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Weld Ability Issue of AISI 202 SS (Stainless Steel) Grade with GTAW Process Compared to AISI 304 SS Grade

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ABSTRACT: AISI 202 SS (stainless steel) has similar mechanical property as compare to AISI 304 SS grade, but its ability to resist corrosion is somewhat less as compare to AISI 304 SS grade in chloride environment. But it is very inexpensive so we can use it in indoor applications like indoor fabrication, automobile trim and application where atmosphere is not a considerable factor. But there is very less research reported on welding of AISI 202 SS grade. In present work we use gas tungsten arc welding (GTAW) process to weld AISI 202 SS grade. GTAW process benefits the welded joint with maximum strength and better deposition rate. The results obtained after welding of AISI 202 are comparable to AISI 304 type satisfying the requirement of prescribed properties of welded joints. Hence 202 type SS can be used instead of 304 type SS for the above mentioned applications.

KEYWORDS: AISI 202 SS, AISI 304 SS, GTAW, Strength, Chloride Environment.

I. INTRODUCTION

GTAW is a fusion process that generates heat by establishing an arc between a non-consumable tungsten electrode and the base metal. In this process, the electrode is not melted and used as a filler metal. Instead, a welding rod is fed into the weld area as in ox fuel welding and brazing.

Any welder with a background in ox fuel welding and brazing will quickly adapt to the GTAW Process because the techniques used are similar. The equipment, however, is the same type as the equipment used in arc welding. In GTAW, inert fluxes do not need to be used. Also, because there is no slag there is virtually no cleaning of weld areas. After world war II, with nonferrous metals more in demand, many GTAW processes were developed under different names such as TIG, (Tungsten Inert Gas), heliarc, and argon arc. Metals over 6mm. had to be pre heated before welding could be carried out. This led to the development of another process, GMAW (Gas Metal Arc Welding).

Almost the complete replacement of nickel is possible by combined Mn. And nitrogen addition. Lower nickel addition requires more manganese and nitrogen to stabilize the austenitic phase. Higher draw ability properties may be obtained with lower nitrogen additions but then chromium content must be reduced down to 14-15% in order to provide the stability to the austenitic phase. AISI 304 stainless steel is widely used in forming applications because of its superior formability. The high nickel price in recent years prompted an investigation into the feasibility of replacing AISI 304 with AISI 202 in applications requiring comparable mechanical properties. The aim of this investigation was therefore to study the weldability of AISI 202 stainless steel using uniaxial tensile tests and observing the chemistry to clear the way to use



Yan (2009) investigated the mechanical properties and microstructure of stainless steel and results showed that the microstructure consists of delta ferrite and gamma ferrite phase. [3]. Morisada (2012) showed the effect and use of high frequency tungsten inert gas welding method in order to decrease the blow holes in a weld [4]. The hardness of the weld metal was lower than that of the heat affected zone (HAZ) metal area and heat affected zone was lower than that of base metal concluded by Durgutlu (2003) in the research where he observed that increasing hydrogen content in the shielding gas reduced the mechanical properties [5]. Kang (2008) analyzed the effect of alternate supply of method of shielding gases in austenitic stainless steel using Gas tungsten arc welding and concluded that welding speed of Ar+67 % He was more than that of supplying alone argon (Ar) but less than Ar ::He ratio [6].

II. RELATED WORK

TENSILE TEST RESULT (TIG WELDING)

Specimen 1	Specimen 2	Specimen 3
Yield strength 495	Yield strength 501	Yield strength 231
Ultimate tensile strength (Mpa) 636	Ultimate tensile strength(Mpa) 853	Ultimate tensile strength(Mpa) 243
% elongation in 25 mm GL	% elongation in 25mm GL 35.50	% elongation in 25mm GL 3.50
Fracture location weld	Fracture location weld	Fracture location weld

III. METHODOLOGY

Three parameters are selected such as gas flow rate, current and welding speed for weld the samples. Argon gas is used as shielding gas in order to protect the welded area from the atmospheric gases. The value of welding current, gas flow rate and welding speed is 160 A, 61/min and 2.5 mm/sec. TIG welding has been performed on SS 202 grade steel for the completion of experiment. In welding process, the cut and grooved samples were welded at above mentioned value of current, gas flow rate and welding speed.

A tensile specimen is a standardized sample cross section. It has two shoulders and a gauge in between. The shoulders are large so they can be readily gripped, whereas the gauge section has a smaller cross section so that the deformation and failure can occur in this area. A procedure calculate the yield strength and the ultimate tensile strength of the material. The procedure begins with a specially prepared specimen, usually 8 inches long and with a 0.50 inch reduced section in the middle

IV. EXPERIMENTAL RESULTS

Here we have used the equipment optical microscope with a magnification of 100X. The microstructure was taken only for the sample which is welded using the optimized parameter. The specimen cut across transverse to the welding direction has been polished in the subsequent emery papers such as 220,400,600,800 emery sheet and followed by cloth polishing. After that the welded specimen was arched to reveal the microstructure. The etchant used for this purpose is 70% HNO3 & 30% H2O etched for few seconds. The micro structural analysis of the main zone.



Fig.1 microstructure of 304 stainless steel

The results for the microstructure of weld metal stainless steel 202 represents a Delta ferrite structure in matrix of austenite in weld metal.



Fig .2 Microstructure of 202 stainless steel

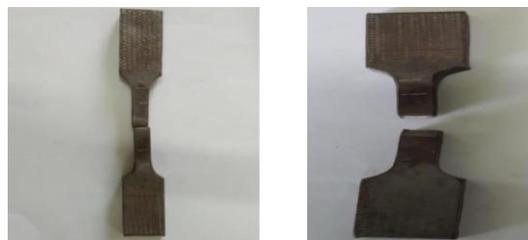


Fig. 3 tensile test sample 1 Fig.4 tensile test sample 2



V. CONCLUSION

The stainless steel grade 202 was used for the present study to explore the strength using input process parameters selected from the trial runs for welding. The tensile strength obtained is fair enough to deal with the serviceability of AISI 202 in the prescribed applications. It can be stated that 202 SS can be utilized instead of 304 SS.

The results obtained from the microstructure shows that structure consists of austenite grains in tensile analysis as well as in parent metal. The microstructure has a delta ferrite structure in matrix of austenite in weld metal. This result confirms previous research of several authors.

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