EFFECT OF POLARITY ON GAS TUNGSTEN ARC WELDING

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Abstract - GTAW is a welding process which uses non-consumable tungsten electrode to fabricate the weld. The GTAW is mostly used for stainless steel and non ferrous metals such as aluminium,magnesium.

The foremost objective of this project is EFFFECT OF POLARITY ON Gas Tungsten Arc Welding. For joining the two metals, a filler rod of a grade 316L & 304L is used for DC+&100% Argon.With the help of a non-destructive test we can find the defects in the weld joints of DC+ & 100% Argon. By Using 316L & 304L filler rod for DC+ & 100%Argon the defects are ER,ICF,LOF,LOP,EP.The mechanical properties of welding joint were investigated by Hardness test and Tensile test.

Key Words: fabricate, ferrous, filler

1.INTRODUCTION

Welding is a process that joins materials, normally metals or thermoplastics, by utilizing high hotness to soften the parts together and permitting them to cool, causing combination. Welding is particular from lower temperature metal-joining strategies, for example, brazing and patching, which don't soften the base metal.

Gas Tungsten Arc Welding (GTAW) or Tungsten Inert Gas (TIG): GTAW or TIG welding process is a bend welding process uses a non consumable tungsten anode to convey the weld. The weld locale is protected from air with a shielding gas all things considered Argon or Helium or every so often mix of Argon and Helium

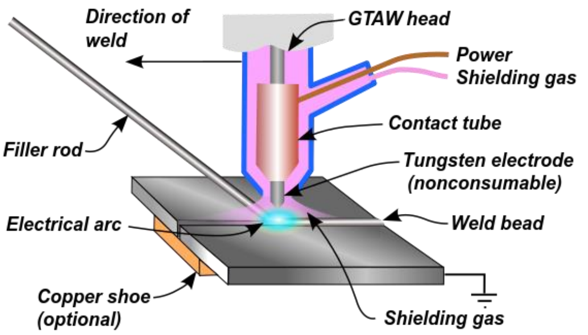

Fig-1 GTAW

TIG welding is prevalently used to accomplish top notch welding of gentle steel or then again slim areas of non-ferrous metals, for example, copper compounds, aluminum amalgams, magnesium, and hardened steel.. The weld is caused with a tungsten anode of 0.5–6.5 mm width.

2. PROBLEM STATEMENT

Joining materials with the help of a gas tungsten arc welding machine is widely used in the concerned industries. It is a process of joining any two workpieces. The main aim of this project is to realize the effect of polarity on Gas Tungsten Arc Welding . Non-destructive testing and destructive testing like liquid penetration testing, hardness test and tensile test was performed where the problems are identified on the two workpieces performed under both DC+ and 100% argon. The problems may arise like excess penetration, lack of fusion, porosity, undercut etc. These problems can be resolved by setting the polarity.

3.SELECTION OF MATERIAL

The material of Stainless Steel is selected with the necessary measurement was bought from the market and the test specimen was ready from it with the required dimensions(mm).

S.no	Material(mm)	Length(mm)	Width(mm)	Thickness(mm)
1.	Stainless Steel	150	100	6

Table-1

4.SELECTION OF ELECTRODE

In this we use non consumable electrode and we use filler rod as grade 316L is used for DC+ and grade 304L is used for 100% argon.

Fig-2 Electrode 316L

Fig-3: Electrode 304L

5.V-GROOVE CUTTING

A weld groove is defined as a channel in the surface of a work piece or an opening between two members providing space. If the weld is between the two work pieces, it is a groove weld.

Fig-4: V-Groove Cutting

6.WELDING THE MATERIAL

The stainless steel metal has been joined together using GTAW at polarities of DC+ and 100% Argon.

- For DC+,the electrode connected as positive and workpiece as negative.
- 80% Argon and 20% carbon is given as gas. For 100% Argon, the gas used is only Argon.

Fig-5: Welding the material

7.LIQUID PENETRATION TEST

This liquid penetration testing is a simple low-cost method of detecting surface breaking flaws such as cracks ,laps, porosity ,etc. And this liquid penetration testing is one of the most widely used Non-Destructive Testing methods (NDT).The principle of liquid penetrant testing is that the liquid penetrant is drawn into the surface –breaking crack by capillary action and excess surface penetrant is then removed; a developer is then applied to the surface,to drawn out the penetrant in the crack and produces a surface indication. The results got are much change than actual.

Fig-6: Liquid penetration test

Steps in LPT:-

Pre-Cleaning: Clean the surface of the job which is your area of interest by cleaner to remove contaminate like slag and corrosion.

Fig-7: Pre-Cleaning

Application of penetrant: Apply the penetrate by spraying or brushing through entire area of interest.

Fig-8: Application of penetrant

Dwell Time: Keep the penetrate on the area of interest for 5 to 10min.During this time the penetrate search for any openings or defects on the surface of the weld and sweep into those openings or defects.

Removal of excess penetrant:The excess penetrant is then removed from this surface.

Developing:Develop the area of the interest by applying developers ,ensure that the area of interest is developed 100% by maintaining a distance of 6 to 7 inches between spray nozzle and area of interest.

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Interpretation:The inspector will use visible light with adequate intensity for visible defects. Inspection of the test surface take place after 5 to 10 minutes of development time and is dependent on the penetrant and developer used .This time delay allows the blotting action to occur.

8. HARDNESS TEST

Hardness tends to the block of material surface to scratched spot,scratching and cutting, hardness after offers clear hint of fortitude. In all hardness tests, a describe power is definitively applied on the piece, changes alive and well for different tests. Ordinary indenters are made of set steel or valuable stone. Rockwell hardness analyzer presents direct examining of hardness number on a dial gave the machine. Basically this testing resembles Brinell hardness testing. It differentiates simply in distance across and material of the indenter and the applied power.

In spite of the way that there are many scales having different blends of weight and size of indenter yet typically 'B' scale is used and hardness is presented as HRC. Here the indenter has a jewel cone at the tip and applied power is of 100 kgf. Fragile materials are routinely attempted in 'B' scale with a 1.6mm dia. Steel indenter at 60kgf. Rockwell hardness testing machine contain a table for setting, a hand wheel to raise or lower the supporting table, a Rockwell ball indenter which is a set steel ball 1/6" in distance across, a Rockwell cone indenter which is a precious stone of code 120.

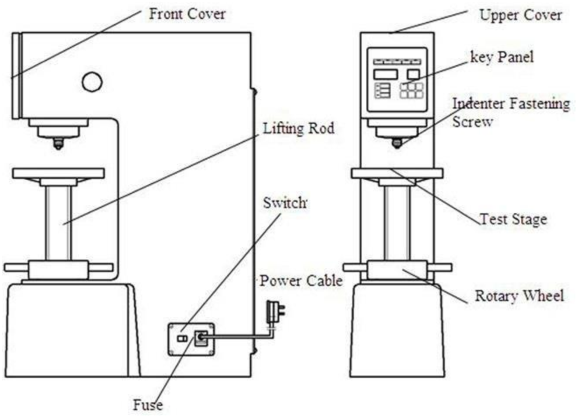


Fig-9: Hardness test

Process:

· Rotate the knob by selecting the load and fix the the suitable indenter.After cleaning the test-piece place the anvil or work table of the machine.Rotate the capstan wheel to elevate the test specimen into contact with the indenter point.Turn the wheel for three rotations forcing the test specimen against the indenter.The pointer should be set on the scale dial at the appropriate position.Force the lever to apply the major load. A dash pot provided in the loading mechanism to ensure that the load is applied gradually.Then the pointer comes to rest pull the handle in the reverse direction slowly.The hardness machine can be read off the scale dial, on the appropriate scale,after the pointer comes to rest. The hardness test is conducted on the weld metal zone, HAZ Zone and Base metal.The same process will done on the DC+ and 100% argon workpieces.

S.no	Weld Metal Zone	HAZ Zone	Base Metal
1	90	111	80
2	108	114	121
3	102	106	117

Table-2: DC+

S.no	Weld Metal Zone	HAZ Zone	Base Metal
1	95	106	96
2	109	123	123
3	100	101	104

Table-3: 100% Argon

9. TENSILE TEST

Tensile test machines is most commonly known as universal testing machines and it is also known as tension test machine which is specially used to evaluate the tensile strength of specimens. The Tensile test is the destructive test which is used to investigate the mechanical properties of welding joint. Our tensile testers will measure mechanical properties such as ultimate tensile strength, yield strength, elongation, and modulus.

PROCESS:

- For this test the material is molded to a standardized sample type and loaded into the machine's grips.
- Mark the specimen and cut the specimen in the required dimensions.
- Measure the initial specimen length,width and thickness.
- Place the specimen between upper and lower jaw faces.
- After gripping the specimen between the faces and tight the jaws.
- Set the elongation scale in a zero position.
- The specimen is pulled apart by the machine until the tension causes the material to break or be deformed.
- When the specimen breaks note the load readings and the elongation of the work piece.

Length	**Thickness**	**Load**	**Deflection**	**Elongation**	**Tensile**
190mm	6mm	65KN	40mm	220mm	515N/mm2

Table-4: Tensile test of DC+

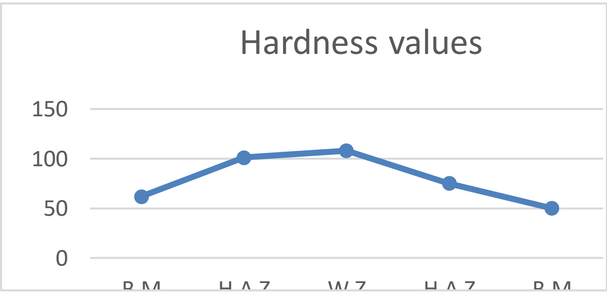
Length	Thickness	Load	Deflection	Elongation	Tensile
180mm	6mm	98KN	67mm	250mm	816.6N/m m2

Table-5: Tensile test of 100% Argon

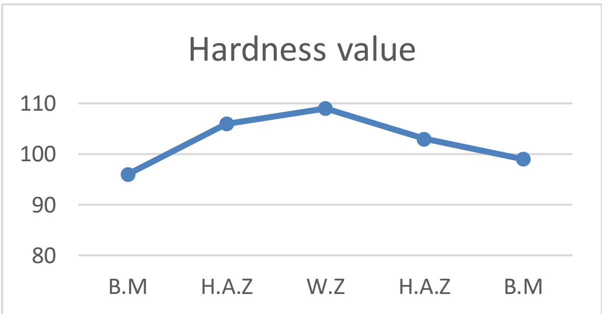
10. CONCLUSION:

In this project we have changed welding parameters are DC+ and 100% Argon. Weld joint undergoes the LPT(non-destructive) test and we have found various defects.The defects are excess reinforcement, incomplete fill, excess penetration.

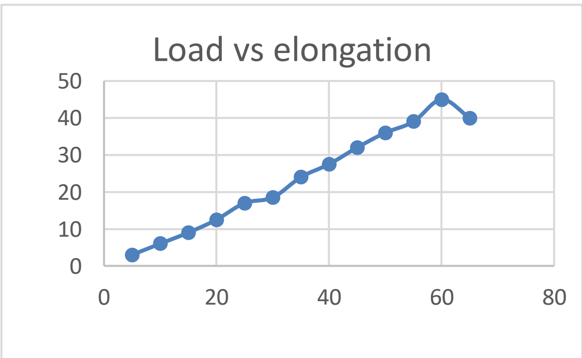
After LPT we performed hardness test with the rockwell hardness test. The following graphs represents the hardness values.



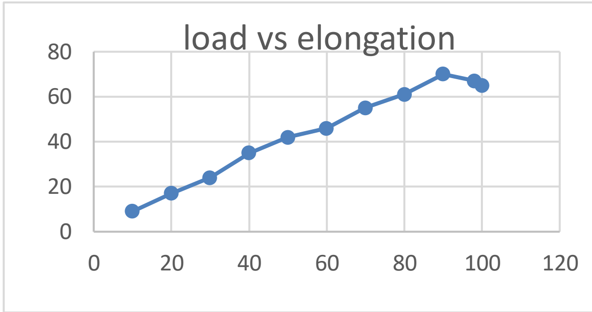
Graph: DC+



Graph: 100% Argon

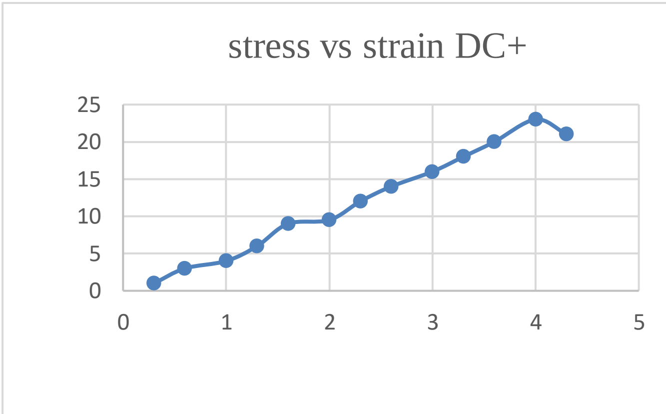


Graph: DC+

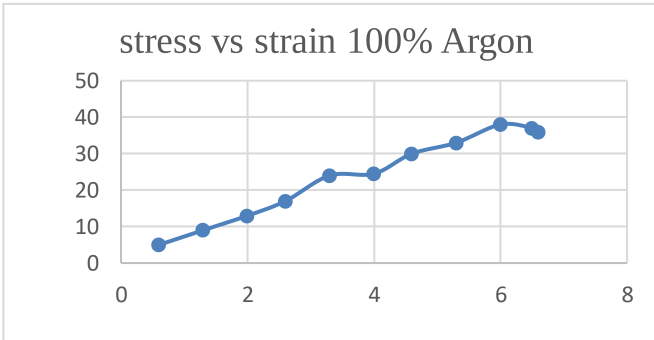


Graph: 100% Argon

STRESS-STRAIN GRAPH:



Graph: DC+



Graph: 100% Argon

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