Original Research Paper Engineering

Comparative Study of Tig Welding Strength in Various Filler Material By Izod and Charpy Method

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ABSTRACT

An experiment has been performed to study the joint strength of a mild steel rod which is done by the help of conventional Tungsten Inert Gas Welding (TIG) by performing two different tests (Izod test and Charpy test) using different filler rods like stainless steel (SS) rod, mild steel(MS) rod and mixed rod(MS & SS). Test has been performed without welding as well as with welding. It has been found that after welding of mild steel rod with different filler rods, rod welded with mild steel (MS) rod having maximum strength in both the tests(Izod and Charpy). Hence, It can be seen that the parent material has maximum strength.

KEYWORDS TIG Welding setup, Specimen of Mild steel, stainless steel, mixed steel, Izod test, charpy test. etc

2. Introduction

2.1.Tig Welding

TIG welding is most versatile arc welding method. Since, It is non consumable therefore, it requires filler rods sometimes. It is performed by both the hands as one is required to hold the welding torch and one is required for holding the filler rod and this makes TIG complex but still it is used due to its versatility with different metals.

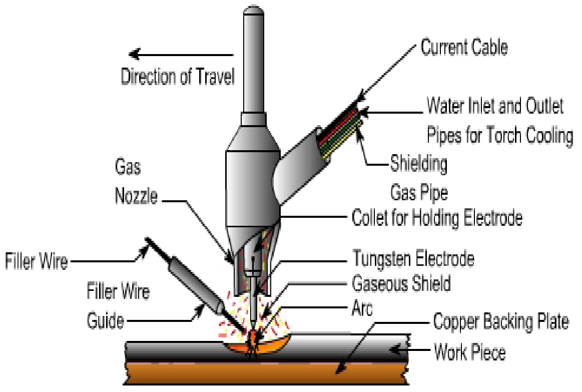

Fig 1. TIG Welding with its terminologies

3.STEEL

Basically pure iron in combination with carbon andother element.There are two types of steel: carbon steel,or a combination of iron and carbon; alloy of steel, which is carbon steel plus manganese, molybdenum,chromium,nickelor other alloying element. A steels quality depends on how it is refind and produced. alloy steel, alloy element,carbonsteel.

3.1.Mild Steel

Mild Steel contains 0.05 to 0.25% of Carbon and due to this, mild steel is also known as low carbon steel. It does have good ductility and malleability but having less tensile strength. Mild steel can be used for many purposes depending upon the properties that it shows when it is gone through heat treatment process.

3.2.Stainless steel

Stainless steel is from family of steel alloy. All alloy in which iron is mixed with carbon and other alloy(Austenitic stainless steel, martensitic stainless steel,ferritic stainless steel).Stainless steel have high strength and toughness as well as good resistance to corrosion.

3.3. Filler rods

Filler rods are used in gas welding which is basically an external material added or supplied to the welding joints for obtaining more strength and other mechanical properties. Some of the filler rods are coated with flux materials which is when melted provides shielding to weld metal pool.

3.4.Izod and Charpy test

These are the parts of Impact resistance test and hence it is a destructive test. In Izod test, the work piece can have V-notch but in Charpy test, it can have V-notch as well U-notch. In this experiment, V- notch is used for both the cases. Position of specimen and type of hammer used is also different. Izod uses farming hammer whereas Charpy uses ball pin hammer as striker.

4.OBJECTIVE of the projects

1. Preparation of the sample for testing.

2. Tig welding is done using different material(mild steel, stainless steel).

3. Checking the strength of specimens on Izod and Charpy method.

5.METHODOLOGY

5.1. TIG WELDING

As mentioned above, TIG welding has been used for welding the metal rod after performing Izod and Charpy test by using different filler materials. First of all, the metal rod goes through Izod test and then TIG welding is performed on those metal rods with the following metal rods:-

Mild steel
Stainless steel
Mixed steel(mixture of mild steel and stainless steel)

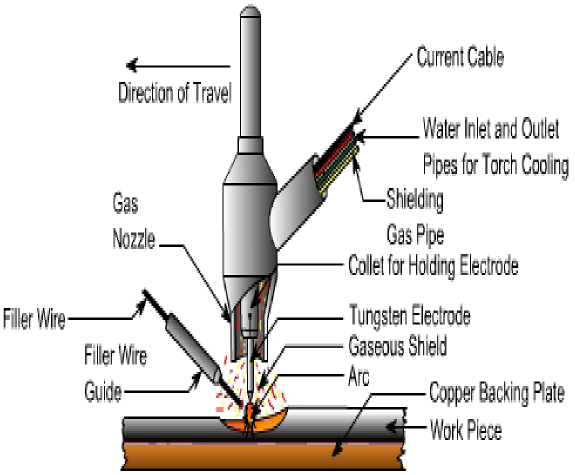

Fig 1. TIG Welding with its terminologies
Fig 1. Shows the equipments used in TIG welding and it is shown in the picture that how the welding is done with its complete terminologies which is used during TIG welding.TIG is performed manually with help of two hands. One is to hold the welding torch and one to hold the filler metal.

Therefore, This is how all the metal rods which were gone through Izod as well as Charpy test were welded.

5.2. Charpy test
Charpy impact testing involves striking a standard notched specimen with a controlled weight pendulum swung from a set height. The standard Charpy-V notch specimen is 55mm long, 10mm square and has a 2mm deep notch with a tip radius of 0.25mm machined on one face. The specimen is supported at its two ends on an anvil and struck on the opposite face to the notch by the pendulum. The amount of energy absorbed in fracturing the test-piece is measured and this gives an indication of the notch toughness of the test material. The pendulum swings through during the test, the height of the swing being a measure of the amount of energy absorbed in fracturing the specimen. Conventionally, three specimens are tested at any one temperature and the results averaged.

Charpy tests show whether a metal can be classified as being either brittle or ductile. This is particularly useful for ferritic steels that show a ductile to brittle transition with decreasing temperature. A brittle metal will absorb a small amount of energy when impact tested, a tough ductile metal absorbs a large amount of energy. The appearance of a fracture surface also gives information about the type of fracture that has occurred; a brittle fracture is bright and crystalline, a ductile fracture is dull and fibrous. The percentage crystallinity is determined by making a judgement of the amount of crystalline or brittle fracture on the surface of the broken specimen, and is a measure of the amount of brittle fracture.

Lateral expansion is a measure of the ductility of the specimen. When a ductile metal is broken, the test-piece deforms before breaking, and material is squeezed out on the sides of the compression face. The amount by which the specimen deforms in this way is measured and expressed as millimetres of lateral expansion.

When reporting the results of a Charpy test, the absorbed energy (in J) is always reported, while the percentage crystallinity and lateral expansion are optional on the test report. It should be emphasised that Charpy tests are ***qualitative***, the results can only be compared with each other or with a requirement in a specification - they ***cannot*** be used to calculate the fracture toughness of a weld or parent metal.

Figure 6.3: Impact Testing Machine for Charpy

Figure 6.4: Charpy Test Specimen

5.3. Charpy Test Specimen

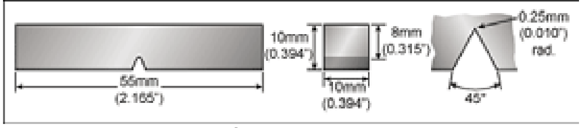

Figure 6.2: Description of Charpy Specimen

Cross section of rectangular bar- 10mmx10 mm

Length of rectangular bar- 55mm

Depth of a v-notch- 2mm

Distance of v-notch from end- at mid position

<u>5.4. Izod test</u> :
The Izod test is has become the standard testing procedure for comparing the impact resistances of plastics. While being the standard for plastics it is also used on other materials.

The Izod test is most commonly used to evaluate the relative toughness or impact toughness of materials and as such is often used in quality control applications where it is a fast and economical test. It is used more as a comparative test rather than a definitive test. This is also in part due to the fact that the values do not relate accurately to the impact strength of moulded parts or actual components under actual operational conditions.

Figure 6.3:Impact Testing Machine for Izod

Figure 6.3: Izod Test Specimen

5.5.Izod Testing Specimen

Cross section of rectangular bar- 10mmx10 mm

Length of rectangular bar- 75mm

Depth of a v-notch- 2mm

Distance of v-notch from end- 28mm from one end

6.EXPERIMENTAL WORK

6.1 CHEMICAL COMPOSTION OF MILD STEEL

Element(%)	Range
C	0.10 max
Mn	0.24-0.44
P	0.76-0.141
S	0.029max
Si	0.29-0.71
Al	0.09 max
Cu	0.32-060

6.2 CHEMICAL COMPOSTION OF STAINTESS STEEL

Element	Weight %
Carbon	0.03
Sulfur	0.01
Manganese	1.50
Aluminum	0.01
Calcuim	0.02
Titanum	0.02
Copper	0.30

7.RESULT

7.1.CHARPY TEST

SPECIMEN	ENERGY ABSORBED (jule)
Ideal specimen	25
Welded with stainless steel specimen	2
Welded with mild steel specimen	16
Welded with combination of stainless steel and specimen	5

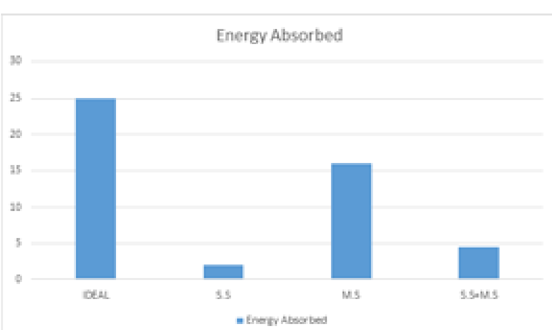

Figure 7.1 comparison of UTS of different welding paremeter

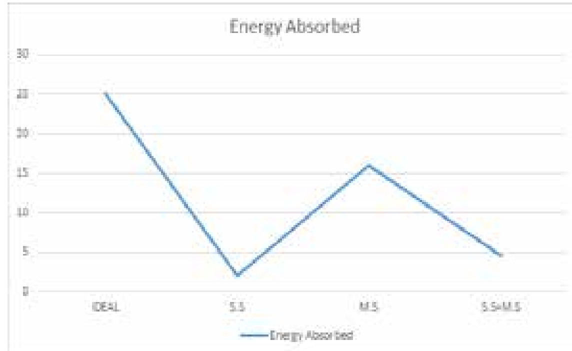

Figure 7.1 comparison of UTS of different welding paremeter

7.2. Result of Izod test

SPECIMEN	ENERGY ABSORBED
Ideal specimen	26
Welded with stainless steel specimen	8
Welded with mild steel specimen	17
Welded with combination of stainless steel and specimen	16

Fig:7.2Comparision *of UTS of different welding paremeter*

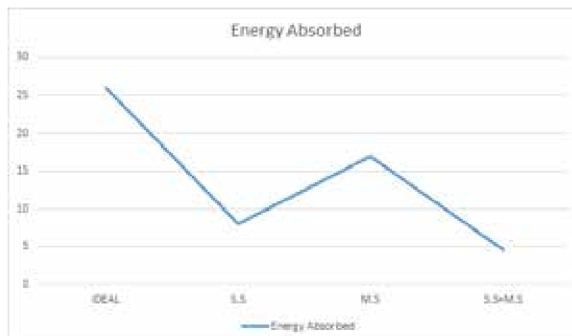

Fig:Comparison of UTS of different welding paremeter

8.Conculsion:

During the study,mild steel(without welding),mild steel and stainless, mixed steel were are testing izod & charpy process. the selection of different grades of stainless steel used for welding play an important role in deciding the properties of the weld. From the study, following conclusions can be drawn –

From the tensile testing experiment, it conclude that the ultimate tensile strength weld with stainless steel specimen is greater than the welded with mild steel and welded with combination of mild steel and stainless steel.

From the charpy testing, it conclude that the toughness is greater in weld with mild steel specimen than welded with stainless steel and combination of stainless steel and mild steel.

From the izod testing, it conclude that the toughness is greater in weld with mild steel specimen than welded with stainless steel and combination of stainless steel and mild steel.

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