

Experimental Study of Shielded Metal Arc Welding Parameter on Weld Strength

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Abstract— shielded metal arc welding is the most commonly used process of joining two similar and dissimilar metals in small scale industry. It is very ease in operation. The obtained joint strength is high and less discharge of metal is done in this process. The various parameters are welding area unit, fastening current, polarity of conductor, angle of conductor. RESPONSE SURFACE METHODOLOGY (RSM) based model is employed to increase the weld strength.

Keywords: Response Surface Methodology (RSM), Shielded Metal Arc Welding (SMAW), Weld Strength

I. INTRODUCTION

Welding is a joining process pf similar and dissimilar metal both by using heat and pressure etc. This process was originally referred to simply as metal arc welding but currently the term SHIELDED METAL ARC WELDING (SMAW) has been substituted. The SMAW sometimes requires application of pressure and sometimes not.

During welding through SMAW, the filler material is not always required but sometimes it cannot be avoided. The welding of metal is done in plastic condition. When the two pieces to be joined is brought together and those are heated up then edge melts and weld pool formation takes place and after cooling the metal the work piece get jointed the metallic bond between them.

The joint gets stronger, when weld pools cools down. SMAW is usually used in steel industries, construction, mechanical and all other automotive sectors.

Shielded metal of arc welding is most commonly used process over all other welding process because of its relevancy, compatibility and all other parametric reviews. For melting the weld metal between plates and the heating source is electric arc. SMAW is like oxy-acetylene welding, a fusion welding process.

The electrode is covered with a coating material known as flux. The decomposition of material is prevented by shielding of coated material. This shielding controls the mechanical, electrical and metallurgical properties of weld metal. The flux in the coating melts and intermingles with the molten metal protecting it against oxidations. The flux forming slag with the oxide deposits on surface of bead and protects the bead, while hot from oxidation.

Cooling rate in shielded metal arc welding is always high. The blanket of slag tends to reduce it but only to a limited extent. To a limited extent it refines the grain structure as well.

SMAW is used for stainless steel, cast iron and ductile iron. While as in case of it is used in nickel based, aluminium based and in non-ferrous alloy welding. Sometimes the welding is depend upon the skill of welder and thickness of fabrics which is being welded. Welding

speed depends upon the voltage applied. The welding electrode diameter is usually taken as 2.5 to 6.5 mm.

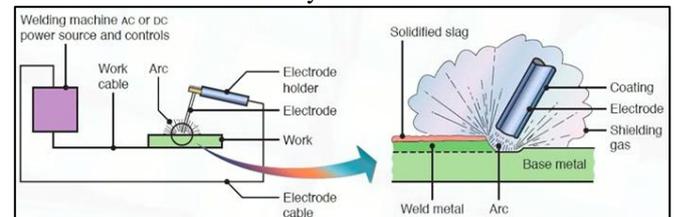


Fig. 1: Shielded metal arc welding

Depending upon the talent of welder shielded metal arc welding speed may increase in forehand/downward process while as lower speed in backhand/upward welding.

Here in shielded metal arc welding, the welding strength is very important requirement in welding joint. Higher the strength rate, higher the lifetime will be. The load bearing capability totally depends upon welding strength. There is drawback of weak welding is that, less load bearing in automobile industry, therefore the fastening strength is primary need in shielded metal arc welding. Keeping the stability of heat sources the fastening strength can be improved, shielding also can improve welding strength of material.

II. LITERATURE REVIEW

Rajeev anjan Et & ALL the goal during this paper is on the point of , optimize varied parameter for shielded metal arc welding , including attachment current , voltage , speed , by developing a mathematical model for a sound weld deposit space of steel specimen, the factorial style has been implicit to finding varied method and parameter , the study disclosed that the weld deposited space varies directly with attachment voltage and attachment current & inverse relationship between speed and weld deposited space(1)

Pravin kumar Et& ALL - during this paper the author exploitation shielded metal arc welding attachment method investigated the lastingness of the fabric with a brand new idea of vibration that is capable to stir the melted metal before it solidifies . The result shows that the stirring of melted metal will increase the attachment strength of the fabrics (2)

Raffi Mohammad Et & ALL -In this paper the author uses SMAW , GTAW , FSW , EBW welding to correlate the micro structural changes and mechanical changes byeach type of welding on nickel free high stainless steel(3)

Senthur Prabua , Atin Jaina , Akhil Gopinatha, N. Arivazhagana Devendranat, Ramkumara , S. Narayana - during this paper author they created a shot to research the mechanical properties of primary solid solution steel exploitation SMAW attfachment(4)

R.P. Singh R.C. Gupta S.C. Sarkar Et & ALL, This paper focuses on simple and accurate model for prediction of weld beads of butt joint by SMAW process. The impact of longitudinal field of force generated by magnet on weld dimension was through an experiment investigated (5)

Talabi, S.I., Owolabi, O.B., Adebisi, J.A. yahaya , T In this paper the researchers investigated the mechanical properties on 10 mm thick low steel plate , by victimisation protected metal arc fastening parameter supply the fastening sample were cut and machined to plain configuration for tensile , impact and impact hardness tests(6)

Nagesh Et & ALL - In this paper the author explore the SMAW welding process that the most important phenomenon such as bead width and penetration are mostly get affected by welding current , welding voltage , arc travel speed (7)

III. EXPERIMENTAL WORK

From experiment it is clear that the welding of steel can be done by using many process such as gas tungsten arc welding, gas metal arc welding welding and many more techniques. But by using gas welding and shielded metal arc welding process on the steel changes its mechanical and all other properties. Here after the welding of steel specimen we need to check the properties, in this case if any property change is found during welding of steel specimen then by many methods it is try to minimize the property change of steel. Here the main focus is on the minimization of property change of specimen. There is various type of changes occur such as microstructural change, macro structural change and others also. To examine the microstructure of shielded metal arc welding and gas welding on specimen in order to minimize the microstructural and microstructural and cold cracks of weldment.

The rolled plates of steel with thickness of 5 mm were cut to the required dimensions (100 mm × 150 mm) by abrasive cutting to prepare the joint configurations. The chemical composition of parent metal is presented in Table 1. The microstructure of parent metal is composed of ferrite with small amount of pearlite. The basic classification of Mn and Ni base E 8018-C1 with nominal composition of 0.06% C, 1.8% Mn and 2.5% Ni electrode was used to weld the naval grade steels. The welding conditions and parameters used to fabricate the defect free joints are presented in Table 1, Table 2.

Rotational speed/rpm	600
Welding speed/(mm·min ⁻¹)	30
Axial force/kN	15
D/T ratio of tool	5
Tool shoulder diameter/mm	25
Pin length/mm	4
Tool inclined angle/(°)	0
Heat input/(kJ·mm ⁻¹)	1.056

Table 1: FSW conditions and welding parameters.

Parameter	SMAW
Filler metal (electrode)	E 8018-C1
Filler diameter/mm	4
Current/A	152
Voltage/V	25

Welding speed/(mm·min)	153
Electrode baking temp.(degree celcius)	300
Co ₂ gas flow rate (L·min)	12
Heat input(Kj·mm)	1.489

Table 2: SMA and GMA welding conditions and parameters.

A. Tensile and impact toughness properties

The tensile properties of the parent metal and welded joints areas. The yield strength and tensile strength of parent metal was 438 MPa and 610 MPa, respectively. But the yield strength and tensile strength of FSW joint are 502 MPa and 664 MPa, respectively. Similarly, the yield strength and tensile strength of SMAW joint are 473 MPa and 578 MPa, respectively, which are 5.2% lower than those of parent metal. Percentage of elongation of parent metal is 29%, whereas the percentage of elongation of SMAW joint is 22%. This suggests that there is a 24% decrement in ductility due to SMAW process.

IV. RESULTS AND DISCUSSION

In this era of welding, there are many materials spectrum used in industry. However investigation of such a whole materials would take a lot of time, only some steels (plain carbon steel, alloy steel, and stainless steel) and aluminium from light materials are being selected in the work forum. By using newly developed technology the joining of aluminium work piece possible through SMAW likewise steel. While joining of aluminium work piece is preferred by using tungsten inert gas welding and metal inert gas welding, due to shorter welding period, obtaining better weld strength and at low production cost.

Here by varying the welding current welding of work pieces can be done of varying thickness that means for low thickness work piece low amperage current is used and high amperage current is used is used for high thickness work piece. The weak and unsatisfactory welding occurs when there is low amperage current is used and sticking of electrode to the work piece occurs, while as when high amperage current is used then melting of work piece occurs and some distortion can be seen on the work piece which is to be jointed.

V. CONCLUSION

The weld ability on the basis of tensile strength of shielded metal arc welding and oxy-acetylene gas welding weldments of mild steel were studied, and its shows the yield strength and ultimate tensile strength of shielded metal arc welding are better than that of gas welding . The experimental result shows that % elongation of shielded metal arc welded work piece to parent metal is very large (54.32%) as compared to gas welded work piece (11.12%).

So we see that results of shielded metal arc welded work piece are for better than those of gas welded work piece.

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