PARAMETRIC OPTIMIZATION OF TIG WELDING USING TAGUCHI METHOD

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ABSTRACT

The present study pertains to the improvement of tensile strength of mild steel weld specimen made of Tungsten inert gas (TIG) welding. L9 Orthogonal array (OA) of TAGUCHI Method has been used to conduct the experiments using several levels of current, gas flow rate and filler rod diameter. Statistical techniques analysis of variance (ANOVA), signal-to –noise(S/N) ratio and graphical main effect plots have been used to study the effects of welding parameters on tensile strength of weld specimen. Optimum parametric condition obtained by TAGUCHI method.

Keywords: *Tungsten inert Gas welding , TAGUCHI Method, Tensile strength, analysis of variance , signal – to –noise ratio , Optimum parametric condition.*

INTRODUCTION

TIG Welding is a manual welding process that requires the welder to use two hands to weld. What separates TIG welding from most other welding processes is the way the arc is created and how the filler metal is added! When TIG Welding one hand is used for holding the TIG tor ch that produces the arc and the other hand is to add the filler metal to the weld joint. Because two hands are required to weld; TIG welding is the most difficult of the processes to learn, but at the same time is the most versatile when it comes to different metals. This process is slow but when done right it produces the highest quality weld! TIG welding is mostly used for critical weld joints, welding metals other than common steel, and where precise, small welds are needed.

Tungsten inert gas (TIG) welding is an arc welding process that produces coalescence of metals by heating them with an arc between a non-consumable electrode and the base metal (Kumar and Sundarrajan, 2009). TIG welding offers several advantages i.e. joining of dissimilar or similar metals, low heat affected zone, absence of slag etc. In TIG welding operation, weld quality mainly depends on featur es of bead geometry, mechanical-metallurgical characteristics of the weld and various aspects of weld chemistry. These features are greatly influenced by the welding parameters such includes current, voltage, gas flow rate, electrode stick-out, edge preparation, position of welding, weld speed (Ghosh et al 2013) etc. Selection of filler rod diameter also has significant effect on weld quality. Selection of optimum parametric setting is essential for obtaining desired weld quality.

LITERATURE REVIEW

Many investigators have suggested

various methods to explain the effect of process parameter on Tig welding process in material properties.

2.1 journals reviews

Sanjeevkumaret. alattempted to explore the possibility for welding of higher thickness Plates by TIG welding. Mild steel Plates (5-6mm thickness) were welded by Pulsed Tungsten Inert Gas Welding process with welding current in the range 130-160 A and gas flow rate 7 -15 l/min. Shear strength of weld metal (390MPa) was found less than parent metal(408 MPa). From the analysis of photomicrograph of welded specimen it has been found that, weld deposits are form co-axial dendrite micro-structure towards the fusion line and tensile fracture occur near to fusion line of weld deposit.

Indira Rani et. alinvestigated the mechanical properties of the elements of mild steel during the GTAW /TIG welding with non-pulsed and pulsed current at different frequencies. Welding was performed with current 140-160A, , with variable filler rod diameter of 1.6-2.4 mm. From the experimental results it was concluded that the tensile strength and YS of the elements is closer to base metal. Failure location of elements occurred at HAZ and from this we said that elements have better weld joint strength.

Ahmed Khalid Hussainet. alinvestigated the effect of welding speed on tensile strength of the welded joint by TIG welding process of mild steel plate 5 mm thickness. The strength of the welded joint was tested by a universal tensile testing machine. Welding was done on specimens of single v butt joint. From the experimental results it was revealed that strength of the weld zone is less than base metal and tensile strength increases with reduction of welding speed.

Tseng et. alinvestigated the effect of activated TIG process on weld morphology, angular distortion, delta ferrite content and hardness of 316 L stainless steel by using different flux like TiO2, MnO2, MoO3, SiO2 and Al2O3. To join 6 mm thick plate author uses welding current 200 Amp, welding speed 150 mm/min and gas flow rate 10 l/min. From the experimental results it was found that the use of SiO2 flux improve the joint penetration, but Al2O3 flux deteriorate the weld depth and bead width compared with conventional TIG Process

Naranget. al performed TIG welding of structural steel plates of different thickness with welding current in the range of 140-160 A, and welding speed of 15-45 mm/sec. To predict the weldment macrostructure zones, weld bead reinforcement, penetration and shape profile characteristics along with the shape of the heat affected zone (HAZ), fuzzy logic based simulation of TIG welding process has been done.

Karunakaranet. alperformed TIG welding of mild steel and compare the weld bead profiles for constant current and pulsed current setting. Effect of welding current on tensile strength, hardness profiles, microstructure and residual stress

distribution of welding zone of steel samples were reported. For the experimentation welding current of 100-180A,welding