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Effect of Oxygen Content Chemical on the Gas Metal Arc Welding

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ABSTRACT

This investigation is to analyze "effect by using oxygen content chemical on mechanical i.e. Penetration & hardness Properties of material. Using the gas metal arc welding process". Effect of welding current, voltage and gas flow rate weld material having 8mm thickness of material (IS2062). During this two different types of chemical powder is used Tio2 and Sio2. After the welding sample are subjected to the testing such as penetration test and the hardness test. The oxidized chemical Tio2 and Sio2 are effective for gas metal arc welding. Depth Vs. width ratio is highest claimed under oxidized chemical Tio2 and Sio2 as we compare it with normal gas metal arc welding.

Keywords : Oxygen content chemical, Gas metal arc welding, IS2062 material, Tio2 and Sio2 chemicals.

I. INTRODUCTION

In this welding process parameter like current, Voltage and Gas flow rate, welding voltage, welding speed, torch angle and other machining parameter selected for economics of welding. Instead of all these parameter we fixed at the optimum and standard level and we apply flux on the welding portion we will get better penetration at this situation and also we will get the effect on the hardness with the high quality of weld. M. Takana studied the effect of surface active elements on weld pool formation using gas tungsten arc welding arcs oxygen and halogen elements with high electron affinity. H. Hirata et.al. Studied effect of chemical composition on welding in fabrication of high alloyed steel. The effects of (S, Se, Te, Si and Mn, Al upon the weld bead). R. I. Hsien et. al. studied effect of minor elements and shielding gas on penetration in gas tungsten arc welding.

Metal inert gas welding (GMAW) is an arc welding process that joint two separate pieces material with the application of heat and joint together. Generated arc create a molten metal and that fill in the gap between two joining material. Material cooling i.e. natural air, water cool or any other method get solidify and join form in between two different pieces, that join is permanent.

In the process of arc welding in which metal inert gas welding various parameter should be consider while welding such that thickness of material, current, voltage requirement so that the desired output we get.

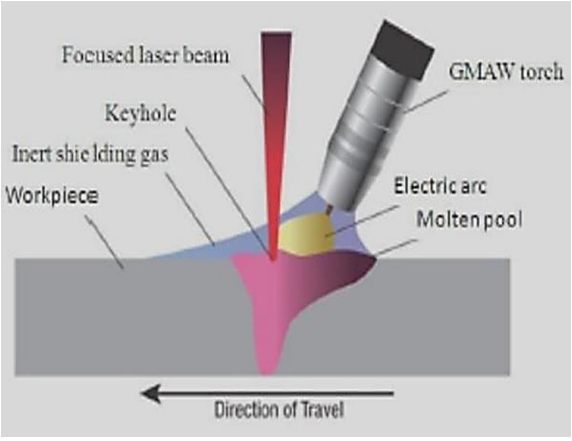


Figure 1. Gas Metal Arc Welding

II. METHODS AND MATERIAL

Mild Steel-
The chemical composition and properties of the material are as follows-
Physical Properties

1. Hardness in HRB-90-91 [210 HV]
2. Tensile Strength-649.66 N/mm^2
3. Yield Strength-540.88 N/mm^2
4. Percentage Elongation- 11.79
5. The tests were conducted on steel strip of 8 mm thickness sample

Areas of Application in the field of welding -
The tank and vessel industry consisting of boilers, pressure vessels, other storage tankers. Its ease of availability and ease of weld ability makes it suitable for the use of many more applications related to welding.

Chemical Composition Table-

SR NO	NAME OF CONSTITUENT	PERCENTAGE %
1	Carbon	0.20
2	Nickel	0.01
3	Phosphorous	0.035
4	Manganese	0.65
5	Molybdenum	0.002
6	Silicon	0.23
7	Chromium	0.02
8	Suplhur	0.026

TABLE 1

Selection of material

1. ASTM (A36) IS2062 Carbon steel
2. It is also known as Plain carbon steel
3. It contain carbon 0.05 to 025%
4. Malleable and ductile in nature
5. It is having good weld ability
6. It is used in high pressure vessel and boilers
7. It is also used in manufacturing various parts in machine
8. It has low tensile strength
9. It is having high fracture toughness
10. It is having melting point 1300^{0}c to 1400^{0}c Density of material is7.85g/cm^2
11. Young's modulus 200 GPA

III. BASIC PRINCIPLE OF GMAW PROCESS

MIG (Metal inert gas welding process) in this process important parameters are Gas flow rate, rate of material deposition, current, voltage, torch angle, gas combination required for the material .

WELDING PARAMETERS

Variable

- Current- recommended 130A (results taken at 100A, 125A, 150A)
- Arc voltage- recommended 25V (results observed at 20V, 25V, 30V)
- Gas flow rate- 15L/min(results observed at 12L/min, 14L/min, 16L/min)

Surface active elements/flux (SiO2 , Tio2, MgCo3, Al2O3, MgO, Cr2O3)

Fixed

- Filler wire diameter – 1 mm
- Wire speed-5m/min
- Welding speed-20cm/min
- Filler wire-ER70s

Input Parameter	Range
Current	110A-150A
Voltage	20-28 V
Gas flow rate	12-16 lit/min

TABLE 2

ACTIVATED FLUX

3.1 Flux and acetone liquid

- Inorganic powder suspended in organic solvent.
- Other flux material contains oxides and halides (chlorides and fluorides).
- Any compound which liberates either Oxygen or Sulphur in weld puddle can be treated as activating flux.
- 150-200ppm oxygen in molten weld puddle acts as surface active element and reduces the surface tension.
- Electron affinity elements such as halides used as flux increases the heat density by arc constriction.
- Combined effect of arc constriction and ad reverse flow yields high penetration.

IV. EXPERIMENTAL PROCEDURE

In the experimental procedure first of all clean the joining plate. the placed together and the proper proportionate mixture of the acetone and the activating flux is prepared in the form of semi solid paste. So that the mixture is easy to apply on the welding plate with help of brush.

Acetone is the evaporative like petrol, that will evaporate and only the layer of the flux adhering to the surface of the material to be welded. Figure is a self explaining the phenomenon of TIG welding with activated flux. The thickness layer of the flux is less than 0.3 mm.

The mean quantity of flux was constant at about 0.2– g/m. Now, we have developed the activating fluxes for stainless steel and carbon steel. It can increase weld penetration by as much as three times. Possibility produce single-pass square-groove full penetration welds up to 12 mm without lining, as shown in

The application of flux.

Step 1-The raw material is first cut off in required sizes through a bench cutter

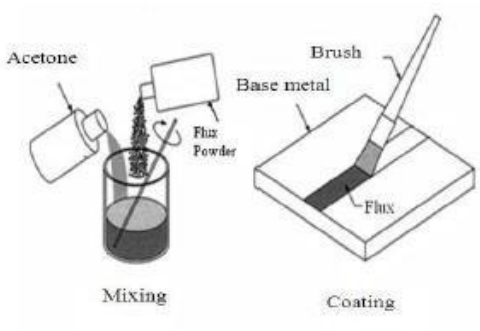
Step 2-The burr is then removed from the specimens through grinding on a bench grinder to that smooth contact surface is ensured.

Application of flux between two plates to be welded

Step 3-To ensure highly smooth contact surface the surfaces are then buffed through buffing wheel.

Step 4-Once buffing operation is performed then acetone is applied over the surfaces so that any dirt, dust particles are removed from the surface.

Step 5 - The plates to be welded together are places adjacent to each other and the portion on which the welding is to be performed is once again cleaned by acetone mixture.



Method of applying flux

Step 6-At the same time proper mixture of acetone and activated flux-SiO2 is prepared and it was ensured that the mixture is uniform and at the same time should be in a position that it can be easily applied over the two surfaces.

Step 7-The mixture was then applied over the surface with the help of brush and proper time was provided so that the acetone mixture was evaporated, or else if the welding is started soon after application, there is chance of catching fire as acetone is highly flammable.

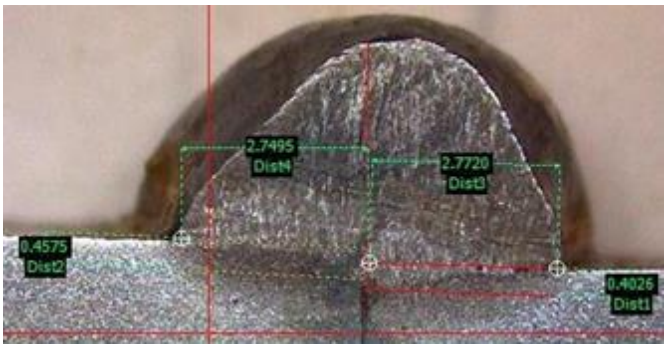
Step 8-Thus after 5 minutes of application of flux the parts were welded

V. RESULT AND ANALYSIS

RESULT

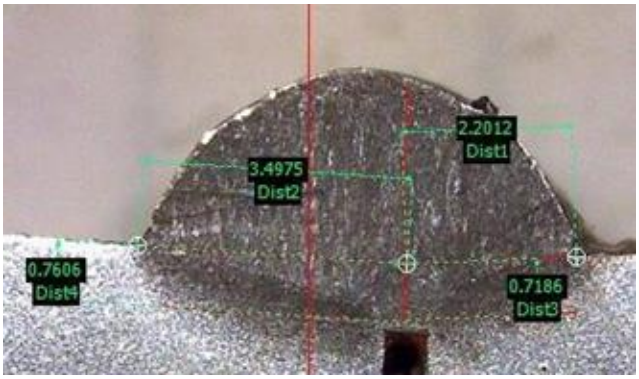
The following input were provided during the welding on the specimens by using SiO2, Tio2 flux which are used during the welding

Sr. no.	Welding Current Ampere I	Welding Voltage Volt V	Gas Flow Rate Lit/min L	Without flux A (mm)	Flux Tio_2 B (mm)	Flux Sio_2 C (mm)
1	100	20	12	0.43005	0.9523	1.6606
2	125	20	14	0.9976	2.2144	1.15124
3	150	20	16	1.2235	1.0245	3.3702



A1

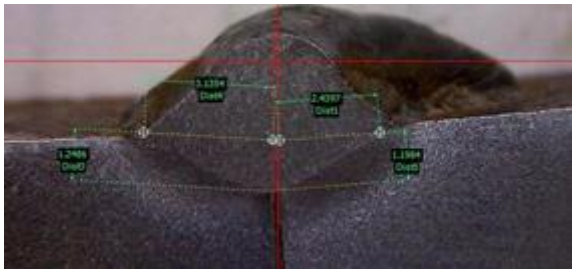
Penetration - 0.43005 Hardness Base Metal-198 At HAZ area-223



A2

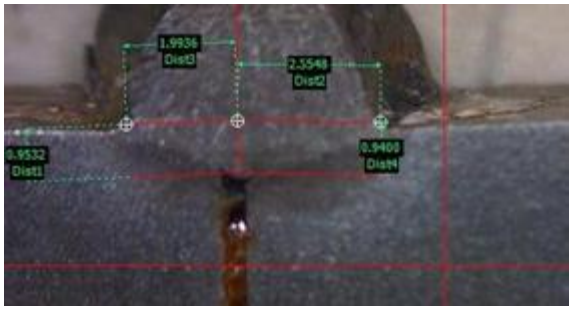
Penetration - 0.9976

Hardness Base Metal-195 At HAZ area-258



A3

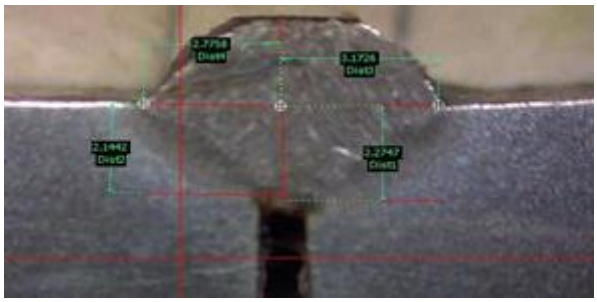
Penetration – 1.2235 Hardness Base Metal-216 At HAZ area-256



B1

Penetration - 0.9532

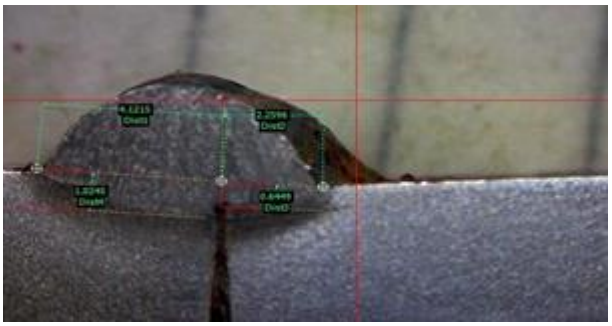
Hardness Base Metal-207 At HAZ area-241



B2

Penetration – 2.1442

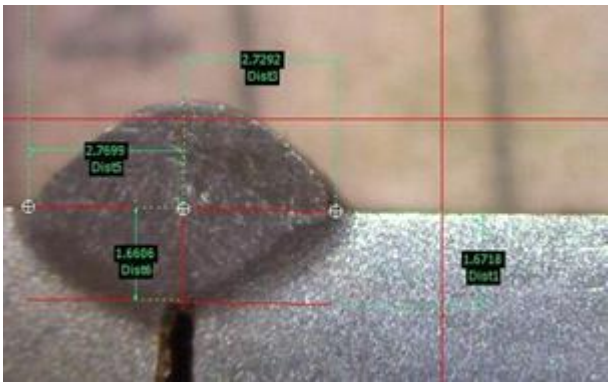
Hardness Base Metal-231 At HAZ area-258



B3

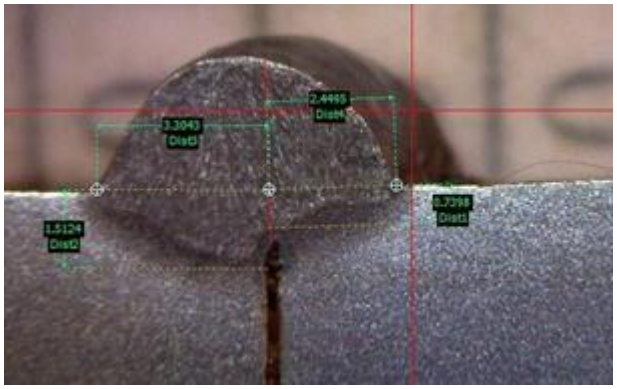
Penetration – 1.0245

Hardness Base Metal-224 At HAZ area-238



C1

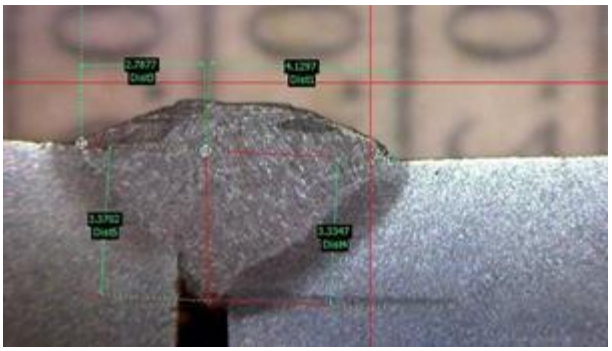
Penetration – 1.6606 Hardness Base Metal-198 At HAZ area-223



C2

Penetration – 1.5124

Hardness Base Metal-226 At HAZ area-261



C3

Penetration – 1.0245

Hardness Base Metal-224 At HAZ area-241

VI.CONCLUSION

This study discusses the effect of best process parameters and activated flux on the material IS2062 at 8 mm thickness. Selection of process

parameters is on basses of literature review and economical suitability of industrial application.

1. Activating flux is most effective for GMAW process to increase penetration as well as strength.
2. The fluxes TiO_2 and SiO_2 depth of the penetration and welding area improved as well as tensile strength and hardness of the GMAW joint also improved.
3. The optimum parameter for penetration is obtained at Welding current 150 Amp. Welding voltage 20 V and gas flow rate 16 Lit/Min

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