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EFFECT OF WELDING ON MILD STEEL MATERIAL ON ITS MICROSTRUCTURE AND PROPERTIES

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ABSTRACT

As the change in the technology in day todays requirement of the different types of structures are needed. To obtain the required shape and size of the model joining of the materials also became important aspect. There are different types of joining process and welding one of them. Though there are different types of welding process are available but all have their own advantage and disadvantages. Here in this study we are using arc welding procedure to join a metal of industrial low carbon steel. This is the basic study of changes in the microstructure and properties due to the heat generated and the heat affected zone during the welding process. In olden days forging was also one of the joining process.

keywords: *forging, welding, grain structure, haz*

I. INTRODUCTION

Welding is a type of joining process., usually joins metals and also a form of thermoplastics. In this process melting of the base metal takes due to the high heat generation during the welding process. A filler material is used to join the metal by forming a pool of molten metal. When it cools it forms the joint and it becomes stronger in strength than the base metal.

Welding process can be done in different type of environments such as open air, under water etc. during welding process some precautions have to be taken in order to avoid damages to human as high heat is produced and the intensity of the arc is high and also it produces fumes which may be hazardous to human beings.

Till the 19th century one of the common type of welding process was forge welding, which was employed by the blacksmiths to join iron and steel by the involvement of heating the metal and hammering it. After this decade a new type of technology emerged that is arc welding and oxyfuel welding. In most welding is preferred for joining metals. And the mechanical properties and the microstructure depend on the composition of carbon content and the addition of the other element. In this study we have chosen low carbon steel which is Having 0.25% carbon because this material is easy to weld without any special tools. As per the previous study pertaining to the low carbon steels, Zakaria et. al[1] have studied the change in grain structure as well as mechanical properties. Gural et.al[2] have studied the effect on the microstructure and strength after welding.

But for this study we utilized electrode 6018 to weld two metal piece and electronic microscope utilized to view the microstructure.

II. METHODOLOGY

Two flat plate pieces of low carbon steel metal is choosen of dimension 50x30x5mm. it is welded by 6018 electrode in single pass weld at a normal speed. Later same another set of metal pieces were joined with same electrode in a single pass but at slower speed.

For the observation of metallographic the part is passed through different process. Firstly the specimen is cutted with dimension 20mm of lenth for observation. Then it is carried out for the surface finish with different coarse of emery paper such as 1/0, 2/0, 3/0, 4/0.

After the process of emery paper it is polished on the disc polishing machine and then it is itched with 2% natal for 15sec and so microstructure of the metal and weld defined.

The composition of the low carbon steel is shown in the table 1. And the composition of the 6018 electrode is shown in the table 2.

Table 1. Composition of Mild steel

C%	0.19
Si%	0.25
Mn%	0.4
Nb%	0.05
Al%	0.09
Mn%	0.009
P%	0.025
Ti%	0.03
S%	0.015

Table 2. Chemical composition of electrode 6018

E6018	%
C	0.028
Mn	0.560
Si	0.330
P	0.016
S	0.010
Ni	0.022
Cr	0.047
Mo	0.01
V	0.014

Table 3. Mechanical Properties of Metal deposition

Yield Point Rel(Mpa)	400
Tensile Strength Rm(Mpa)	500
Elongation A5 (%	25
Akv Value (J)	95

Figure 1. Parts of welded plate which is used for study

Figure 2. Cutted part for the study

III. RESULT AND DISCUSSION

In this study firstly we studied the microstructure of the base metal and the microstructure of the after welding, so the effect of microstructure is illustrated.

3.1 Base metal Structure

As per observational result of the base metal comprise of ferrite and region of pearlite (α-Fe+Fe_3C) at the edges as shown in fig 3. The pearlite bands are observed as shown in fig 4. Which is due to the presence of Mn in the zones.

3.2 Structure after welding

As we know heat will affect the structure of the material, to emphasize it we observed the change in the structure in optical microscope. Zakaria et al[1], has shown the elongationof ferrite grains which is due to heat flow. And joints are of presence of large grains at the fussion line.

Now at the heat affected zone a particular type is observed that is widmanstatten ferrite and some pearlite which is called as solid state phase transformation. At the heat affected zone it contains larger grains as compared to base metal. After the heat affected zone there exist two phase. At the first phase i.e high temperature change of δ-Fe to γ-Fe and the another one is change of γ-Fe to α-Fe [7].

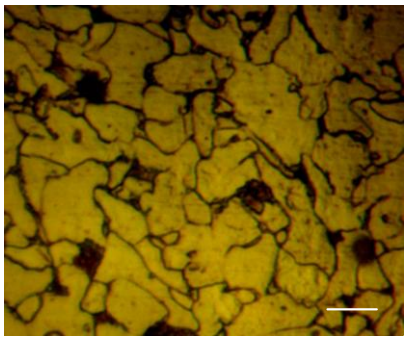

Figure 3. Microstructure of MS plate

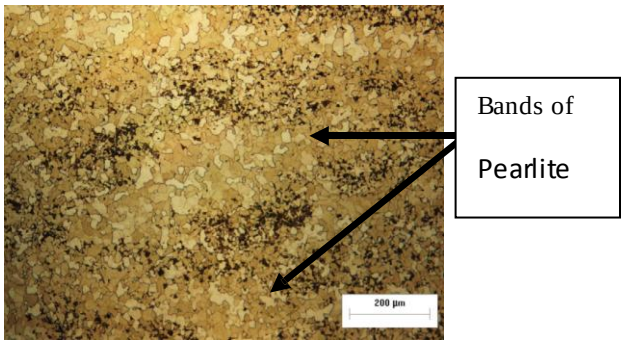

Figure 4. Microstructure of MS plate in base metal

As per the welding process, the effect of it at different parts varies and the hardness testing is the usual approach. As per the many researchers to know the main effect is can be done by the hardness testing. By the hardness testing at a values of 195-240 HV. One of the researcher though observed highest value [2]. In thid study the hardness is affected by the type of electrode deposition and type of welding process is odopted.

IV. CONCLUSIONS

This study represents the arc welding effect on the Mild steel plate. The deposition rate also effect the generation of the heat affected zones. As the time taken more then the transformation of the heat will be more on

the plate which effects the grain structure near the weld metal, and which prolongs the heat affected area. And due to this heat involvement on the plate, the strength changes and the widmanstatten is present in the heat affected zones.

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