ANALYSIS OF TIG WELDING TO ASSURE THE QUALITY AND CORRECTNESS OF THE WELD

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Abstract : In modern manufacturing industries welding is the most commonly used fabrication process to join to or more work pieces together. This process is a fast and simple as compare to any other fabrication and assembly process. The paper carried out in this field has given different ways and techniques to weld practically all metals.
Index Terms - Welding techniques, Destructive test, Weldment.

I. INTRODUCTION

Welding is a process that joins materials usually metals, alloys or thermoplastics, by coalescence. For joining of two or more pieces of metal together by one of the welding processes, heat is the most essential requirement. Pressure may also be employed but this is not essential in many processes [1,2]. The application of heat, pressure or both heat and pressure will depend upon the type of welding. During welding process, the pieces to be joined are melted at the joining surface and a permanent joint is attained after solidification[3,4,5]. The use of filler material to form a weld pool of molten material depends upon the type of weld and the materials to be joined. Different factors affect metallurgical changes that occur during welding.[6,7]

II. LITERATURE REVIEW

Welding of higher thickness plates by TIG welding. Aluminum Plates (3-5mm thickness) were welded by Pulsed Tungsten Inert Gas Welding process with welding current in the range 50-115 A and gas flow rate 6 -16 l/min [8,9,10]. Shear strength of weld metal (70MPa) was observed less than parent metal (82 MPa). Mechanical properties of the weldments of AA6351 during the TIG /GTAW welding with non-pulsed and pulsed current at different frequencies. Welding was performed with current 72-75 A, arc travel speed 710-750 mm/min, and pulse frequency 4 and 8 Hz [11,12,13]. The effect of welding speed on tensile strength of the welded joint by TIG welding process of AA6351 Aluminium alloy of 4mm thickness. The strength of the welded joint was tested by a universal tensile testing machine [14,15]. Further the effect of activated TIG process on welding, angular distortion and hardness of 315 L stainless steel by using different flux like MnO_2, SiO_2 and Al_2O_3. To join 6 mm thick plate author uses welding current 200 Amp, welding speed 152 mm/min and gas flow rate 12 l/min[16,17,18]. Effect of welding current on tensile strength, hardness profiles and residual stress distribution of welding zone of steel samples were reported. For the experimentation welding current of 110-190 A, welding speed 119.54 mm/min, pulse frequency 5 Hz have been considered. [19,20].

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III. EXPERIMENTAL PROCEDURE

In this experiment, total ten aluminum plates of dimension 200 * 200 *6 mm are taken, and double V-grooves over one side of each Aluminium plate is prepared and the surface of the groove is smoothed by the emery paper and than double V-groove joint TIG welding at different current intensities is done on these plates. Double V-Grooves are prepared because this V-groove provide proper filling of the weld and forms a strong weld pool which have good ultimate strength. 6 mm thickness Aluminium plates selected for the this work. These plates were divided into dimension of 200 mm x 200 mm. After that surfaces are polished with emery paper to remove any dust or any types of foreign material. Then Aluminum plates are held in the working table so that a butt join can be prepared. Alternate current was used in TIG welding. Table 2 shows the various parameters selected for this experiment.

Table 1: Welding parameters

Parameters	Range
Current	150 – 270 A
Voltage	50 V
Distance of tip from center	4 mm/s
Gas flow rate	10 l/min
Current type	AC
Dimension	200 X 200 X 6

After forming the double V-groove on one side of each plate, all the 10 plates are categorized in 5 categories, two plates in each category namely category V1, V2, V3, V4 and V5. Both the plates of each category are welded together . The plates of each category are welded together at different current intensities. After welding the specimen size becomes 200 X 200 X 6mm. After performing the welding, from all the 5 welded specimens 4 flat strips with dimension of 400 X 20 mm were cut out in rectangular bar form, one each strip for tensile test, hardness test, bend test and Radiography test. Tensile test was performed by FIE make, Universal tensile testing machine, UTES-40. Tensile test is use to find Ultimate Tensile stress,

yield stress and elongation % of the specimen. This Universal testing machine is also used for the bend test. Both the ends of the strip is clamped and the peg exerts pressure on the welded portion of the strip. If the crack or any other defect occurred on the welded portion of the aluminium strip than the specimen fails in the bend test. Third strip from each specimen is used for hardness test. Hardness Rockwell test was conducted on each specimen. And the fourth strip was used for Radiography test. The gamma radiation emitted by the radioactive elements are penetrating radiations whose intensity is modified by passage by passage through the material. The amount of energy absorbed by a material depends on its thickness and density. Since we performed the test on the TIG welded aluminum strip, therefore the amount of energy absorbed by aluminium weld depends on its thickness and its density.

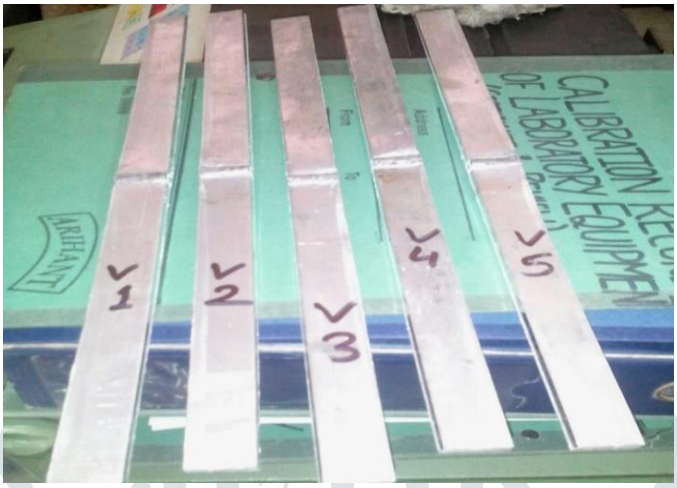

Fig. 1: Strips of width 20mm and thickness 6 mm from each specimen

Table 3: Experimental Planning

Exp. No.	Electrode work piece Distance (mm)	Argon gas flow rate (l/min)	Voltage (V)	Welding Speed (mm/s)	Current (A)
1	3	9-10 l/min	50	3.5	180
2	3	9-10 l/min	50	3.5	200
3	3	9-10 l/min	50	3.5	225
4	3	9-10 l/min	50	3.5	250
5	3	9-10 l/min	50	3.5	270

IV. Result and Conclusion

As mentioned before 5 specimens namely V1, V2, V3, V4, and V5 were selected for the experiment. Each specimen is prepared by performing Double-V groove TIG welding at different current intensities. The purpose of this experiment was to understand The effect of the current on the other mechanical properties of the welding of the Aluminium plates. Four tests namely tensile test, bend test, and Radiography tests were conducted for this purpose. Rockwell Hardness test was performed on all the specimens namely V1, V2, V3, V4 and V5. Before performing the experiment, the surface of the specimen was made flat with the help of Hand Grinder and the roughness was removed over the surface of the specimen. Three hardness test reading were taken on each specimen.

Table 8: Hardness test readings of each specimen

Sr. No.	Specimen Name	Current (A)	Hardness test Reading 1 (HRB)	Hardness Test Reading 2 (HRB)	Hardness Test Reading 3 (HRB)
1	V1	180	48	40	50
2	V2	200	60	64	65
3	V3	225	53	59	56
4	V4	250	53	58	60
5	V5	270	55	58	52

From the result it can be seen that the maximum Hardness value in each reading is achieved in the specimen V2 which was welded at the 200A.

V. CONCLUSIONS

The experiment conducted for welding of aluminum plat by TIG welding shows that with the increase in current, the elongation % also increase that means with the increase in the current intensity, the ductility of the TIG welded Aluminium specimen also increases. Because of the Double V-groove joint, none of the specimen fractured from the weld portion. This proves that Double V-groove joint provides good strength to the specimen. The Ultimate tensile strength and the Yield stress for the aluminium plate of thickness 6 mm is highest in the specimen V3 which was welded at 220 A.

VI. REFERENCES

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