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The Investigation of Mechanical Properties of Dissimilar Material Weld Joint by GMAW & MMA Process

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Abstract- In this paper discussed about the investigation of mechanical properties of dissimilar material of weld joint by Gas Metal Arc Welding (GMAW) and Manual Metal Arc (MMA) process. In this study to evaluate of strength of weld joint, weld size of weld joint and torsional strength of weld joint. In this investigation used two types of weld joint, groove joint (V-joint) and butt joint. In this investigation used impact test, torsional test and welding size. The main purpose of this study comparison between welded joint and welding techniques. The parameters of welding are welding current, welding voltage, welding speed. In the metal inert gas welding used wire electrode size is 0.8 mm diameter. In this investigation used mild steel sheets and stainless-steel sheets. The thickness of sheets is 4mm, 5mm, 6mm, the dimension of sample size of butt joint and groove joint is 230 mm X 120 mm X 4mm X 5 mm X 6 mm.

Keywords- GMAW, MMA, Mild steel, Stainless steel, Butt Joint, Groove Joint (V-joint).

I. INTRODUCTION

Gas metal arc welding is very popular techniques for make the welding joint. Metal inert gas welding also called the metal active welding process. Metal inert gas welding need of a wire, this wire is also called electrode wire. The size of wire which is used in the welding is 1mm, 1.5mm and 0.8mm. The part of welding machine is welding torch, wire feeder, electrode gun, shielding gases.

The used of shielding gas to protect the weld joint from the atmospheric air. Due to atmospheric effect create defect on the welded joint. The name of shielded gases which used at welding time is Helium, Argon etc.

The advantages of MIG welding technology are use in thin sheet metals. The welding of metal inert gas welding is very faster in comparison to others arc welding technology. The utilization of GMAW in the automobile industries and fabrication in manufacture of the sheet metals. In this welding the productivity of production rate is high. Due to high production rate, used of this technology very high level.

The working of metal inert gas welding when supply the current to welding machine then the power pass to the machine. When the electrode gun touch on the work piece, electric arc generated due to generate the electric produced the heat this heat welds the material and also melt the wire electrode. This wire electrode passed through welding gun. The shielded gases also pass-through welding gun. After completed welding process then apply the shielding gas to protect the defect on the welding joint.

Fig 1. MIG Welding Machine

In this welding processed used to consumable electrode. Metal inert gas welding is most commonly used to repair cars, motor bikes, recreational vehicles, vans and SUVs2. The fact that it can provide a strong weld for even very thin metals makes MIG welding the ideal technique for assembling and repairing the body and / or interior of any vehicle.

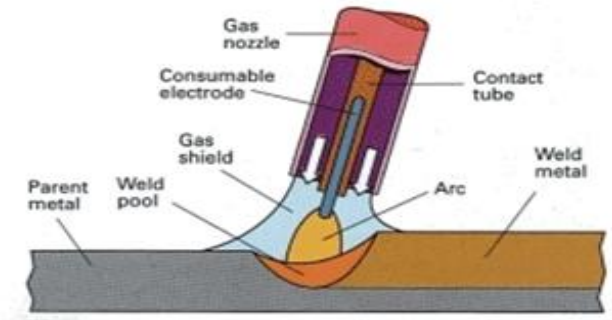

Fig 2. MIG Welding Process

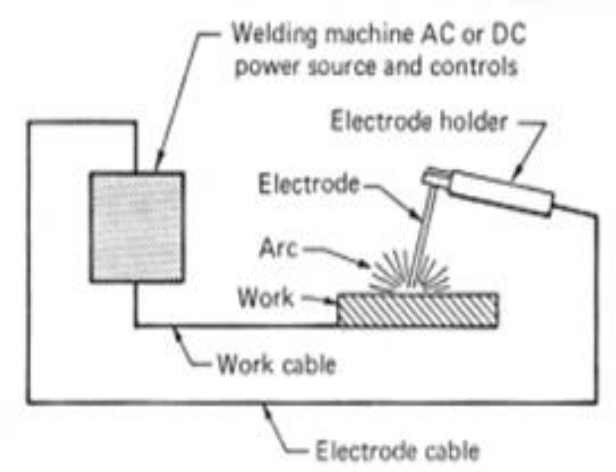

Fig 3. ARC Welding Process

In welding also used the consumable electrode in above Fig 3. Shows that welding gun connected to AC or DC current the electrode clamp by the help of welding gun. When the welding gun touch to base metal then electric arc generated due to this arc heat generated due to heat formation the material melt and electrode also melt and after all the molten metal fill into the welding pool.

In this welding, the speed of arc welding is very slow in comparison to metal inert gas welding. Manual arc welding, it's very oldest techniques for joint the different material joint or similar materials weld joint. The productivity of product is slow in comparison to gas metal arc welding process.

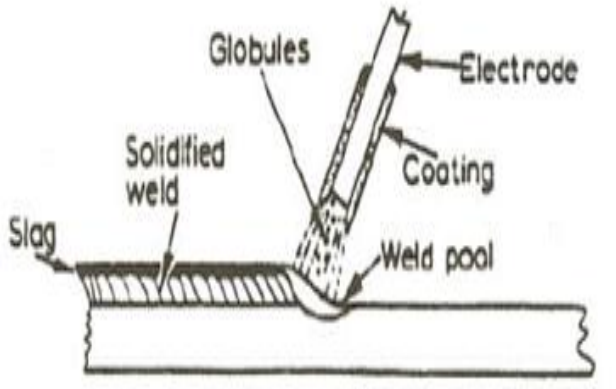

Fig 4. MMA welding

The central metal electrode or core wire acts as a consumable, providing the filler metal for the weld. MMA welding can be used to join most steels, stainless steels, cast iron and many non-ferrous materials.

Manual arc welding also called as shielded metal arc welding or stick welding. In this welding process the arc is struck between an electrode flux coated metal rod and the work piece. Both the rod and surface of the work piece melt to create a weld.

II. EXPERIMENTAL WORK

In this section discussed about the experimental work and also discussed about the need of this experiment. In this experiment used the MIG and MMA welding technology and two different types of weld joint, Groove joint and Butt joint.

Some experimental test is performed in this investigation, impact test to evaluate the strength of welded joint and torsional test to examination the observation of energy during testing time. In this study also discussed about the travelling time and travelling speed.

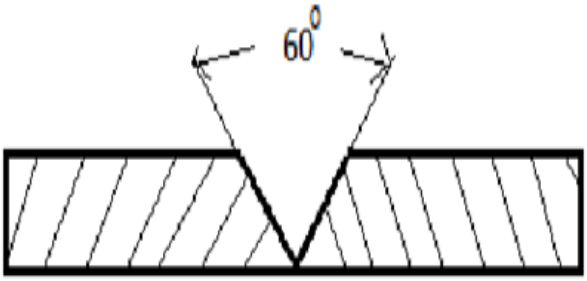

Fig 5. V-Joint

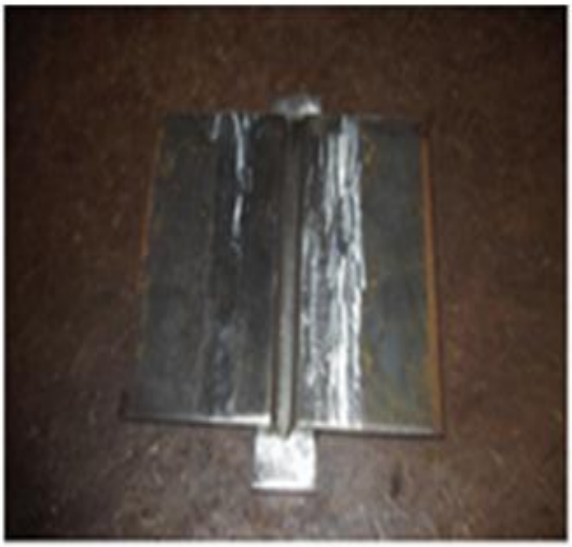

Fig 6. Groove weld joint

In these types of joint two sheets are connected to each other but some angle provides between the sheets. 600 angle mention between the both sheets. This gap also called as welding pool. Melt materials fil into the welding pool.

The use of grove joint, panelling, ceiling or wall wood design, and flooring. Grooves are used to house the panels in frame and panel construction and the bottoms of drawers. It is also commonly used in aerospace automotive and construction.

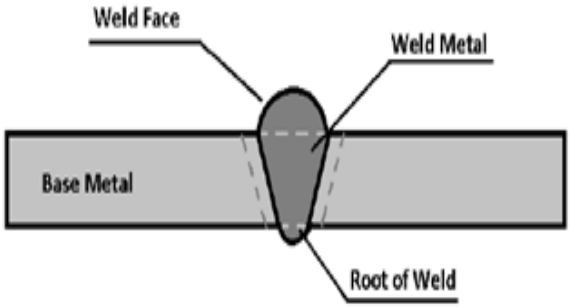

Fig 7. Butt Joint

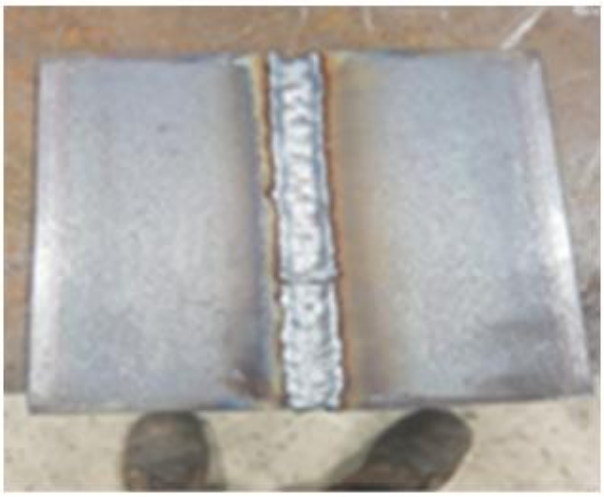

Fig 8. Weld Butt Joint

In these types of joint two base metal kept to each other and joint gap fill by the help of welding electrode. The welding electrode travelled on the base metal surface and after solidification both sheets joined. But groove joint is stronger than butt joint.

Butt joints are simplest joint it is use only small gluing area, which mean they can be cheap furniture and some time have dowels add- ed to reinforce them. The butt joint also used in the automobile sector and also used in the domestic things.

Table 1. Experimental data of impact test.

MAW			MIG	
Thickness	Butt Joint	V- Joint	Butt Joint	V-Joint
4mm	34	44	49	54
5mm	54	58	60	66
6mm	62	65	67	79

Table 2. Experimental data of torsional test.

MAW			MIG	
Thickness	Butt Joint	V- Joint	Butt Joint	V-Joint
4mm	338	354	340	380
5mm	349	369	358	410
6mm	355	378	365	418

Table 3. Experimental data of weld size.

MAW			MIG	
Thickness	Butt Joint	V- Joint	Butt Joint	V-Joint
4mm	2.8	3.4	3.6	4.8
5mm	3.2	3.8	4.2	5.2
6mm	3.8	4.2	4.8	5.8

*Strength in KN/MM2 and Weld size in MM.

III. RESULT AND DISCUSSION

After experimental details, now discussed about the result of whole investigation. In this experiment used both materials (Mild steel & Stainless-Steel) sheets have good strength. The graphical representation mention below.

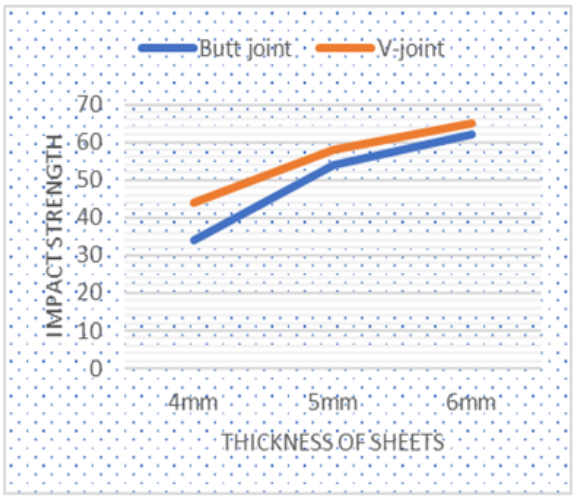

Fig 9. Effect of impact strength on thickness of welded plates subjected to MAW.

In this graph shows that the strength of 'V'- Joint is high in comparison to butt joint. In this graph shows that different point of strength on different types of material thickness

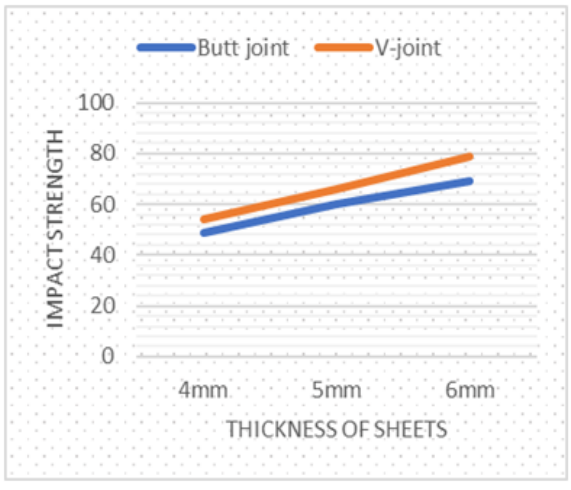

Fig 10. Effect of impact strength on thickness of welded plates subjected to MIG.

In this graph shows that the thickness of sheets is 4mm, 5mm, 6mm. In this graph shows two types of joint and them strength. According to experimental parameters the strength of welding joint of groove joint is more in comparison to butt joint.

In this graph the red line shows to strength of groove (V-joint) and blue line also shows the strength of butt joint strength.

In this figure also shows that used different types of materials sheets thickness in the same way the strength shows at point to point. The metal inert gas welding weld joint is more effect in the comparison to manual arc weld joint.

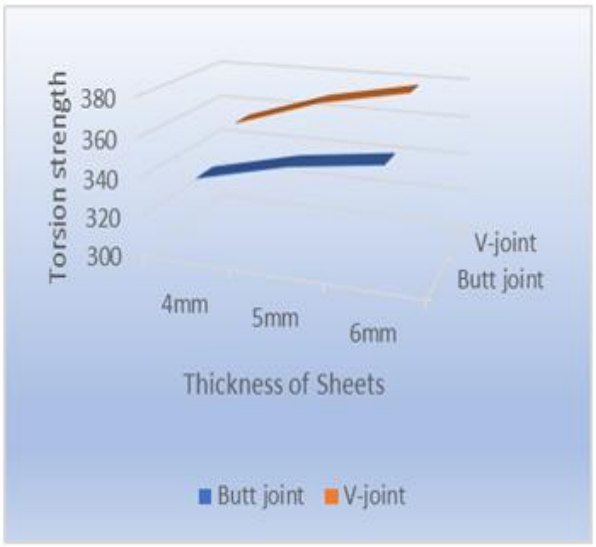

Fig 11. Effect of torsional strength on thickness of welded plates subjected to MAW.

In this figure shows that the strength of dissimilar weld joint. In this shows two line of weld joint energy observation when the experiment performs. In this graph shows the energy observes in the groove joint weld joint in comparison to butt joint. The MIG welding technique is best in comparison to manual arc welding technique.

After perform the experiment, the metal inert gas welding is very fast technique of welding in comparison to manual arc welding. The travelling speed of metal inert gas welding is fast in comparison to manual arc welding technique.

In this shows to evaluation of energy observation by metal inert gas welding technique. Gas metal arc welding technique has very fast welding speed in comparison to manual arc welding. In this graph shows that energy observation of different types of welding joint, the name of different types of welding joint are v-joint and butt joint. After experiment found that the strength of groove joint is more in comparison to butt joint.

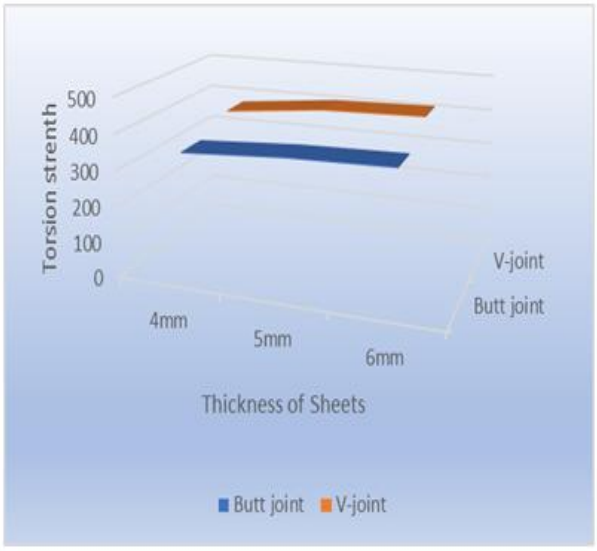

Fig 12. Effect of torsional strength on thickness of welded plates subjected to MIG.

In this experiment used different types of materials, the name of materials are mild steel sheets and stainless-steel sheets. The thickness of sheets is also different; the thickness of sheets is 4mm, 5mm and 6mm. In this graph shows that two lines one is red line which is shows the strength of groove joint and second is blue which is shows the strength of butt joint. After experimental study found that the metal inert gas (MIG) welding or gas metal arc welding (GMAW) weld joint is stronger in comparison to manual arc welding technique.

Fig 13. Weld size (MAW)

In this figure shows that the welding size of dissimilar material weld joint. In this study used two types of joint first is groove joint (V-joint) and second is butt joint. According to this graph the area of weld joint of groove joint is more in comparison to butt joint. This weld joint made by the manual arc welding technique.

In this study used different types of materials first is mild steel and second is stainless steel. Manual arc welding is very oldest technique and also used of this technique very old time in the automobile industry and aerospace industry and also used in the domestic things. But the production rate of this welding is slow.

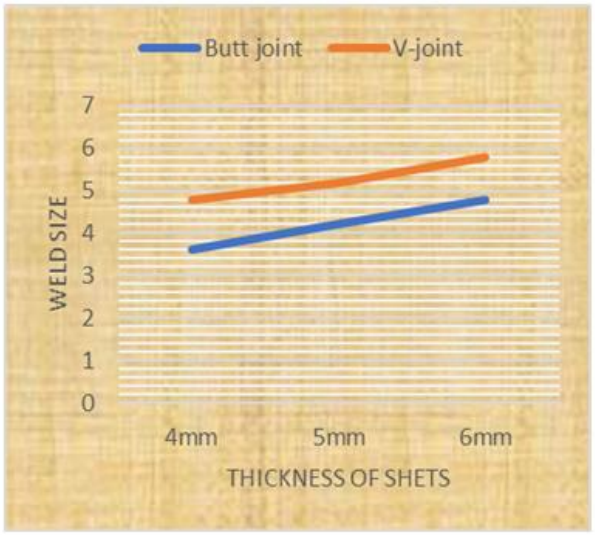

Fig 14. Weld size (MIG).

In this figure shows that area of dissimilar weld joint. In this experimental study used two types of joint first is groove joint and second is butt joint and also used different types of material (Mild steel & stainless steel). This graph shows that the area of dissimilar weld joint is more in comparison to butt joint.

This dissimilar welding joint made by gas metal arc welding or metal active welding process. Metal inert gas welding is very popular technique for used to make the strong similar or dissimilar weld joint. The thickness of sheets is also different types. The thickness of sheets is 4mm, 5mm and 6mm. The diameter of welding electrode wire is 0.8mm.

VI. CONCLUSION

In this experimental study found the MIG welding weld joint is stronger in comparison manual arc welding weld joint. In this study found the strength of groove weld joint is more in comparison to butt joint. The dissimilar weld joint area of groove joint is more in comparison to butt joint dissimilar area.

In this study found the metal inert gas welding is faster in comparison to manual arc welding technique. In the experimental study of torsional study found the energy observation is more of groove joint is more in comparison to butt joint. The production rate of manufacturing of metal inert gas welding is more in comparison to manual arc welding process.

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