"PARAMETRIC OPTIMIZATION OF TIG WELDING BY USING ARGON SHIELDING GAS ON S316 MATERIAL"

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ABSTRACT

Generally, all welding processes are used with the aim of obtaining a welded joint with the desired weldbead parameters, excellent mechanical properties with minimum distortion. Stainless steels are widely used.due to their superior fracture toughness, good inter granular corrosion resistance and non-requirement of post process annealing. TIG welding is most popular method for welding of stainless steel material. Weld speed and input current are found to be the most significant parameters. Finally, the strength of the weld is validated by tensile and penetration test. The properties of the material and welded joint are affected by a large number of welding parameters. Properties include Tensile strength, penetration, Hardness etc. The objective behind this project is to optimize tensile strength and penetration to determine the influence of process parameter on the quality of weld.

Keywords: Tig welding, Argon gas, tensile strength, weld penetration, hardness,s316material

1. INTRODUCT

Welding is a permanent joining process used to join different materials like metals, alloys or plastics, together at their contacting surfaces by application of heat and or pressure. During welding, the work-pieces to be joined are melted at the interface and after solidification a permanent joint can be achieved. Sometimes a filler material is added to form a weld pool of molten material which after solidification gives a strong bond between the materials. Weld ability of a material depends on different factors like the metallurgical
changes that occur during welding, changes in hardness in weld zone due to rapid solidification, extent of oxidation due to reaction of materials with atmospheric oxygen and tendency of crack formation in the joint position.
GTAW or TIG welding process is an arc welding process uses a non consumable tungsten electrode to produce the weld. The weld area is protected from atmosphere with a shielding gas generally Argon or Helium or sometimes mixture of Argon and Helium. A filler metal may also feed manually for proper welding. GTAW most commonly called TIG welding process was developed during Second World War. With the development of TIG welding process, welding of difficult to weld materials e.g. Aluminium and Magnesium become possible. The use of TIG today has spread to a variety of metals like stainless steel, mild steel and high tensile steels, Al alloy, Titanium alloy. Like other welding system, TIG welding power sources have also improved from basic transformer types to the highly electronic controlled power source today.

2.1 Literature Review:

Ajit Khatter, Pawan Kumar, Manish Kumar: The purpose of this study is to propose a method to decide near optimal settings of the welding process parameters in TIG welding. The properties of the welded joints are affected by a large number of welding parameters. Properties include Tensile strength, Impact force, Hardness etc. Modeling of weld bead shape is important for predicting the quality of welds. In an attempt to model the welding process for predicting the bead shape parameters (also known as bead geometry parameters) of welded joints, modelling and optimization of bead shape parameters in tungsten inert gas (TIG) welding process has been tried in the present work. TIGwelding process, considering the effects of main variables on weld strength. Also by using the same experimental data, an attempt has been made to predict the bead shape strength. In the study which parameter is most effectively effect the weld strength. Weld strength varies under various conditions. By using Taguchi and ANNOVA technique an optimal solution is find out, which provides us an optimal results of the varying condition.

J Pasupathy, V Ravisankar: Mathematical model was developed to predict the tensile behaviour of TIG welded dissimilar joints made of 2mm low carbon steel and 1mm AA1050 alloys. The design of experiments concepts was used to optimize the desired number of experiments. TIG welding parameters like Current, Speed and Distance was chosen as the major parameters. Tensile behavior of the dissimilar joints was evaluated. The models were developed by Response Surface Method (RSM). Analysis of variance (ANOVA) was applied to find the significant parameters. The adequacy of the developed models was checked by calculating correlation coefficient.

B.Y. Kanga, Yarlagadda K.D.V. Prasadb, M.J. Kanga, H.J. Kima, I.S. Kimc: Welding system has now been concentrated on the development of new process to achieve cost savings, higher productivity and better quality in manufacturing industry. Discrete alternate supply of shielding gas is a new technology that alternately supplies the different kinds of shielding gases in weld zone. As the new developed methods compared to the previous general welding with a mixing supply of shielding gas, it cannot only increase the welding quality, but also reduce the energy by 20% and the emission rate of fume. As a result, under the same welding conditions , compared with the welding by supplying pure argon, argon + 67% helium mixture by conventional method and the welding by supplying alternately pure argon and pure helium by alternate method showed the increased welding speed. Also, the alternate method showed the same welding speed with argon + 67% helium mixture without largely deteriorating of weld penetration. The alternate method with argon and helium compared with the conventional methods of pure argon and argon +67% helium mixture produced the lowest degree of welding distortion.

N. Kiaee, M. Aghaie-Khafri: Gas tungsten arc welding is widely used for connecting of boiler parts made of A516-Gr70 carbon steel. In this study important process parameters namely current, welding speed and shielding gas flow rate were optimized using response surface methodology (RSM). The simultaneous effects of these parameters on tensile strength and hardness were also evaluated. Applying RSM, simultaneous effects of welding parameters on tensile strength and hardness were obtained through two separate equations. Moreover, optimized values of welding process parameters to achieve desired mechanical properties were evaluated. Desired tensile strength and hardness were achieved at optimum current of 130 A, welding speed of 9.4 cm/min and gas flow rate of 15.1 l/min.

V. Subravel, G. Padmanaban, V. Balasubramanian: The effect of welding speed on tensile and microstructural characteristics of pulsed current gas tungsten arc welded (PCGTAW) AZ31B magnesium alloy joints was studied. Five joints were fabricated using different levels of welding speeds (105−145 mm/min). It was found that the joints fabricated using a welding speed of 135 mm/min yielded superior tensile properties compared to other joints. The formation of fine grains and uniformly distributed precipitates in the fusion zone are the main reasons for the superior tensile properties of these joints.

Ahmet Durgutlu: In this study, the effect of hydrogen in argon as shielding gas was investigated for tungsten inert gas welding of 316L austenitic stainless steel. The microstructure, penetration and mechanical properties were examined. Pure argon, 1.5%H_2–Ar and 5%H_2–Ar were used as shielding gas. The highest tensile strength was obtained from the sample which was welded under shielding gas of 1.5%H_2–Ar. After bending test, cracks, tearing and surface defection were not observed on the samples that were welded under all three shielding media. Mean grain size in the weld metal increased with increasing hydrogen content. Additionally, weld metal penetration depth and its width increased with increasing hydrogen content.

Sunil Patel , Mr. Sandip B. Patel: Gas tungsten are welding has wide application in industries due to its advantages such as high reliability, low cost, higher production rate, shielding gas is a concept which used in GTAW welding. In Present work, an attempt has been made to use different shielding gas composition use to improve weld appearance and strength of the weld-melt and using optimal technique like Genetic algorithm getting best combination of process parameters. Gas tungsten are welding (GTAW) welding with filler wire addition is a candidate process for welding of SDSS. In GTAW, the quality of the weld is characterized by the weld-bead geometry as it influences the mechanical properties and its performance during service. This work focuses on the and optimization using Genetic Algorithm for determining the optimum/near-optimum GTAW process parameters for obtaining the optimum weld-bead
geometry during welding of SDSS material. Parameters selected for study were Welding current, Trails were carried using with different Shielding gas mixtures, Filler Rod Diameter.

A. Kumar a, S. Sundarrajan b: The present work pertains to the improvement of mechanical properties of AA 5456 Aluminum alloy welds through pulsed tungsten inert gas (TIG) welding process. Taguchi method was employed to optimize the pulsed TIG welding process parameters of AA 5456 Aluminum alloy welds for increasing the mechanical properties. Regression models were developed. Analysis of variance was employed to check the adequacy of the developed models. The effect of planishing on mechanical properties was also studied and observed that there was improvement in mechanical properties. Microstructures of all the welds were studied and correlated with the mechanical properties

Tong WEN, Shi-yao LIU, Shi CHEN, Lan-tao LIU, Chen YANG: A device for superimposing vibration on workpiece in both horizontal and vertical directions during tungsten-arc inert gas(TIG) welding was developed, with maximum power output of 2 kW at frequency of 15 kHz. AZ31 sheets with thickness of 1 and 3mm were used in the vibratory welding. Microstructures along with the mechanical properties of the weld joints under differentvibrating conditions (vibration direction, vibration amplitude and groove angle) were examined. It is observed that the grain size in welding zone decreases remarkably with the application of vibration, while the amount of second phase *β*-Mg17Al12 within the zonedecreases slightly; meanwhile, microhardness of the weld joints, macroscopic tensile strength and elongation of the weldmentincrease. Vibration, especially the one along vertical direction, has more impact on the performance of the thick weldments. Influence of vibration on microstructure and mechanical properties of weldments is affected by wave energy transferring in the melt anddepends on the processing and geometric parameters including amplitude and direction of vibration, thickness, and groove angles.

S. Chatterjee, T. van der Veldt: The laser beam welding process can be combined, in principle, with the arc welding process. When these two welding techniques are coupled as one process, the laser beam and arc (Gas Tungsten arc welding, plasma or gas–metal arc welding (GMAW)) interact at the same time in one zone (plasma and weld pool) and mutually influence and assist one another. Such process coupling is referred to by the term hybrid welding process

Conclusion:

From the experiment of TIG welding of S316 material following conclusion can be made

- In result observation best welding hardness at 90(Amp), 15(Volt), 14(Litre/min)gas flow.
- Best penetration at 125(Amp), 20(Volt), 16(Litre/min)gas flow.
- With the manual welding system uniform welding of s316 material can be possible.
- Welding strength, weld penetration and hardness of the weld joint depends on the welding parameters like welding speed, welding current and gas flow rate.
- With the increase in current, penetration of the weld joint increases.
- And also with increase in current, hardness of weld joint inctreases
- Hardness value of the weld zone change with the distance from weld centre due to change of microstructure.
- For both side welding Hardness is found almost equivalent to the Hardness of base material.

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