An Experimental study on TIG welded joint between Duplex Stainless Steel and 316L Austenitic Stainless Steel

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Abstract *An attempt was made to join the two dissimilar material between Duplex Stainless Steel (DSS) and 316L Austenitic Stainless Steel (316L SS) by Tungsten Inert Gas (TIG) welding process. 316L SS was used as filler metal. The microstructures of DSS and 316L SS were evaluated before and after the TIG welding. The various mechanical tests were conducted to evaluate the mechanical properties. Although the welded joint revealed the acceptable mechanical properties, the hardness and impact strength of the welded zone of DSS were higher than the welded zone of 316L SS. In this paper, the focus is on characterization and analysis of the welded joint. The microstructure and chemical composition of the selected metals were also found to play an important role on mechanical properties. The results are summarized to rationalize the relationship between chemical composition, welding conditions, and heat affected zone microstructures, and then mechanical tests such as X- ray test, impact test, hardness test, tensile test and bending test.*

Keywords— *Dissimilar metal weld, TIG welding, Duplex Stainless Steel, 316L Austenitic Stainless Steel.*

I. INTRODUCTION

The effect of process parameters of Tungsten Inert Gas (TIG) welding process was investigated by many researchers. Bravo et al [1] investigated dissimilar welding of super duplex stainless steel for offshore applications joined by GTAW process for structural behavior. Poznansky et al [2] analysed the corrosion rate of the duplex and super duplex stainless steels in sea water applications. Honey combe et al [3] carried out an investigation on TIG welding process for optimal parametric combinations and geometry of welded joints using the Grey relational analysis and Taguchi method. Mourad et al [4] carried out a research work to select the optimum process parameters for TIG welding to weld the stainless steel and the optimal weld pool geometry. They have suggested that parameters will vary to metal to metal. However, front height, front width, back height and back width are important factors for the weld pool [4]. Ibrahim et al [5], found that hardness of pure titanium material varies gas flow rate and numbers of welding passes.

Straffelini et al [6], carried out an investigation to find the effect of TIG welding parameters like welding speed, current and flux on depth of penetration and width in welding of 304L stainless steel. From this study, it was observed that flux used has the most significant effect on depth of penetration followed by welding current. Luo et al [7], observed that the use of fluxes, even of extremely simple formulation, can greatly increase (up to around 300%) the weld penetration in TIG welding. Hence, in the current investigation, two dissimilar metals (316L SS vs. DSS) were welded by TIG welding process and its microstructure and mechanical properties were evaluated.

II. METHODS

The two dissimilar metals such as AISI 316L type austenitic Stainless Steel (316L SS) and Duplex Stainless Steel (DSS) were selected for TIG welding. These two materials were surface finished before welding. After welding, the microstructure of heat affected zone of these base metal and weld portion was evaluated by optical microscope. X ray test was conducted to identify the defects in the weld. Tensile test, impact test, hardness test and bend test have been conducted to evaluate the mechanical properties of welded joints..

III. RESULT AND DISCUSSION

A. X-Ray Test

The radiographic examination was done for the three samples at the radiographic size of 3" X 8". The X- ray test picture is presented in Fig. 1. The results reveal some of the pores within the acceptable level. Hence, the soundness of welding is proven and it can be proceed for further mechanical testing.

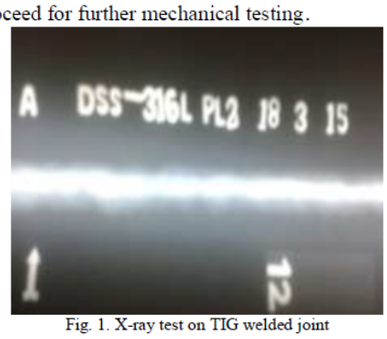

Fig. 1. X-ray test on TIG welded joint