIG welding of AA7005.TIG welding set up will be used to weld 10mm thick AA7005 plate by changing the welding specifications. The effect of these specifications will be analyzed.*

Keywords- TIG welding, AA7005, Welding current, Gas flow rate, Welding speed, Tensile strength, Impact strength.

1. INTRODUCTION

Welding is the process of joining the similar or dissimilar metals or alloys with the help of pressure or heat or both the pressure and heat. The work pieces to be joined at the interface and after solidification a permanent joint can be made. Weld ability of a material depends on thermal conductivity, heat affecting zone thermal expansion of metals.TIG welding is the welding process which is mostly used for aluminum and its alloy.TIG welding process comes under the category of an arc welding process.TIG welding process is basically an arc welding process used to weld metals with non consumable tungsten electrode. The electrode is connected to a power source and a shielding gas is used to protect the welding surface from atmosphere. Generally Argon or Helium is used as shielding gas.

2. WELDING OF ALUMINUM ALLOYS

Many industries which are involved in transportation would like to reduction of mass on their product in order to fuel saving, reduction of emission. Hence the light weight materials like aluminum and magnesium came into picture. Thermal conductivity of aluminum is very high therefore heat is conducted quickly away from the welding area. It is essential for a heat source to reach instantly at aluminum's melting point of 565/650 ^{0} C.

Aluminum is a reactive metal that quickly forms an oxide layer on the surface and strength of the weld area become weak. The most usual aluminum and aluminum alloy welding methods use DC current.

TIG welding is commonly used for welding aluminum alloys. In this study aluminum alloy 7005 is selected as the base material, it comes under aluminum 7xxx series. Zinc and magnesium are the most widely used alloying elements for aluminum.AA7005 posses good welding characteristics and resistance to corrosion.

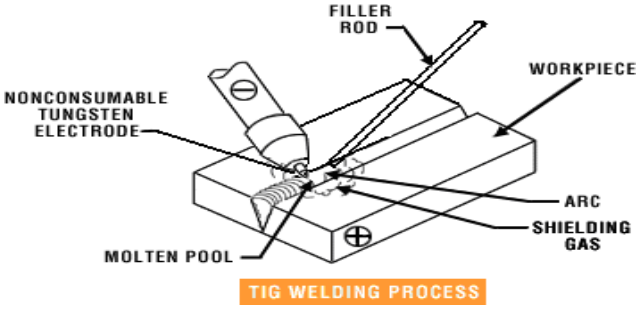

Fig -1: Schematic diagram of TIG welding

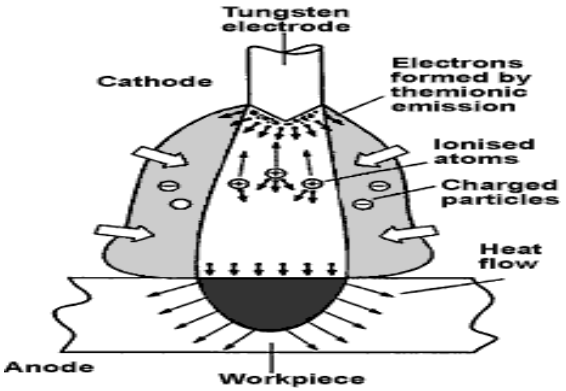

Fig -2: Mechanism of TIG welding

The physical properties of AA7005 are similar, expect higher density of 2.78 g/cm^3 than AA6061 alloy and may be little stronger depending on their temper. Zinc and magnesium are the commonly used alloy for aluminum.

These alloys are used primarily for bicycle frames, due to its relative case of welding it is extensively used in defence, aerospace and marine applications due to its high strength.

The properties of AA7005 are given below in TABLES.

TABLE -1: Chemical composition of AA7005

Al	Mn	Mg	Cr
93.3%	.45%	1.4%	.13%

TABLE -2: Physical properties of AA7005

PHASE	Solid
ATOMIC WEIGHT	26.9AMU
MELTING POINT	630^{0}C
BOILING POINT	2470^{0}C
DENSITY	2.78gm/cm^3

TABLE -3: Mechanical properties of AA7005

PROPERTIES	VALUE	CONDITION
Poisson's Ratio	2.6-2.8	25^{0}C
Elastic Modulus (GPa)	70-80	25^{0}C
Tensile Strength(MPa)	193	25^{0}C
Yield Strength (MPa)	83	25^{0}C
Elongation (%)	20	25^{0}C
Shear Strength (MPa)	140	25^{0}C

3. CONCLUSION

Tig welding of aluminum alloys and based on past work the following conclusions are drawn.

Welding speed, welding current, welding voltage, electrode diameter and electrode gap, work piece material, shielding gas etc. are important process parameters for TIG welding.

Out of the listed parameters welding current, gas flow rate and welding speed play a vital role to perform precise and uniform welding of aluminum alloys.

The range and selection of parameters depend upon type of material, strength required and specifications of welding machine used.

Welding strength and welding profile is greatly influenced by selection of welding material and welding technique.

For better strength and cleanliness in TIG welding of aluminum, AC power source is mostly preferred.

Design of experiment can be determined by Taguchi method, Response Surface Technology and full factorial design.

Minitab software is an important application for the evaluation of result.

Microstructure investigation at different zones of weldment gives a comparative outcome between TIG welding and base material to differentiate the effect of temperature distribution.

3. REFERENCES

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