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Investigation on the Impact Strength of MIG Welded Mild Steel Specimen

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***Abstract*—Impact strength, is the capability of the material to withstand a suddenly applied load and is often measured with the Izod impact strength test or Charpy impact test, both of which measure the impact energy required to fracture a sample. The testing of impact strength of mild specimen has been carried out using Izod testing machine. This paper meant to analyze the impact strength of welded mild steel specimen impact strength.**

***Keywords*—Mild Steel Speciment, MIG welding, IZOD Testing**

I. INTRODUCTION

Composition of **0.05%-0.25%** carbon and up to 0.4% manganese known as mild steel, it is a low cost material that was used for our impact strength analysis. Impact strength of material is meant for analysis of the toughness of the specimen. Toughness of specimen prepared according to AISI specifications was tested both without welding first then after welding. Toughness of material in physical sense gives the energy a specimen can absorb when affected with sudden load till failure. Izod impact testing is an ASTM standard method of determining the impact resistance of materials. An arm held at a specific height (constant potential energy) is released. The arm hits the sample. The specimen either breaks or the weight rests on the specimen. From the energy absorbed by the sample, its impact energy is determined which indirectly determines the toughness of specimen.

II. METHODOLOGY

A. Two mild steel specimens of 50*50mm were prepared for MIG welding. The filing of specimen was carried for proper joining and removing kimpurities at the surface.

B. Metal inert gas welding was carried out at current of 105A and voltage of 22V. The specimen was welded with consumable electrode making it more effective then TIG.

Metal Inet Gas Welded Specimen

C. After carrying out the required welding process, the notch was prepared of 2mm depth by means of shaper machine. Figure shoes the specimen after process.

AISI Standard Specimen for Impact Testing

D. The testing of the specimen was carried out in IZOD impact strength testing machine. The required specimen was fitted on to the machine and sudden load was applied on it.

III. OBSERVATIONS

The required dimensions of specimen were measured from Vernier caliper. The depth at notch was found to be 2mm and the breadth of specimen is 10mm. required area being $20mm^2$.

The Table1 shows measurement of impact strength of the specimen:

Table.1: Values recorded from the IZOD machine

S.NO	Loss of energy due to friction	Energy required to break the specimen	Impact Strength
	N-m	N-m	$N\text{-}m/mm^2$
1.	12	56	2.8

$$\text{IMPACTSTRENGTH} = \frac{\text{Energy required to break Specimen}}{\text{Area of specimen at notch}}$$

IV EXPERIMENTAL APPARATUS

The experimental setup for Izod sample testing is as shown in figure 1:

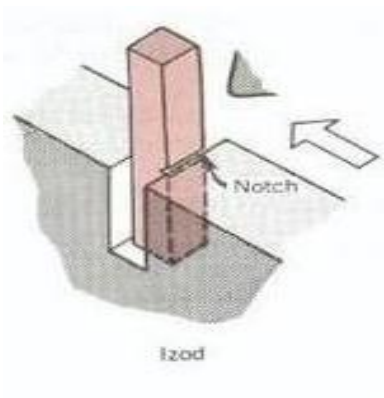

Fig.1: Schematic diagram of Izod Sample testing

The sample as shown is fitted in vertical position and the hammer is lifted and it hits the specimen with high potential energy. The hammer with its potential energy breaks the specimen. Below table 2 shows the IZOD Machine Specifications:

Table.2: IZOD Machine Specifications:

Pendulum drop angle	120°
Pendulum effective Wt.	1.3725 -4.575 kg
Striking velocity of pendulum	2.45 m/sec
Pendulum impact energy	0.42-1.4 kg-m
Scale graduation	0.005 -0.072 kg-m
Distance of axis of pendulum rotation from centre of specimen to specimen hit by pendulum	204 mm
Permissible by friction & wind age etc.	0.50% of impact energy

V MIG WELDING

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas(MIG) welding or metal active gas (MAG) welding, is a welding process in which an electric arc forms between a consumable wire electrode and the work piece metal(s), which heats the work piece metal(s), causing them to melt, and join. Along with the wire electrode, a shielding gas feeds through the welding gun, which shields the process from contaminants in the air. The properties of MIG Welding torch are shown in Figure 2 and Figure 3.There are four primary methods of metal transfer in GMAW, called globular, short-circuiting, spray, and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

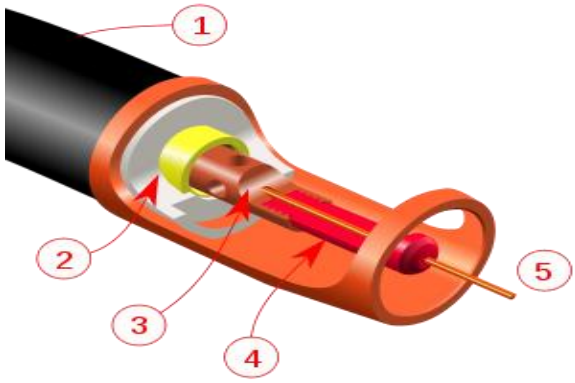

Fig.2:Schematic Diagram of MIG Welding Torch

1- Torch handle
2- Molded phenolic Dielectric and threaded metal nut
3- Shielding Gas Diffuser
4- Contact Tip
5- Nozzle Output Face

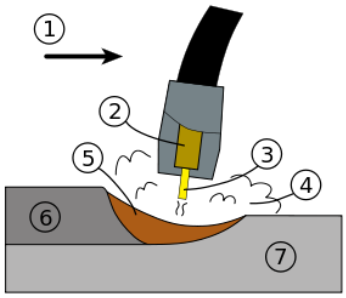

Fig.3:GMAW weld area. (1) Direction of travel, (2)Contact tube, (3) Electrode, (4) Shielding gas, (5)Molten weld metal, (6) Solidified weld metal, (7)Workpiece.

VI RESULTS:

The below figures shows the experimentation procedure of weldment samples .Figure 4 shows the welded Mild steel sample. It's a polished specimen after the MIG welding.

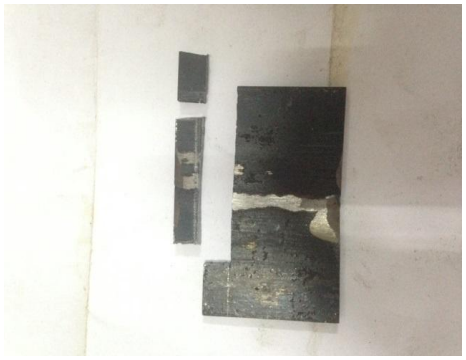

Fig.4: MIG welding of 2 samples in our experiment

Figure 5. Shows the sample ready after cutting it into required dimensions. The sample was polished and it was sent to milling machine for notch preparation.

Fig.5: Fabricated Sample according to ASME standard

Figure 6. Shows the prepared Mild Steel specimen. V notch has been prepared over the specimen for testing on the Izod Impact testing Machine.

Fig.6: ASME standard sample with notch for Izod testing

Figure 7. Shows broken specimen after completion of izod test. The impact strength of specimen was measured after test.

Fig.7: Sample after the Izod testing

VII RESULTS AND DISCUSSION

- Metal Inert Gas welding has been successfully used to join two mild steel samples.
- The IZOD machine is used to calculate the impact strength of the welded sample.
- Through the experiment, the energy required to break the specimen was estimated to be equal to 56 N.m
- The impact strength of the welded sample is hence found to be equal to 2.8 N-m/mm^2

VIII CONCLUSION

From the values recorded and the samples after testing obtained, we can conclude that the impact strength of MIG welded specimen is hence estimated by using IZOD Impact Testing Machine.

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