Influences of TIG welding on tensile and impact behaviour of aluminium alloy joint

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ABSTRACT

Aluminium is a non-magnetic, silvery-white, ductile and soft metal which is the most abundant metal and the third most abundant element in the earth crust. It also makes its existence in the form of its alloys in which aluminium is predominant metal. Copper, magnesium, manganese, silicon, tin and zinc are the typical alloying metals. Aluminium alloys are widely used in engineering structure, components and aerospace manufacturing where light weight and corrosion resistance is required. There are no. of welding parameters which affect the welding quality for again repeatability. Different parameteric ranges & their effects are studied. In this particular study, TIG welding set up will be used to weld 10mm thick AA7005 plate by changing the welding parameters. The effect of these parameters on tensile and impact strength of welding joints will be analyzed.

Keywords- *TIG welding, AA7005, Impact strength.*

INTRODUCTION

Welding is a fastening process used to join different ferrous and non ferrous materials like metals and. It is one of the mostly used welding processes for aluminium and its alloys [1]. The work-piece to be joined are melted at the interface and after solidification a permanent joint achieved. Sometimes a filler material is added to form a weld pool of molten material which after solidification gives a strong bond between the materials. Weld ability of a material depends on melting point of metal, thermal conductivity, reactivity, thermal expansion of metals, electrical resistance and surface conditions.

TIG Welding

It uses a non consumable tungsten electrode. The electrode is connected to a required power source and shielding gas is also employed through welding gun [2]. Generally Argon or Helium is used as shielding gas to protect welding surface from atmosphere. The application of filler metal is optional depends upon the kind of weld or requirement. The electrode is non-consumable. The process give rise to the formation of fumes and gases while melting the work piece and filler rod to form a weld. Helium and argon are specially used as shielding gases because they does not chemically react.

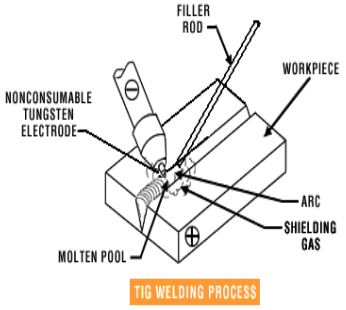

Fig.1 Schematic diagram of TIG welding

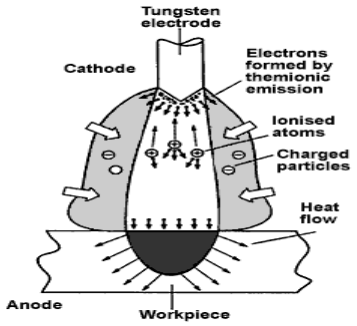

Fig.2 Mechanism of TIG welding

1.2 Welding Of Aluminum Alloys

AA7005 is a merely alloy of this series with good weldability and can be TIG welded without causing cracks and poor strength joints. Unlike other AA7xxx, it do not contain Cu in its composition which reduces its ductility and corrosion resistance. Hence susceptibility to solidification cracking of aluminium-copper alloys is increased. Zinc and Magnesium are the most widely used alloying elements for aluminium. AA7005 possess good welding characteristics and resistance to corrosion. The physical properties of AA7005 are similar, except higher density of 2.78 g/cm³ than AA6061 alloy and may be little stronger depending on the temper. Unlike 6061, It does not need to be precipitation hardened, but can be aired cooled. These alloys are used primarily for bicycle frames, due to its relative ease 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 TABLE I, TABLE II and TABLE III as shown:

TABLE I. COMPOSITION OF AA7005

Al	*Mn*	*Mg*	*Cr*	*Zn*	*Ti*	*Zr*
93.3%	*.45%*	*1.4%*	*.13%*	*4.5%*	*.04%*	*.14%*

TABLE II. PHYSICAL PROPERTIES OF AA7005

Phase	*Atomic Weight*	*Melting Point*	*Boiling Point*	*Density*
Solid	*26.9AMU*	*6300 C*	*24700C*	*2.78gm/cm3*

TABLE III. MECHANICAL PROPERTIES OF AA7005

PROPERTIES	*VALUE*	*CONDITION*
Poisson's Ratio	*2.6-2.8*	*250 C*
Elastic Modulus (GPa)	*70-80*	*250 C*
Tensile Strength (MPa)	*193*	*250 C*
Yield Strength (MPa)	*83*	*250 C*
Elongation (%)	*20*	*250 C*
Shear Strength (MPa)	*140*	*250 C*

LITERATURE REVIEW

TIG welding is highly precise and clean welding process yet the control and execution of different welding parameters is quite necessary for successful outcome. The different welding parameters are selected by the operator based on his experience or from literature survey. It is not always necessary that the selection of parameters can be optimal and will give same set of result for particular welding environment. In this study, a literature review has been made and attempt has been made to analyze the effect of different parameters on the welding geometry.

CONCLUSION

Literature survey reveals that a lot of work has been done on TIG welding of aluminium alloys. The research work has been found in literature for TIG welding of aluminium alloys and based on past work the following conclusions are drawn:.

- 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 aluminium, 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 an comparative outcome between TIG welding and base material to differentiate the effect of temperature distribution.
- UTM and Impact Testing Machine can be used for Tensile and Impact testing of TIG welded joints.
- Welding defects can be eliminated by proper welding precautions and controlling the different welding parameters.
- Automation of TIG welding process can make it more useful and precise. It can help to achieve faster welding speed, less distortion and even thin welding sheets can be easily welded with less skill required.

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