ORIGINAL RESEARCH PAPER

Volume - 9 | Issue - 6 | June - 2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MILD STEEL AND WELDING PARAMETERS AND THEIR IMPACT ON THE MATERIAL PROPERTIES THROUGH EXPERIMENTATION

Engineering

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ABSTRACT

Welding has been used for many years and has applications in various fields. Various kinds of metals are used in this practice such as mild steel. Mild steel has Carbon quantity at low degree. On the other hand, stainless steel has excessive carbon quantity which makes it tough. But it also makes it prone to corrosion. This study tries to assess the correct welding material parameters like welding process, parameter process, welding Sequence, preheats patterns, compression rate and composite information in order to match the base parameters such as hardness, impact strength, durability, minimum body strength, etc. A Piece of mild steel is cut into pieces and applied with various processes to make individual welding pieces with different properties. Then, those samples go through various kinds of tests to Measure the material parameters. Results showed that the processes had peculiar impacts on the properties of the material. This Experiments only studies Four Parameters for Four Materials.

KEYWORDS

Welding, Mild steel, Stainless steel, Materials.

1. INTRODUCTION

1.1 Importance and Applications of Welding

Initially, the financial significance of welding used to be on the whole identified for repairing all kinds of worn and corrugated metals. The economics and developments introduced about through the modern methods of reducing strategies and bone grafting methods have located them as a distinguished device in accomplishing design, building and restore purposes. Some of the plans are listed below. Instead of Broadcasting. Various sorts of machinery, which had been manufactured with the aid of casting, are now being manufactured and made into promotional materials. The base of the machinery, casings and struts are made of popular metal shapes and saucers that are rolled up and built-in with any of the metal casting processes. Riveting and bolting replacement. Welding is turning into greater and greater vital in the everyday assemblies of metals as it presents quicker and greater environment friendly meeting and at the identical time, the mixture structure is mild in weight.

1.2. Shielded Metal Arc Welding

This welding additionally acknowledged as metallic welding, arc welding, and is the utmost broadly used approach in distinct arc welding layers. Welding is carried out by means of electric powered arc heating which is stored between the give up of the inserted "metallic electrode and the work piece". By using the electrode code rod, the arc melts the base metal, heat are generated.

1.3. Mild Metal

Mild iron is a kind of metal, used in 85% of all steel structures in the USA. This textual content will speak about the houses of skinny metallic and shed mild on why it is genuinely known as 'gentle' and what it genuinely means.

1.3.1. What is Mild Steel

A moderate metal is a kind of alloy of steel that carries an excessive quantity of carbon as a giant surface. The alloy is made up of metals and non-metals, alloy have unique properties. The alloys allow us to set off a deficiency of pure iron with the aid of including different materials. To discover out what a slight metal is, one should comprehend what alloys are mixed to make a metal. So, let's seem to be at what we imply via metal, which will assist us to apprehend what slight iron is and additionally to apprehend the houses of moderate iron. Steel is any metallic alloy, along with "0.2% to 2.1%" carbon, as a bonding agent. In addition to carbon, there are numerous metals that are section of the metallic alloys. "Non-iron and carbon compounds", used in "iron chromium, manganese, tungsten and vanadium". All of these substances, as nicely as carbon, act as stabilizers. That is, they stop the unfold from going on in the crystals of iron and stop the layers of tennis as of slipping into one another. This is what makes metal more difficult than steel.

1.3.2 Cast Iron Structures

Mechanical traits of the steel decide its use. Some of the metallic constructions include:

- Hardness
- Tensile strength
- Brittleness
- Toughness
- Ductility
- Malleability

2. Problem Formulation

The Problem of Changing the structures used during the casting Process leads to direct and indirect structural imbalances, which can lead to repairs or reworking of a piece of work. This, in turn, upsurges manufacture costs and leads to delays. For industries, for example, the cost of reorganizing them as a straightforward one can cost money and time. The problem of structural change, therefore, remains a major concern for the Welding industry. To address this problem, it is important to predict the number of structural changes such as hardness, impact strength, durability, minimum body strength, etc. Throughout welding processes. When the strategies for predicting the variation of properties have been recognized, then the difficulties can be effectively managed. Inside welding processes various factors like the type of welding process, parameter process, welding sequence, preheats patterns, compression rate and composite information which contribute to the deviation of the welded construction. Significantly those constraints contain impact on the excellence of the weld and which parameter give the most important effect on the quality of the weld are major problems in the welding industry.

3. Experimental Analysis

This section teaches about various machines and materials such as "Welding Machine, Hardness Tester, Impact Testing Machine, Universal Testing Machine"as well as Additional materials old throughout research.

3.1 Welding Machine

The welding machine is made of high quality mechanical technology. With the IGBT power supply and PPM technology, the inverter converts DC voltage, which is adjusted from AC input voltage to high AC voltage, as a result, voltage is adjusted and adjusted. Therefore, the effect is much smaller for a large transformer and lightens the weight of the inverter welder, which scans the welding performance by 30%.

Fig.1: WELDING MACHINE (TORNADO 401)

Table.1: The technical specifications of this welding equipment are given below:

Input power voltage(frequency)(V,H)	Three phase380±10% 50/60 Z
Rated input power capacity KVA	14
Rated input current (A)	21
Rated output current (A)	400
Output current adjustment range(A)	50-400
Output voltage adjustment range(V)	16-36
Rated output voltage(V)	29
Rated duty cycle %	25-60
Efficiency %	85
Power factor COSÖ	0.93
Arc ending current(A)	50-400
Arc ending voltage(V)	16-36
Weight KG	56

3.2: Specimen for varying current

The welding current is the electrical amperage in the power scheme as the weld is organism made. The welding machine which we are using during research shows the current variation. With the help of the regulator given in the machine, we can control the current. During this research we select five values of current for the observations.

Fig.2: Varying current Specimen

3.3: Specimen for varying Welding Speed:-

Welding speed shows the distance of a torch moving through a weld line/ time. In this study, five standard welding speeds were investigated while considering some of the intermediate-level parameters. The table shows the five different speed values used.

Fig.3:Varying Welding Speed Specimen

4. Specimen for Varying Heat Input:-

Welding is most significant procedure parameters in the management of weld responses. It can be called the electric energy provided by the arc that is heated to an object.

In operation, however, the heat input can be balanced (e.g., if the arc performance is not captured Consideration) is expressed as a measure of the arc power provided by the electrode Arc travel speed, as exposed in the subsequent equation:

$Q = I \times V \times 60 / v$

Here, v-arc welding speed, V- Welding arc voltage, I - welding current, Q - Heat input

Fig.4: Varying Heat Input Specimen

4.1: Various Testing

After preparing a sample of various parameters, the next stage is to perform a variety of tests. For this a variety of considerations are cut into these composite piece.

4.2: HARDNESS MEASUREMENT: The following is the most common method of hardness testing used in modern machinery:

1. Rockwell hardness test
2. Brinell's toughness
3. Vickers
4. Knoop hardness

4.3: Rockwell Hardness Test

This test is a measure of hardness based on a complete upsurge in thinking when loading a load. Hardness numbers have no units and are usually given on the R, L, M, E and K scales. An increase in the number on each scale means that things get more complicated. Hardness is variously defined as resistance to intrusion, initiation, mechanization, wear or tear, and retraction. The multiplicity of meanings, and the relative multiplicity of the weighting tools, as well as the lack of basic definition, indicates that hardness may not be the basic material, but rather a combination of strength, stiffness, strength, modulus of elasticity, and others. In the Rockwell method of hardness testing, the depth of indenter penetration under certain test conditions is determined.

Fig.5: Hardness Tester

There are numerous Rockwell scales besides the "B" & "C" scales, (called standard scales). Some scales also utilize the character of the scale mark addition, as well as several utilize a diverse metal indenter. The Rockwell design used correctly will have a hardness number followed by "HR", which will be followed by another book that shows a particular Rockwell rating. An example is "60 HRB", indicating that this color has a hardness reading of 60 on the "B scale". There is a second "Rockwell tester" called the "Rockwell Superficial Hardness Tester". This machine works similar to a Rockwell tester, but is used to test thin strips, or soft spot surfaces, small parts or parts that may fall under standard test conditions. The Superficial tester uses a small reduced load, only three pounds, and the maximum load is reduced to "15 or 45" kilometers reliant on the indenter, which is the same material used on standard scales. Using a 1/16 "size, iron ball indenter, "T"(meaning a smaller sheet test) is applied to the mass display.

5. 8Microstructure Testing

5.1: Preparation of Microstructure Samples:

After installing the straps the soft pieces are provided with the upper end by filling. The composite pieces are cut from a power hacksaw. The welded part of the welded material is so large that it contains single weld beads and high penetration. After the cutting of the power hacksaw as shown above the sample is cut in such a way that the weld beads are always in the center and can be held in good hands by continued operations. After that the installation work is distributed to all faces of the sample weld bead. After filling with the help of "hammery paper" the process of haming was performed.

6. RESULT & DISCUSSION

As a result of tests and study we can conclude the result of several procedure parameters on the "properties of mild steel". In this experiment we select the four parameters and reflect their impact on "hardness, impact strength, thermal strength and microstructure".

The several procedure parameters which we choose:-

1. Welding speed
2. Welding current

3. Arc Force
4. Heat Input

For the dissertation, the study reflects the above parameters on the following "properties of mild steel".

1. Impact strength
2. Hardness
3. Tensile Strength
4. Microstructure

Effect of Current on Hardness

study the impact of the current presence on the complexity we took values for the present time and read its effects on the complexity. The table provided with the graph represents the difference of current and current. Let us deliberately make the complexity of the weld bead, the hot-spot and the inaccessible

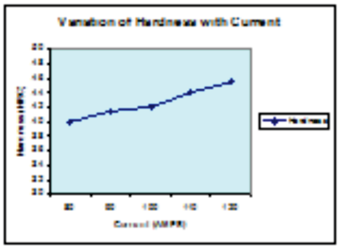


Fig. 6: Graph between Current and Hardness of Weld Bead.

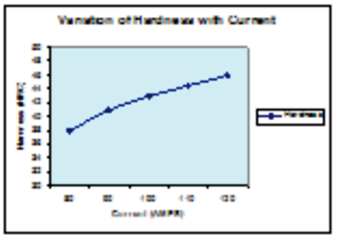


Fig. 7:Graph between Current and Hardness of HAZ.

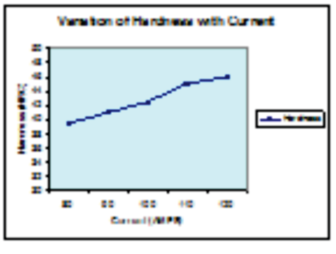


Fig. 8: Graph between the Current and Hardness of Unaffected Zone.

Effect of Heat Input on Tensile Strength

By taking the five values of heat input, we will study the effect of "heat input on tensile strength" as shown in table below-

5.12 Table for Heat Input and Tensile Strength

Sr. No.	Heat Input (Watt)	Tensile Strength (N/mm2)
1	1700	419
2	1950	449
3	2250	463
4	2400	474
5	2600	497

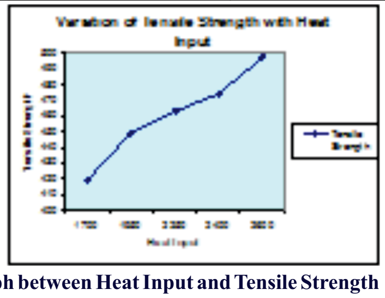


Fig 9: Graph between Heat Input and Tensile Strength

Effect of Arc Force on Hardness

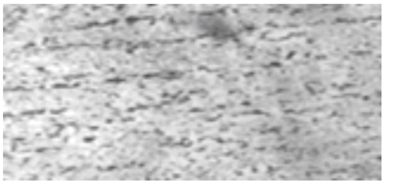
To study the current impact on hardness of the hardness we took Values of welding speed and studied the effects of hardness. The table provided with the graph represents the deviation of the merger with the current. Let us consider the hardness of the weld bead, the working surface and the inaccessible surface.

Table for Arc Force and Hardness

Sr. No.	Arc Force	HARDNESS (HRC)		
		WELD BEAD	HAZ	UNEFFECTED ZONE
1	80	45.5	44	39.5
2	85	41.5	46.5	43
3	90	44	47.5	45
4	95	45.5	44	49
5	100	39	46	43

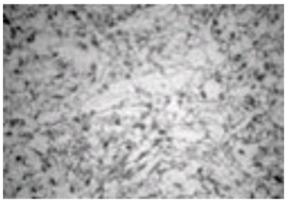
Testing Result of Microstructure

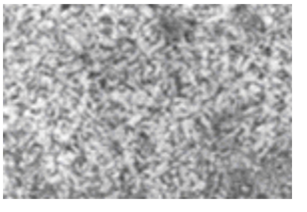
On microscopes that are equipped with inbuilt cameras, microstructure tests are performed. Throughout this study the microstructure only for current variation is investigated. Here we are taking 5 values of current for investigating the microstructure. The figure shown below shows the change in microstructure due to change in current. As shown in fig. there are a microstructure of base metal and the microstructure shown in the figure shows "ferrite grains" and small amounts of "perlite at the grain boundaries".



5.21 MICROSTRUCTURE OF BASE METAL

The presence of pearl site appears with a minute amount of martensite resulting in a small increase in hardness





7. CONCLUSION

This study assists in calculating the proper parameters for welding in the Shielded Metal Arc Welding procedure. Through out study the change in hardness, impact of strength, corrosion strength and microstructure at numerous stages of the procedure are examined. The physical values and characteristics of these structures are dissimilar which indicates that throughout the heating process there are certain changes in the material conditions. In the previous arc force and heat input are 2 categories that we didn't deliberate through out the heating process. But these components have a real impact on the quality of the welding that can be seen from the discussions above. The given conclusions are drawn from the overhead study.

1. Increase in hardness and a slight decrease in the strength of the force and the tensile strength as the current rises.
2. The microstructure varies with increasing current. Initially "mild steel" have "ferrite and Pear lite" at grain boundaries. As current ferrite concentrations are transformed to Cementite and marten site.
3. Upsurge in hardness and an increase in the impact strength and tensile strength with accumulative speed of welding.
4. Slight up surge in the stiffness and impact of the tensile strength with increasing arc strength

8. FUTURE SCOPE

There are also many future dimensions with arc welding research. At the time of this study only 4 parameters were researched for the 4 materials. Likewise other parameters may be researched for the same properties as well. The effect of procedure parameters can be investigated in other softening procedures as well.

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PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

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