Efficient Activated Metal Inert Gas Welding Procedures by Various Fluxes for Welding Process

[1]Dr. L Suresh Kumar,[2]V Sandhya*,[3]V Jaipal Reddy

[1,2,3]Assistant Professor, Department of Mechanical Engineering, ChaitanyaBharathi Institute of Technology (A), Gandipet, Hyderabad.

Abstract

In the past years so many developments and innovation are made to increase the performance of the welding machine by reducing the power consumptions, cost, labour skills and many more. In a row, A-MIG welding process is one of the welding processes which increase the welding properties of material at the same consumption of the power and resources. A-MIG welding is wildly used to optimize the parameter of MIG welding. A steady flow welding power gracefully delivers electrical vitality, which is directed over the bend through a segment of exceptionally ionized gas and metal fumes known as plasma. Metal inert gas (MIG) welding is most regularly used to weld thick segments of tempered steel and non-ferrous metals, for example, aluminum, magnesium, and copper compounds. Three sorts of oxides, Fe_2O_3, SiO_2, and $MgCO_3$, were utilized to research the impact of initiating transition helped gas metal bend welding (GMAW) on weld dab math, precise twisting and mechanical properties. The most noteworthy impact on the inward structure factor was knowledgeable about instance of MnO dynamic transition, which diminished the inside structure factor by 20 %. If there should arise an occurrence of the outside structure factor the applied SiO_2 dynamic transition caused the greatest increment which is 37 %. In the hardness dispersion and the microstructure of the joints, including the weld metal and the heath influenced zone, no critical contrasts were experienced contrasted with the example welded with no transition material.

Keywords: MIG welding, GMAW (gas metal arc welding), micro structure, flux winding.

1 Introduction

Metal inactive gas welding known as gas metal arc welding which uses aexpendableconductor to generate arc between workpiece and electrode. The inert gas argon, in rare cases helium (more expensive) gases are used to protect the weld bead for atmosphere contaminates, these gases are also called shielding gas and filler materials are normally used. The procedure grants those drivers more amazing control through those welds over contending procedures for example, protected metal circular segment welding Furthermore gas metal circular segment welding, permitting for stronger, higher personal satisfaction welds. MIG welding is utilize to joint ferrous Furthermore non-ferrous materials for example, steel, copper, aluminum, magnesium, nickel, What's more their alloys..

MIG welding procedure has fails to weld thick section of material in single pass and it has low productivity. To recover the performance of MIG welding triggered flux are used to increase the depth of penetration in single pass. Activated flux is mixed with the acetone and blinder and applied thin past on the workpiece by brush or spray. A-MIG welding system makes it could reasonably be expected to heighten the accepted MIG welding hones for joining those more than 10 mm thick plate by absolute pasquinade with no edge preparation. The mechanical properties moved forward contrasted with those welds made without any flux material. Over our Examine we investigated the impacts of eight distinctive animated fluxes and mixtures On point of interest Throughout GMAW utilizing animated protecting gas. In the event that of circular segment welding the main impetus of the struck them streams in the weld pool could a chance to be originated starting with four separate phenomena, those buoyancy, those surface-tension (which brought about the with the goal known as Marangoni impact [9]), the high speed development of the circular segment plasma, and the Lorentz energy. [10,11]

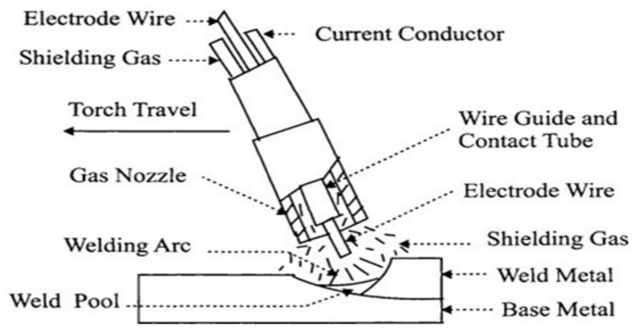


Fig. 1 Schematic diagram of MIG welding

M. Zuber et al. (2014) have investigated on Consequence of flux coated gas tungsten arc welding on 304L. In this investigation the researcher used SiO2 flux and the result shows that the penetration increased up to 200%, ferrite number increased up to 14 % and the hardness value of the material also increased.[1] G. venkatesan et al. (2014) has studied on Consequence of ternary fluxes on depth of penetration in A-TIG welding of AISI 409 ferritic stainless steel. In this study the flux increased depth of penetration up to 100%. [2] XiongXie et al. (2015) have researched on Impacts about nano-particles fortifying initiating flux on the microstructures Also mechanical properties of TIG welded AZ31 first mass of the magnesium compound joints. Those specialist utilized blended TiO2 and nano-SiC particles as actuated flux and demonstrated that microstructure, microhardness On combination zone, extreme elasticity might have beenimproved [3].

Based on previous researches, the present investigation is deals with three types of activated fluxes which are applied on the workpiece prior to welding. The bead geometry is then compared after welding with and without using activated fluxes. The effect of the different fluxes is also studied.

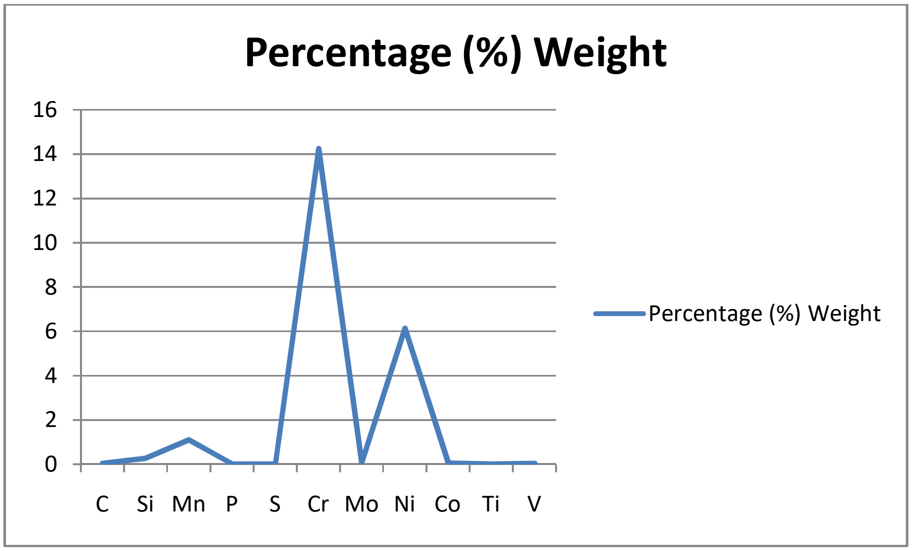
2 Experimental Procedure

A. Base metal and itscomposition

The material utilized in this learning is austenitic stainless steel 301. The composition of the base metal is given in table 1. The work pieces were cut in the dimension of 100 mm X 50mm X 10mm plates. Before welding the work pieces were grinded with 220 grit emery papers and it cleaned with acetone.

Component	Percentage (%) Weight
C	0.054
Si	0.284
Mn	1.11
P	0.021
S	0.008
Cr	14.25
Mo	0.093
Ni	6.15
Co	0.067
Ti	0.009
V	0.054
Fe	Rest

Table 1 Conformation of material



B.

C. Preparation offlux

The weld bead geometry of welding should be studied after applying the flux paste on the surface of workpiece.

The pasted were made with the mixing of acetone and very small amount of sodium silicate as binder and apply with the help of brush or spray shown in Figure 2. Acetone has tendency to vaporize and leave the flux on the surface of workpiece and sodium silicate has tendency to sticking and bind the flux particle together.

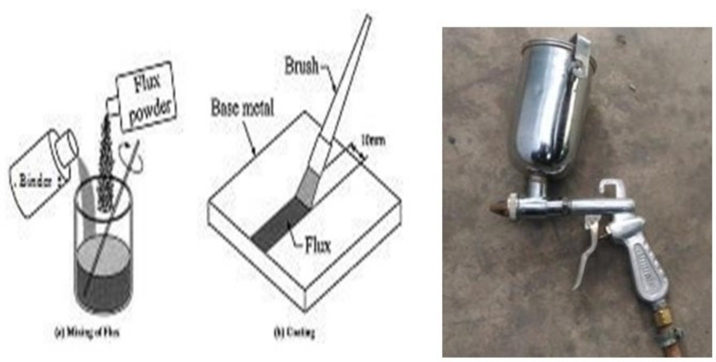


Fig. 2 Flux preparation

D. Experimentalprocedure

In the first step, the welding parameters are decided on the basis of several trial experiments and are listed in table 2.

Parameters	value	units
Welding current	180	A
Total arc voltage evolution	12-18	V
Travel speed	120	mm/min
Arc gap	2.5	mm
Diameter of electrode	2.6	mm
Gas flow rate	14	L/min

Table 2 Process parameter for welding

Prior to welding the metal power is mixed with acetone and sodium silicate (as binder) to make paint like solution and applied a very thin layer approximately 0.2mm on the workpiece surface with the help of brush or spray. Uniformity in applied flux is most important to get good quality of weld and more depth of penetration.

(a) (b) (c)

Fig. 3 Photograph of applied fluxes (a) MnO_2 flux, (b) TiO_2 flux and (c) SiO_2 flux.

TIG welding is done on the work pieces which are coated with the fluxes and without flux. The pattern of the TIG welding on workpiece shown below,

(a) (b) (c) (d)

Fig. 4 Photograph of weld bead on workpiece (a) without flux (b) MnO_2 flux (c) TiO_2 flux (d) SiO_2 flux

E. Stereo zoom microscope analysis

The weld bead measurement was done as per UNS SS30100 Standard on stainless steel specimen on the stereo zoom microscope analyser available at SLIET Longowal (Punjab). For stereozoom microscope analysis, the specimens have been prepared using standard procedure like grinding, polishing using successively fine grades of emery up to 3000 grit size and Al_2O_3 power. It was help to remove scratches on the surface that are to be metallographic-ally analysed. Before analysis, etchant is use to reveal bead geometry. Stereo zoom analyser is used to measure the bead geometry like bead width, depth of penetration and heat affected zone (HAZ) of the specimens.

3 Results

Stereo zoom analysis of the weld bead with and without flux is represented as follows:

A. Effect of weld bead with and without flux of weld bead

In conventional TIG welding, the direction of convection in weld is towards the edge from the centre of the weld. This convection shows low depth of penetration and wide weld width. But in activated TIG welding the convection is reverse from edge to centre to the weld. The images show the differences between conventional TIG welding and activated TIG welding. [4]

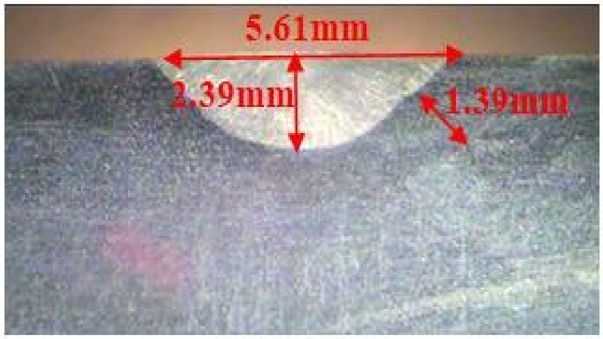


Fig. 5 Stereo zoom analyzer images for without flux

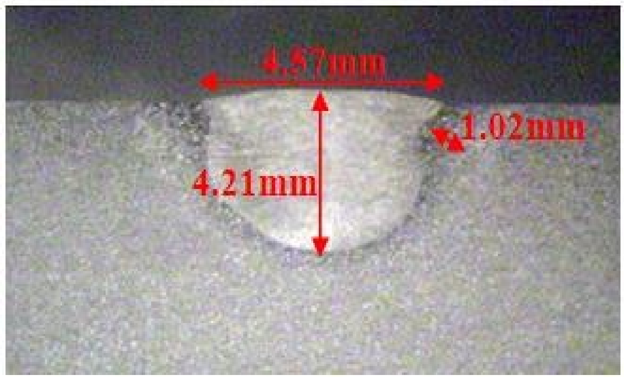


Fig. 6 Stereo zoom analyser images for MnO_2flux

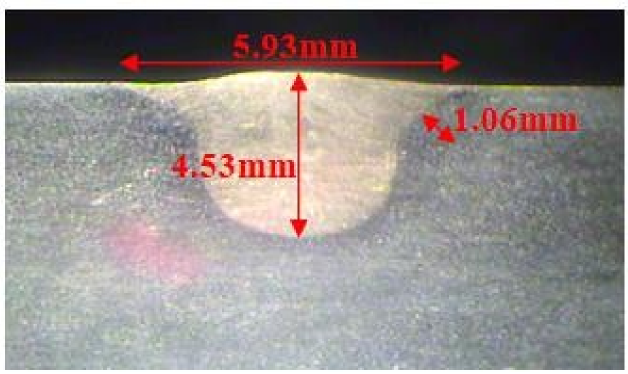


Fig. 7 Stereo zoom analyser images for TiO_2flux

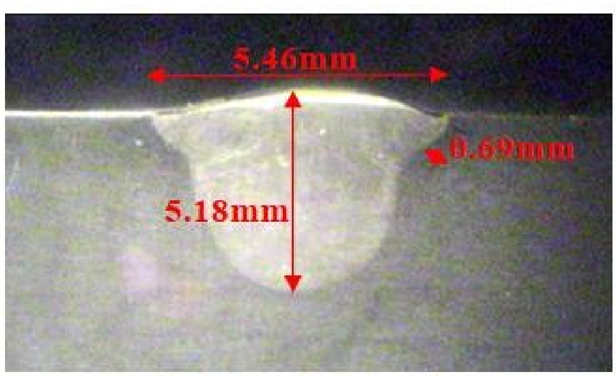


Fig. 8 stereozoom analyser images for SiO_2flux

The results show that application of fluxes increase the depth of penetration. MnO_2 activated flux has lowest penetration among the other fluxes up to 4.21mm and SiO_2 activated flux has highest depth of penetration up to 5.18mm.

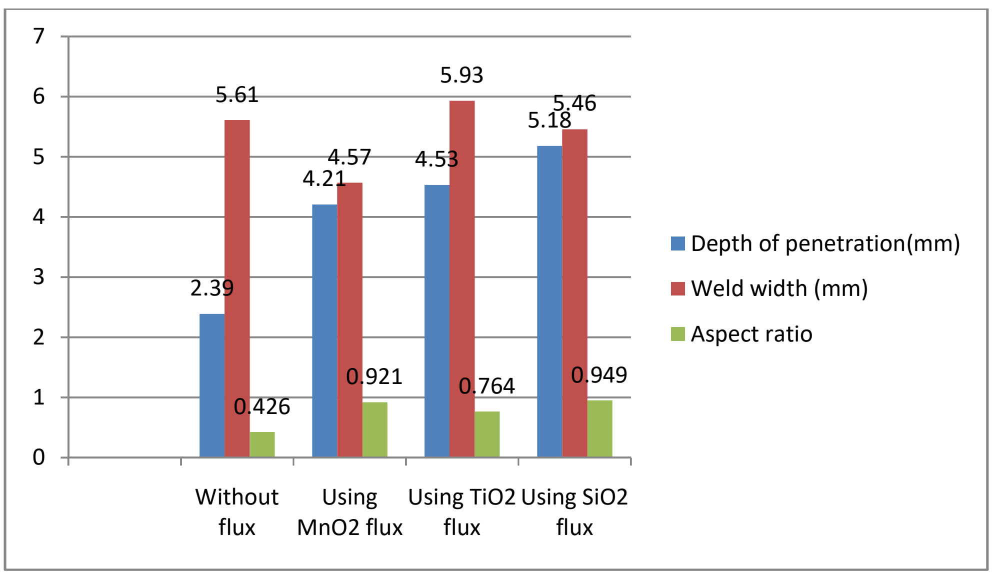
B. Effect of aspect ratio with and withoutfluxes

In conventional welding, the surface tension at midpoint of weld is less than edge of the weld that shows molten metal take place form center to edge, this phenomenon is called Marangoni effect. Due to phenomena of surface tension in conventional TIG welding depth of penetration is less than width of weld bead.[4] Therefore the aspect ratio in conventional welding is 0.426. Application of flux constrict the arc to the center of the weld bead this leads the surface tension towards the center of the weld bead and the penetration achieved more than the conventional TIG welding process. It is observed that use of SiO_2 activated flux provide better aspect ratio as compare to other used flux instudy.

Table 3 Aspect ratio for various fluxes

TIG Welding process	Depth of penetration(mm)	Weld width (mm)	Aspect ratio
Without flux	2.39	5.61	0.426
Using MnO_2 flux	4.21	4.57	0.921
Using TiO_2 flux	4.53	5.93	0.764
Using SiO_2 flux	5.18	5.46	0.949

Figure.9. Aspect ratio



Conclusions

From the Study following conclusion are drawn.

The use of flux is more beneficial as compare to conventional TIGwelding.

It is observed that aspect ratio with flux is increase 80-122% for different coatedflux.

Extremefeature ratio experiential is 0.949 for SiO_2 flux. So it is extraadvantageous to usageSiO_2flux.

It is observed that using SiO_2 flux results in minimum heat exaggerated zone (HAZ), results in unaffected strength of weld and basemetal.

References

[1]. M. Zuber et al. (2014), "Effect of flux coated gas tungsten arc welding on 304L", IACSIT International Journal of Engineering and Technology, Vol. 6, No. 3 pp. 177-181

[2]. G. venkatesan et al. (2014), "Effect of ternary fluxes on depth of penetration in A-TIG welding of AISI 409 ferritic stainless steel", Elsevier Ltd. Pocedia Materials Science 5 pp. 2402 – 2410

[3]. XiongXie et al. (2015), "Effects of nano-particles strengthening activating flux on the microstructures and mechanical properties of TIG welded AZ31 magnesium alloy joints", Elsevier Ltd. Materials and Design 81 pp. 31–38

[4]. Prof. A.B. Sambherao (2013)," Use of Activated Flux For Increasing Penetration in Austenitic Stainless Steel While Performing GTAW", Elsevier ltd. International Journal of Emerging Technology and Advanced Engineering pp. 220-224.

[5]. Sanjay G. Nayee et al (2014), "Effect of oxide-based fluxes on mechanical and metallurgical properties of dissimilar activating flux assisted tungsten inert gas welds" Elsevier Ltd. Journal of Manufacturing Processes 16 pp. 137–143.

[6]. Akash B. Patel et al. (2014), "The effect of activating fluxes in TIG welding by using ANOVA for SS 321", ISSN, Int. Journal of Engineering Research and Applications pp. 41-48

[7]. Jay J. Vora et al. (2015) has studied on "Experimental investigation on mechanism and weld morphology of activated TIG welded bead-on-plate weldments of reduced activation ferritic/martensitic steel using oxidefluxes", Elsevier ltd. Journal of Manufacturing Processes 20 pp. 224-233.

[8]. AnkurBajpai et al. (2015), "Investigations on structure–property relationships of activated flux TIG weldments of super-duplex/austenitic stainless steels",

Elsevier B.V. Materials Science & Engineering A 638 pp. 60–68

[9]. Sándor, T., Mekler, C., Dobránszky, J., Kaptay, G. "An improved theoretical model for A-TIG welding based on surface phase transition and reversed Marangoni flow. "Metallurgical and Materials Transactions a Physical Metallurgy and Materials Science". 44A, pp. 351-361. 2013.

[10]. Lu, S., Fujii, H., Sugiyama, H., Tanaka, M., Nogi, K. "Weld Penetration and Marangoni Convection with Oxide Fluxes in GTA Welding", Materials Transactions. 43(11), pp. 2926-2931. 2002.

[11]. Kou S. "Welding Metallurgy." Chapter 4, pp. 97-117. John Wiley & Sons, Inc., Hoboken, New Jersey. 2003