MICROSTRUCTURE CHARACTERISTICS AND MECHANICAL PROPERTIES OF ALUMINIUM ALLOY WELDED JOINTS USING GAS TUNGSTEN ARC WELDING

[1]CH.Divya Bharathi, [2]CH.Neeraja

[1]Assistant professor, [2]Assistant professor
[1]Mechanical department,
[1]CMR Technical Campus, Hyderabad, Telangana, India.

Abstract : In this study, standard fusion fastening processes: MIG, TIG and solid state method friction stir fastening (FSW) were applied to six millimeter thick plates of aluminimum alloy. The weldments were evaluated by playing small structural examinations together with optical microscope and scanning microscope (SEM) and moreover as hardness measurements. Mechanical testing has been done by suggests that of tensile and bend tests. The mechanical properties and small structural options of atomic number 13 (Al5052) weldments processed by gas atomic number 74arc fastening (GTAW) and gas metal arc welding (GMAW) and friction stir welding are investigated. Weldments processed by each strategies are mechanically softer than the parent material Al5052, and will be potential sites for plastic localization. The microstructure of the welds, together with the lump zone and warmth affected zone, has been compared in these 3 strategies exploitation optical research. The mechanical properties of the weld are have additionally been investigated exploitation hardness and tensile tests. it's revealed that Al weldments processed by GTAW are mechanical additional reliable than those by GMAW. the previous bears higher strength, additional plasticity, and no apparent microstructure defects. Perceivable consistence in weldments by GMAW is found, that might account for the distinct mechanical properties between weldments processed by GTAW and GMAW. it's instructed that caution ought to be exercised once exploitation GMAW for Al3003 within the high-speed-train trade wherever such lightweightweight metal is broadly used. but fused samples have additional strength than that of MIG welded samples. The weld metal microstructure of MIG welded specimen contains equiaxed dendrites as a results of set process throughout MIG welding whereas FSWed specimen have formed microstructure.

***IndexTerms* - Tungsten inert gas welding, metal inert gas welding, friction stir welding, aluminimum alloy5052, mechanical properties microstructures.**

I. INTRODUCTION

Among aluminimum alloys, Al3003 ordinarily utilized in defense, construction, automotive, railway, aviation and regionindustries, could be a representative non-age-hard alter Al-Mg alloy that possesses a horny combination of properties like light-weight weight, moderate high strength, sensible corrosion resistance, workability, and tested weld ability, sensible electrical and thermal physical phenomenon [1–6]. For the change of integrity of aluminimum alloys, fusion attachment processes have ordinarily been utilized in many industrial applications. A solid state process-friction stir attachment, (FSW) fictional and proprietary at The attachment Institute (TWI) of United Kingdom in 1991, is taken into account to be the foremost important development in metal change of integrity in an exceedinglydecade. This comparatively new attachment method has at the start and significantly been applied for welding the high strength aluminimum alloys and alternative gold-bearing alloys that are onerous to weld by standard fusion welding. FSW of aluminimum alloys has been utilized in the applications of craft, construction, automotive, railway, defense industries and attracted intensive analysis interest thanks to the potential engineering importance and issues likereduced strength of the joints, distortions, residual stresses, gas porosities, science precipitations within the weld metal and HAZ, lack of fusion, high constant of thermal growth, natural process shrinkage, high solubility of atomic number 1and alternative gases related to standard attachment

II. Material and experimental procedures

III. In this paper, a non-heat treatable Al- -Mg alloy which is mainly used in the construction of tactical military vehicles and shipbuilding has been used. In Table 1, the chemical composition and the mechanical properties of the base metal have been demonstrated. Welding processes that have been applied to the base metal are: MIG and TIG as conventional fusion welding processes and friction stir welding as solid state welding process. Butt joints of double sided welds were obtained.

IV. As metallographic examination, the cross sections of the welded joints were prepared, polished and etched with modified Keller’s reagent for about 30sec, visualized as macro- and micrographs using LOM.

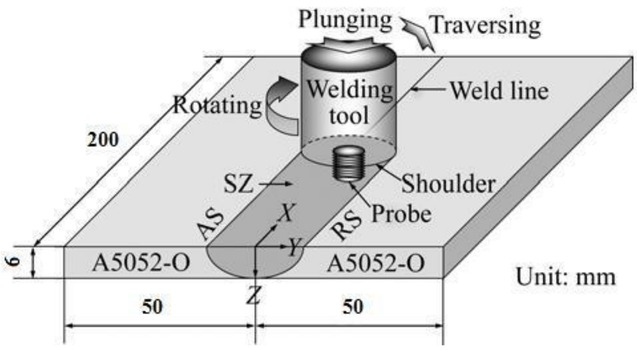


Fig.1 Schematic representation of friction stirs welding process

SEM examination has additionally been connected to the Thermo-mechanical influenced zones of rubbing blend welded example. Vickers Micro hardness estimations were done as line investigation, under 200 g test load at 2 mm profundity from the face and root side of each cross segment of the welds. For mechanical testing, transverse tractable (fig 3) and twist test examples were set up from the welded plates with reference to EN 895 and EN 910 measures, separately.


Fig.2 Tinioulesen universal testing machine

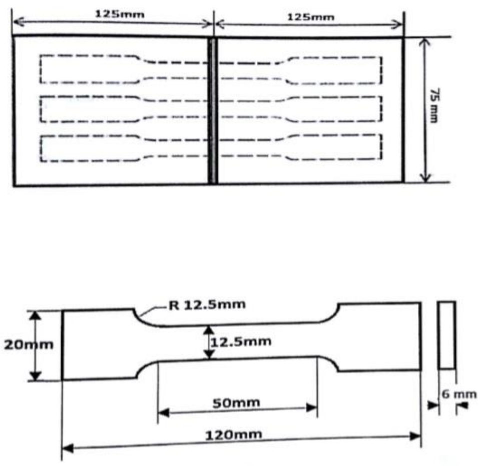


fig 3 Schematic Diagrams for Dimensions of Specimen for Tensile Test

V. RESULTS AND DISCUSSIONS

Aggregate of 4 examples with mix of various parameters of welding current, and welding speed both filler wire was performed. In the examination elastic testing has been done on UTM, Hardness testing has been done on Rockwell hardness analyzer, Impact testing (Izod) has been done on effect testing machine.

a) TENSILE TEST

Tensile test was conducted by using Universal Testing Machine type of TUE-C-200 with different loads applied to the specimens. The crosshead speed to pull the specimen at 1 minute /mm was used. 4 tensile tests were performed in total and the tensile stresses of these 4 specimens were recorded. The result of the tensile testing shows that the weakest area is located in the heat affected zone (HAZ),roughly 10-15mm from the weld. Fig shows a sample after tensile test and notice that the material has been deformed and necking occurs before fracture and this is a typical ductile fracture. Ultimate load and ultimate tensile strength obtained from the 4 specimens with different parameters are presented in table 6.1. All samples have different tensile strengthsbut sample 1 and 2 higher compared to others.

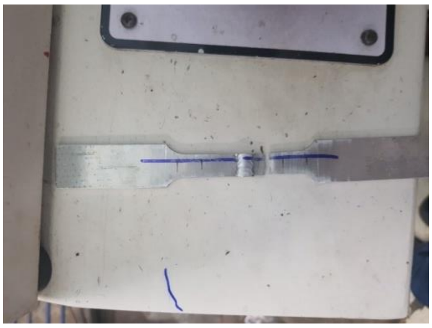


fig 4 ***Fractured Tensile Sample***

Table 3.1 : Tensile Strength andLoad at Peak Values of Samples

Samples	Current (amp)	Filler diameter (mm)	Load at yield (KN)	Tensile strength(N/mm^2)
Sample 1	190	2.4	1.47	48.502
Sample 2	190	2.0	1.61	55.457
Sample 3	197	2.4	1.09	37.003
Sample 4	197	2.0	1.31	46.480

b) Hardness Test

The hardness of the weld metal is estimated with the assistance of the Brinell hardness testing at B grade (HRB) and the normal hardness at various hardness of the welded areas are given beneath table 3.2 The filler metal utilized in TIG welding is ER3003 cathode which contains magnesium, manganese and chromium as chief alloying components. These alloying components may encourage carbides which may add to higher hardness levels.

Table 3.2 Hardness Values of Samples

Samples	Current (amp)	Filler Diameter (mm)	Load (KG)	Ball intender diameter (mm)	Impression diameter at weld zone(mm)	Hardness (BH)
Sample 1	190	2.4	187.5	2.5	1.65	76.78
Sample 2	190	2.0	187.5	2.5	1.50	95.49
Sample 3	197	2.4	187.5	2.5	1.70	71.58
Sample 4	197	2.0	187.5	2.5	1.60	82.45

c) IMPACT TEST

Effect quality is the estimation of vitality engrossing limit of the material. Effect is an abrupt burden, which is connected on the work piece having a V-score profundity of 2mm. The vitality seen by the weld metal is estimated with the assistance of the Izod effect testing machine. The vitality consumed by the various examples with anaverage worth was appeared in table 3.3

Table 3.3 Impact test values of samples

Samples	Current (amp)	Filler diameter (mm)	Impact test (J)
Sample 1	190	2.4	2
Sample 2	190	2.0	2
Sample 3	197	2.4	4
Sample 4	197	2.0	4

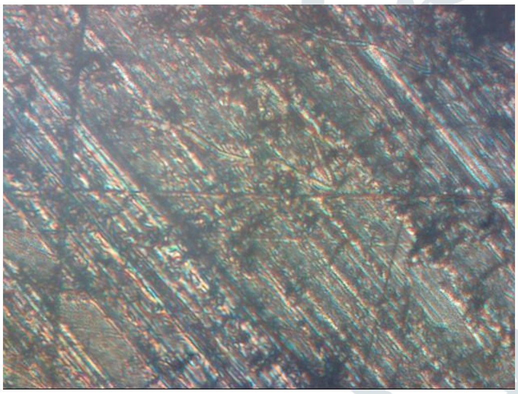
d) **Microstructure**

Granularity (additionally called graininess), the state of existing in grains or granules, alludes to the degree to which a material or framework is made out of recognizable pieces or grains. It can either allude to the degree to which a bigger element is subdivided, or the degree to which gatherings of littler undefined substances have consolidated to increase recognizable elements. A kilometer broken into centimeters has better granularity than a kilometer broken into meters; though, conversely, particles of photographic emulsion may bunch together to frame particular recognizable granules, reflecting coarser granularity. Coarse-grained materials or frameworks have less, bigger discrete segments than fine-grained materials or frameworks.

A coarse-grained depiction of a framework respects enormous subcomponents.

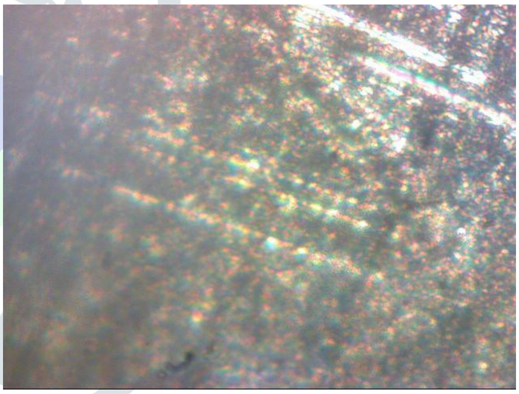
A fine-grained depiction respects littler segments of which the bigger ones are formed.

The microstructure of the weld metal is estimated with the assistance of the computerizedtrinocular metallurgicalmicroscope METZ-780.The given example 2 had microstructure of fine grains and content like structure. The miniaturized scale test report of base metal and weld zone has appeared in fig



(a)

Figure5(a) Base Metal Microstructure at AA3003



(b)

Figure5(b) Base Metal Microstructure at AA6061

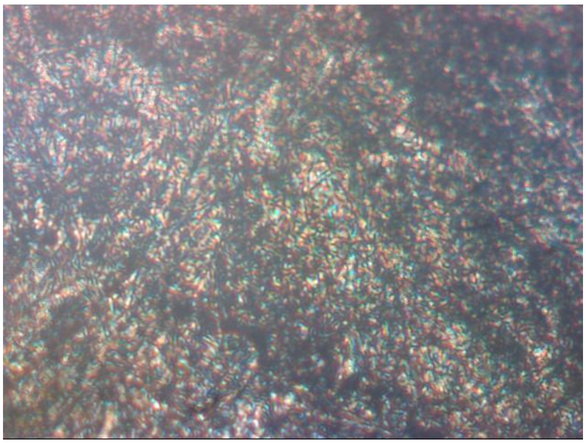


Figure6Microstructure at Weld Zone

VI. CONCLUSION

- AA3003 and AA6061 metals of 3mm are successfully connected by GTAW with aluminum ER4043 filler metal
- The proper processing parameters were welding current of 190A,and filler rod diameter is 2.0mm
- All the tests are performed based on ASTM standards respectively.
- The microstructure of equiaxed grains and script like structures with grain sizes are visible.
- The highest tensile strength among four samples of thickness 3mm is observed to be 55.457 N/mm^2 for sample2.
- By the above results it is concluded that with the process parameters of current 190A and filler rod 2.0mm diameter produced good welded joints.

REFERENCES

[1] A.K. Lakshminarayanan, V. Balasubramanian,K.Elangovan, "Welding Processes On Tensile Properties Of AA6061 Aluminium Alloy Joints"

[2] Balasubramanian, V. Ravisankar, V. Reddy, M.G. "EffectofPulsed Current Welding On Mechanical Properties ofHigh Strength Alloy"."International Journal of Advanced Manufacturing Technology", March 2008.Pg No. 254-262

[3] Prakash, J. Tewari, S.P. Srivastava, B.K.2012. "ShieldingGas forWelding ofAluminumAlloys by TIG/MIG Welding-A Review". "International Journal of Modern Engineering Research" (UMER). VOL. 1.

[4] Khanna, O.P.2009. "A Textbook of Welding Technology". 19th ed. New Delhi. Dhanat rai publications.

[5] R S Parmar, "Welding Engineering and Technology", Khanna Publisher, 2002, 2nd Edition, New Delhi.

[6] "Advanced Welding Society" (AWS). 1996. Welding Hand Book. Vol. 3.

[7] Abbasi, K. Allam, S. Khan, M.I.2012. "An Experimental Study On theEffect of TIG Welding Parameters On Weld-Bead Shape Characteristics". "Engineering Science and Technology: An International Journal" (ESTIJ. Vol. 2.).

AUTHOR DETAILS

[1]CH.Divya Bharathi from CMR Technical Campus working as an Assistant professor in Mechanical department, Hyderabad, Telangana, India

2CH.Neeraja from CMR Technical Campus working as an Assistant professor in Mechanical department, Hyderabad, Telangana, India