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Research Paper Engineering

Comparative Study Of Strength Of A Welding Joint By Using Different Filler Material

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ABSTRACT

After study the various research papers we conclude that no one work is done on the testing of the tensile strength of TIG welding for different filler material(MS,SS and MS+SS). Mild steel is commonly known as plain-carbon steel Here, mild steel is used along with other steels so that a better comparative study should be done by testing the strength using different filler rods in UTM (Universal Testing Machine). In this project, TIG welding is selected to be done because of its new welding process which gives high quality welding and also due to its relatively pollution free property. The aim of this work is to study the tensile strength of mild steel metal by breaking it for TIG welding. In the whole process, different filler metals such as mild steel, stainless steel and also the combination of both of them are tested at UTM through welding. Then, a comparative study is done by comparing the strength by using mild steel metal and others using different filler rods.

KEYWORDS : Mild steel specimen, UTM (Universal Testing Machine), TIG (Tungsten Inert Gas), filler rod etc.

INTRODUCTION:

TIG WELDING:-

Tungsten inert gas (TIG) welding became an overnight success in the 1940s for joining magnesium and aluminum. Using an inert gas shield instead of a slag to protect the weld pool, the process was a highly attractive replacement for gas and manual metal arc welding. TIG has played a major role in the acceptance of aluminum for high quality welding and structural applications. In this project, concept of TIG welding is taken for steel like stainless steel, mild steel or combination of both of it so that the actual strength of any particular steel could be tested easily among all.

MILD STEEL:-

Mild steel is basically the most commonly used steel by many steel companies because of its cheapest steel availability. The Galvanized metro steel company is one of them. The reason of its so much popularity is not only its low cost but easy availability, yet weldable and while it rust easily, it is still a very long lasting product. This type of steel contains maximum of 0.29% carbon, and can be magnetized and utilized in nearly any project that necessitates using a great amount of metal.

TIG FILLER RODS:-

For TIG, filler rods are fed by using second hand as the first holds the tungsten torch. These rods typically come in 3-foot lengths and are packed in 10 or 50-pound boxes (or tubes). A welder's choice of diameter ranges from 1/16" to 1/4". Since the composition of the filler rod is the same as MIG, the same products are sold for TIG welding, under the category "TIG cut lengths.

UTM (UNIVERSAL TESTING MACHINE):-

UTM is also popularly known as' Material Testing Machine 'or 'universal tester'. This machine is basically used to test the compressive strength and tensile strength of the material. The "universal" part of the name reflects that it can perform many standard tensile and compression tests on materials, components, and structures. The reason Universal Testing machine is named so because it can perform all the tests right from compression, bending to tension and examine the material in all mechanical properties.

OBJECTIVE:

Preparation of sample for testing.

TIG welding is done using different filler material.

Testing of standard specimen on UTM machine.

METHODOLOGY:

Mathematical Formula:-

$L=5.56\sqrt{A}$ where L is length and A is area $A= (d*\pi*d)/4$ where d is the diameter

TIG WELDING METHOD:-

TIG welding is an arc welding process that uses a non-consumable tungsten electrode to produce the weld. The weld area is protected from atmosphere by an inert shielding gas (argon or helium), and a filler metal is normally used. The power is supplied from the power source (rectifier), through a hand-piece or welding torch and is delivered to a tungsten electrode which is fitted into the hand piece. An electric arc is then created between the tungsten electrode and the work piece using a constant-current welding power supply that produces energy and conducted across the arc through a column of highly ionized gas and metal vapours. The tungsten electrode and the welding zone are protected from the surrounding air by inert gas. The electric arc can produce temperatures of up to 20,000oC and this heat can be focused to melt and join two different part of material. The weld pool can be used to join the base metal with or without filler material.

UTM (Universal Testing Machine):-

Universal Testing Machine serves for conducting tests in tension, compression, bending and shearing for metals and other materials.

The testing machine is operated hydraulically. Driving is performed by the help of an electrical motor.

The machine is equipped with pendulum dynamometer, a recording device for registering load-deformation diagram. Load verification of

the testing machine meets the requirement of IS 1828-1975.

EXPERIMENTAL WORK:-

Work done is experimented with the preparation of standard specimen of the sample whose chemical composition and sample sizes are specified as follows:

CHEMICAL COMPOSITION OF MILD STEEL AND STAINLESS STEEL

Name of content	% of content
Carbon	0.16-0.18%
Silicon	0.40%
Manganese	0.70-0.90%
Sulphur	0.040%
Phosphorus	0.040%

	STAINLESS STEEL STANDARD	STAINLESS STEEL MATERIAL
Carbon (C)	0.035 MAX	0.016
Silicon (Si)	0.75 MAX	0.36
Manganese (Mn)	2.00 MAX	1.165
Chromium (Cr)	17-20.0 MAX	18.60
Sulphur (S)	0.03 MAX	0.002
Phosphorus (P)	0.04 MAX	0.023
Nickel (Ni)	8-13.0 MAX	10.11

Fig 1.Unbreakable and breakable specimen

SAMPLE DETAIL:-

Rod Diameter- 20mm

Rod length- 300mm

Tapper distance- 80mm

Tapper depth- 10mm

Result Analysis:-

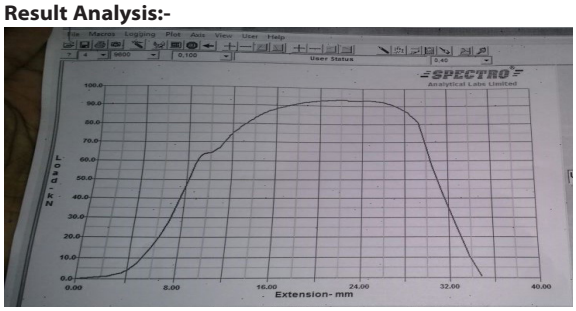

Fig 3.Strength of unwelded mild steel.

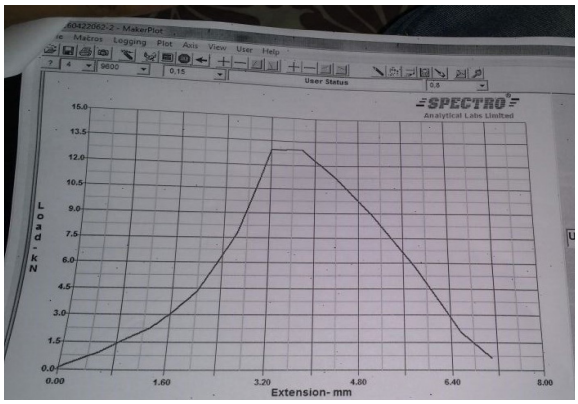

Fig 4.Strength of welded specimen by using stainless steel filler material

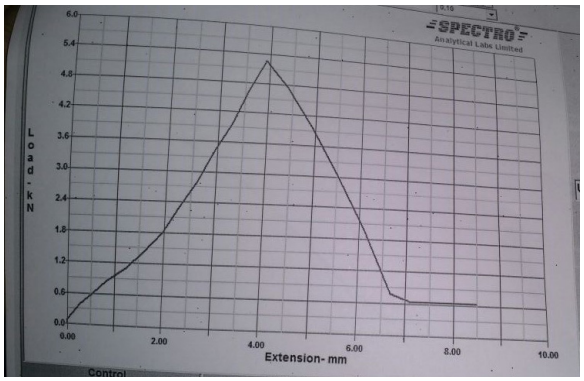

Fig 5.Strength of welded specimen by using mild steel filler material

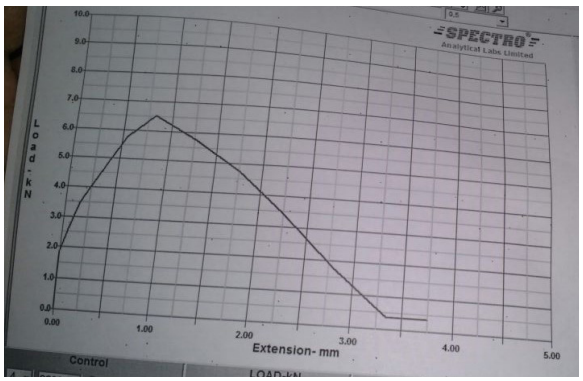

Fig 6.Strength of welded specimen by using mild and stainless steel filler material

Result Table:-

Filler material	Load (KN	Strain(mm)
Mild steel	5.27	6.40
Stainless steel	13.02	6.60
Mild +stainless steel	6.52	3.33

CONCLUSION:-

After doing this work we conclude that the stainless steel sustain higher load 13.02 kN and also give 6.60 mm strain which is higher to the mild steel and combination of mild steel + stainless steel.

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