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Review on TIG welded stainless steel alloy

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ABSTRACT

The TIG welding device is soldered to increase welding efficiency in Stainless Steel 304 (SS-304) by modifying various welding parameters. Effects on the strength and toughness of the weld joint of solding current, gas flow rate (CO2) and welding speed were examined. Optical microscopic analysis on the welding zone was performed to determine the effect of soldering parameters on soldering efficiency. In order to understand the change in the mechanical features of a welded zone a micro-hardness value of the welded zone was measures on the cross section.

Keywords: TIG Welding, Vicker Hardness Test, Tensile Test, Micro Structural Test, Voltage, Speed, Current, Stainless Steel Alloy-304.

1. INTRODUCTION

For the joining of distinct materials for example alloys, metal in permanent joining process with the application of heat is called welding. The welding capability of a material relies on numerous features, such as the metallurgical changes, which happen throughout welding because of fast solidification modification in the hardness of the weld region, with propensity of crack forming as well as atmospheric oxygen in the joint position generated by the reaction of the materials, there is degree of oxidation.

1.1 Welding Process Types

Categorizing the welding procedures depends on the use of heat sources are below:

1.1.1 ARC Welding: In this an electrical power supply is utilized to generate an arc among the electrode or the work-piece material to be linked such that metals of the work-piece are melted at the surface before they are welded. Power source can be of the AC or DC for arc welding operation. The electrode used to solder arcs may be either consumable or unusable. Outer filling content may be used for electrodes which are not consumable.

1.1.2 GAS Welding: By combustion of gas mixture, a high temperature flame is created in gas welding process which is utilized to fix the work-piece. An outer filler material is utilized for appropriate welding. Oxy-acetylene gas welding is the ordinary form of gas welding method where a certain heat is generated by an acetylene & oxygen reaction.

1.1.3 Resistance Welding: It is produced by the interaction between the surfaces of two metals triggering the resistance due to the passage of large volume of current (1000–100,000 A). Spot-welding is the majority popular technique of resistance welding, in which a pointed electrode is used. A wheel-shaped electrode may be used to seam-weld continuous type spot resistance welding.

1.1.4 High Energy Beam Welding: For this method high strength is used to heat the work parts and connect them together for e.g. Laser beam. For sometimes welding of dissimilar materials such kinds of welding are mainly utilized, by conservative welding procedure which is not achievable.

1.1.5 Solid-State Welding: Melting of the work piece materials do not involve in the solid-state welding procedures to be joined. The friction, ultrasonic, explosion etc. are the common types of solid-state welding.

1.2 Types of Arc Welding

For a variety of kinds of materials, the arc welding is broadly utilized in between all such type of welding processes. Common types are:

1.2.1 Manual Metal Arc Welding: It is referred as SMAW i.e. Shielded Metal Arc Welding which is the popular form method in that flux-coated consumable electrode is utilized throughout arc welding procedure. The flux falls apart as well as shielding gas is produced through the melting of the electrode in which the welding area is protected against atmospheric oxygen as well as other gases. Slag is formed with that molten filler metal is coated, when it is transported to the weld pool from the electrode. The slag falls onto the weld pool surface as well as covers the weld as it solidifies from the environment.

1.2.2 Gas Metal Arc Welding (MAG/MIG): An incessant as well as unpreserved wire electrode is utilized in this sort of welding procedure. Sometimes a shielding gas combination of argon as well as carbon dioxide, or usually argon, is blown into the weld zone via a welding gun.

1.2.3 Gas Tungsten Arc Welding (GTAW): This is classified as tungsten Inert Gas (TIG). The TIG or GTAW arc welding

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procedure operate the non-consumable tungsten electrode to make the welding product. Usually Argon or Helium, or perhaps a combination of Argon as well as Helium, the welded area is confined from the shielding gas atmosphere. Filler metal might also feed manual process for suitable welding. GTAW was created throughout World War II and was most widely known as TIG welding method. Development in the TIG welding procedure, it is likely to weld the materials e.g. Aluminum as well as Magnesium. Today metals like Al alloy, Titanium alloy, stainless Steel, mild Steel as well as high tensile steels variety are spread by the use of TIG. Like other welding system, since necessary transformer kinds to the extremely electronic controlled power source now the TIG welding power sources have enhanced.

1.3 Welding Fundamentals

If 2 clean surfaces bring get in touch with each other, a welded joint is obtained and either heat or pressure applied to attain a bond, both are applied. The fundamental basis of welding is the tendency of atoms to bond [1]. In all-welding processes the underlying principle is the inter-diffusion between the materials that are joined. In the liquid, mixed or solid state, the diffusion may be taken place.

1.3.1 TIG Welding: In 1930 the period of Second World War, for welding aluminum and magnesium in aircraft industry, the TIG welding was demonstrated first by Russell Meredith. To every branch of manufacturing welding technology has obtained access virtually; to name a few, pipeline, aircraft, automobiles, launch vehicles, nuclear power plants, ships, building construction, rail road equipment's, boilers. With the widespread applications of welding, the welding technology needs constant upgrading [2]. By causing coalescence the welding joins materials, generally metals, or a thermoplastic that is fabrication or sculptural process. For generating the weld, this operates a non-consumable tungsten electrode that is an arc welding process.

By an inert shielding gas, the weld area is confined from atmosphere, as well as filler metal is usually utilized. From the power source, the power is supplied, during a hand-piece or welding, the power source supply power as well as is brought to a tungsten electrode that is fixed into the hand piece. Then between the tungsten electrodes an electric arc is created and a constant-current welding power provide is utilized by work piece that produces the energy and during a column of highly ionized gas as well as metal vapors it conducted across the arc [1]. From the surrounding air by inert gas the tungsten electrode as well as the welding zone is protected. The electric arc will generate temperatures of up to 20,000 ° C, but this heat be able to combined to melt as well as connect two separate pieces of material. The weld pool may be utilized for connecting base metal with or with no filler material.

And the normal differences in the duration of the arc that arise in manual welding have no impact on the welding present. The capability to restrict the current to the fixed value is similarly important while the electrode is short circuited to the job component, or high current can flow unnecessarily damage the electrode. The size of the power source open circuit voltage is 60 to 80 V. The electrode is used as both the liquid metallic device as well as the red-hot filler wire tip with inert gases that protect a non-consumable tungsten pin. The Argon or Helium gas can be operated for shielding purposes. For a broad range of materials Argon is preferred and as no flux is used, inclusion cannot occur due to flux. Using TIG process almost all metals can be welded. By TIG choosing the appropriate combination, the dissimilar metal can also be welded. With zirconium or thorium these non-consumable tungsten electrodes are alloyed. In AC application Zr alloyed tungsten is used and has got good arc starting characteristics and to contamination it has high resistance. On the type of shielding gas, such as position of the weld type, the length of electrode, the cooling of the holder, the current carrying capacity of the electrode is depending.

For specified current if electrode is large, welding will be difficult and the arc will become erratic. However, the chances of electrode melting are increased by the selection of smaller diameter rod. The stainless steel TIG welding, with argon and 5% hydrogen, the nickel and its alloy may be carried out. To reduce the amount of oxides formed with stainless Steel and to increase the arc heating efficiency, the hydrogen helps. A mixture of argon as well as helium can be utilized in the case of aluminum alloy. In almost all positions, TIG welding can be done. In pressure component and other critical applications for root pass TIG is often used, a clean and accurate element is given by this. By TIG welding, the weld is made totally in aerospace works, owing to the high quality demanded there. By TIG welding, the Aluminum alloy is generally welded. With some amount of helium, Argon is the main shielding gas. By TIG with AC power source the high alloy steel, Mg, Zr, Ti, Ni alloys can be readily welded. As some of these alloys (Ti and Zr) are highly reactive must be ensuring by the pure inert gas atmosphere [3].

The highest quality welds most consistently is produced by the Gas tungsten arc welding. In any configuration it can weld all metal, but on heavy section it is not economically competitive. For welding STAINLESS STEEL, it is most popular and for nearly all process the stainless-steel pipes are used and especially in cryogenics where fusion is very necessary. On welding current due to high frequency voltage superimposed in TIG, the shielding gas gets ionized. To create a reservoir of molten material, this is sometimes achieved by melting the parts of work or applying a filler material which cools to make a solid joint, either used in combination with heat or pressure, or by itself, to generate the weld. In manual arc welding, the important procedure variables are: arc voltage, welding current as well as speed. Through their effects on weld bead penetration, the effect of these procedure variables is established. By weld bead geometry, the weld quality was strongly characterized because in formative mechanical properties of weld, the weld pool geometry performs an imperative role [4-6]. Due to increased welding current, the heat affected zone influenced with the enlarge of heat input. Because low heat input, the width of heat exaggerated zone enhances [7].

In appearance the weld bead geometry of weld repaired aluminum alloy was like as cast STAINLESS STEEL but different in the micro-structure [8]. In gas metal arc welding procedure, the relation between welding parameters and weld bead geometry was investigated which results on weld bead geometry as greatest effect of welding current. Beyond an optimum value if welding speed decreases on weld pool due to the pressure of electric arc, the depth of penetration is decreases [9]. The cooling rate is influenced by the heat input parameter, weld mechanical properties and weld bead size [10]. For low gun angle less depth of penetration was obtained due to less pre-heating of base metal [11]..

1.3.2 Principles oF TIG welding: With the electrode attached to the power source 's negative pole, DCEN conventionally utilizes direct current for welding most of the TIG process materials. An efficient oxide removal does not give by the welding on this polarity.

If in the DCEN (direct current electrode negative) or DCSP (Direct Current Straight Polarity) 2/3rd of the heat then it is concentrated on the weld joint. On the tungsten electrode, the DCEP (direct current electrode positive) or DCRP (Direct Current Reverse Polarity)2/3 rd of the heat is concentrated. For DCEN penetration is deepest, least for DCEP and less for AC.

1.3.2.1 DCSP - Direct Current Straight Polarity: This is used in this kind of TIG welding. The negative terminal of power supply is connected with the Tungsten electrode. DC welding process is most commonly and widely used by this type of connection. The negative terminal is being connected with the tungsten; it will just get thirty percentage of the welding energy. A good penetration as well as a narrow profile is shows by the resulting weld.

1.3.2.2 DCRP - Direct Current Reverse Polarity: The +ve terminal of power supply linked with the tungsten electrode in such kind of TIG welding setting. Because most heat is on the tungsten, such kind of connection is utilized hardly ever, so the tungsten can easily burn away and easily overheat. A shallow is produces by the DCRP, at low Amp broad profile as well as is mostly utilized on very light material.

1.3.2.3 AC - Alternating Current: For most white metals, it is the favored welding current, e.g. magnesium as well as aluminum. The tungsten heat supply is distributed as the AC wave travels from one side of the pump to the other. The tungsten electrode is successful in the half cycle, and the electrons move from the material to the tungsten. This should help in the deposition of some skin oxide on the base material. This side of the wave formation is considered half free. The wave has moved to the point where the tungsten will be pessimistic, as well as the electron flow from the tungsten welding electrode to the base material. The cycle's side known as Anodic cleaning.

1.3.2.4 Alternating Current with Square Wave: By a wave form as well as with the beginning of contemporary electricity AC welding machines be able to generated called Square Wave. Every side of the square wave could give a more penetration as well as cleaner half of the welding cycle as well as it has a better control [12].

1.4 TIG Welding Advantages

The TIG welding processes have specific merits as follows:

- Concentrated Narrow arc
- Ferrous and non-ferrous metals are able to weld by TIG welding
- Flux is not used by TIG welding and does not leave any slag
- Throughout TIG welding, there is no spatter as well as fumes

1.5 TIG Welding Applications: This procedure is well suitable for metal sheet thicknesses of around 5- 6 mm. The TIG be able to also weld the thicker material plate, resulting in high inputs, mechanical properties of base material, resulting in distortion as well as decrease, utilizing multiple passes. In TIG welding high quality welding welds is able to attain separately owing to high degree of control in heat input as well as filler additions. In all points as well as the procedure TIG welding can be performed that is helpful for the pipe as well as tube joint. The TIG welding requires very little or sometimes no finishing as it is a highly controllable, precise method. This welding method can be used for both manual as well as automated operations. In high-tech technologies in industry for example-

- Aircraft
- Nuclear industry
- Maintenance as well as repair work
- Food processing industry
- Exactness manufacturing industry
- Automobile

1.6 TIG WELDING PROCEDURE PARAMETERS

The values as well as consequence of this procedure affect parameters are given here:

1.6.1 Welding Current: The splatter as well as job component get weakened which can contribute to higher current in TIG welding. Lesser current setting in this leading to stick of the filler wire again. For lower welding current, greater heat-affected region may also be seen and the same amount of filling materials ought to be added over longer amounts of time to deposit as high temperature. The set current mode can change the voltage, so that preserve a steady arc current. Welding a welding power supply is a source which supplies electrical current. High current is required by the welding and in welding; it can need above 12,000 amperes. The low current will also be utilized for gas tungsten arc welding, welding two razor blades together at 5 amps. The weld area is heated, as well as fusion takes place during the pulse current period. The weld area is left to cool as well as solidify as the current in the background drops. Pulsed-current GTAW has a various merit as well as warp age in thin work pieces as well as lower heat input but also subsequently a reduction in distortion. In addition, the weld pool greater control is allowed by this, and weld penetration can increase quality and welding speed. A similar method GTAW manual is programmed for programming a specific rate as well as magnitude of current disparity; it allows the operator for specialized applications making it useful [13].

1.6.2 Welding Voltage: Voltage defining as the two points having potential difference or the electric potential energy difference between two points per unit charge, known as electric tension or electrical potential difference. [13] Based on the TIG welding equipment, the welding Voltage could be fixed or adaptable. A wide sort of functioning tip distance as well as easy arc initiation, the high initial voltage is allowed. In welding quality high voltage, be capable of direct to the large variable.

1.6.3 Inert Gases: The working metals dependent is the shielding gas choice as well as effects on the welding cost, splatter, and electrode life, weld temperature, weld speed etc. The finished weld penetration depth as well as hardness and brittleness, surface profile, strength, resistance, porosity, of the weld material is also affected by this. For TIG welding applications, the Argon or Helium may be operated successfully. Pure argon is utilized for welding of enormously thin material. An arc is provided by the Argon that functions more easily and calmly. For most of the applications, the argon is preferred by these reasons, except in larger thickness where higher heat as well as penetration is needed. It is necessary to use pure argon to weld structural steels, titanium as well as magnesium, aluminum, stainless steels, structural steels, low alloy steels as well as aluminum. The Argon hydrogen combination is utilized for welding in certain types in nickel alloys as well as stainless steels. The total helium blend is utilized with aluminum along with copper. The Helium argon

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mixes is able to utilize with low alloy steels, copper as well as aluminum.

1.6.4 Welding Speed: This is crucial consideration for TIG welding. When welding pace is improved, the heat or power input per unit length of weld is declined, so a lesser amount of welding support outcomes as well as the welding penetration decrease. The bead size and weld penetration are controlled by the welding speed or the speed of travel. It is interdependent with current. Lessens the wetting action, increases the tendency of undercut because when welding speed is extreme.

1.6.5 Gas Flow: For welding running through an outlet flow gauge before travelling to the welder through the gas hoses and regulator, the shielding gas is used. The outlet flow gauge is substituted by a flow meter. With gas flow increments marked around the tube, a flow meter is an enclosed tapered glass or plastic cylinder. A ball float rests by inside the tube. Through the flow meter when the gas flows, through the flow meter the float rises to the amount of gas flowing and to the welding machine

1.6.6 Solid TIG Stainless Steel Welding Wire AISI 304-L: The most popular stainless-steel alloy consists 18% chromium as well as 8% nickel as well as must be welded with an over-alloy filler metal like ER 308LSi. This quality of AISI 304L (L stands for low carbon) is mainly used in kitchen equipment, food sector as well as similar requirements which needs a reasonable resistance to corrosion against general forms of corrosion. Because of its low carbon content, 304L offers an easier to weld stainless Steel as well as leads to improved corrosion resistance after welding. Due to the addition of 2-3 per cent molybdenum, this stainless-steel alloy offers better corrosion resistance compared to AISI 304L. Because of the higher strength, the Ceweld304-LSiwelding wire differentiates itself so this provides a important stable arc notably when welding on thin stainless steel sheets with an impulse arc. This wire is also ideal for the Hotwire Tig cycle with intermediate cleaning here among layers by a totally different surface procedure.

1.7 Stainless Steel

The austenitic Steel patented in 1912 by engineers Eduard Maurer and Benno Straus currently makes up seventy percentage of the whole stainless-steel production in the world. Austenitic steel, or 200 as well as 300 series stainless steel, is Steel that has been super-heated to extreme temperatures. This process changes the crystal structure of the Steel. While this improves the features of the Steel, this process destabilizes the material. So, a stabilizing element is required, typically manganese and/or nickel.

1.7.1 Stainless Steel 300 Series: Three hundred sequence of austenitic, non-magnetic, stainless steels. The crystal structure transforms to "austenite" as nickel is applied to stainless Steel in adequate quantities. The general composition of 300 series austenitic stainless steels is 18%chromium or 8%nickel. This increases their resistance to corrosion, as well as changes the structure from ferritic to austenitic. Austenitic grades are the very frequently utilized stainless steels, representing over 70 per cent of production. Stainless corrosion resistance, maintaining their strength at high temperatures, as well as making them easy involve most frequently chromium, nickel, as well as molybdenum. This Steel is primarily utilized in the manufacturing, aerospace, as well as building sectors.

Table 1.1: Chemical composition of stainless Steel 300-Series Grades

Grade	Chemical Composition (wt %)				
AISI	Cr	Ni	Mn	N	
304	18.0 – 20.0	8.0 – 10.5	2.0 max	0.10 max	

2. RELATED WORK

Yugang Miao et al. 2015 Evaluated the possibility of Double-Sided Arc Welding (Caus-DSAW), Bypass Current, for high-speed, 2 mm thick 304 stainless steel welding. The metal transfer process, as well as the arc behavior, were monitored using a high-speed camera. The current MIG – TIG coupling arc density distribution was measured using the probe method. The bypass current enhanced the filler wire's melting productivity as well as decreased the base metal's heat input; with bypass, currently added, the current density at the arc center reduced by thirty percent. The droplet growth period has been shortened to raise the transfer frequency by fifty percentages. The viability of applying the BC-DSAW to thin-plate high-speed welding was checked, as well as the effects of bypass pressure on the seam size, current stress, heat intake & metal transfer were examined. Depends on the experiments, the subsequent assumptions may be reached that the accuracy joints of the thin plate could be achieved utilizing the BC-DSAW in the Metal transfer mode shifted from the short circuit mode to the globular mode as well as the transfer frequency improved by fifty percent after the bypass current was utilized, that enhanced the welding performance as well as the reliability of the BC-DSAW system. [16].

Jianxiong Li et al. 2015 The impact of torch position as well as the angle on welding quality as well as welding procedure stabilization effect of Pulse on Pulse Metal Inert Gas (MIG) welding – brushing of 6061 aluminum alloy to 304 stainless steel in lap configuration was reviewed. Arc images, electrical signals of welding current, as well as welding voltage, were obtained by a high-speed camera as well as an electrical signal amplification device in synchronous modes, respectively. The results found indicate that arc form, macrostructure, microstructure as well, as mechanical properties are susceptible to the aiming direction of the torch when the travel angle of the torch is 20 °, and the working tip 0 °. It is easier to punch the arc as well as keep it on the aluminum alloy surface compared to stainless Steel. High-strength joints, whose fracturing occurred in Al alloys heat-affected areas at 89 MPa up to 72 percent of Al alloys' tensile strength, were produced. The findings are described as follows: arc form, macrostructure, microstructure as well as mechanical properties are responsive to torch targeting location iftorch travel angle an is 20 ° or working angle ß is 0 °; Nevertheless, the impact of the aiming location of the torch is negligible whenever the angle is 20 ° and ß is 20 °. This research method can be incorporated conveniently as well as efficiently into the real-time monitoring of the welding cycle, and offers comprehensive guidance in the MIG welding of aluminum alloy to stainless Steel [10].

Jianxiong Li et al. 2016 Studied pulse influence on pulse stability of the modern pulse gas metal arc brazing (P-GMAB) device, that was calculated by welding current and voltage signal calculation. Outcomes depends on time domain as well as frequency domain analysis show that the pulse-on-pulse gas metal arc brazing welding process stability far outweighs the P-GMAB's. Such objective tests are checked for laboratory studies and thus are confirmed. Nonetheless, for PP-GMAB high-energy pulse, the droplet transition mode is mainly ODPP with a few numbers of two drops per pulse (TDPP); for low-energy pulse, ODPP is retained during the entire welding cycle by the metal switch. The improved welding form by using the pulse mode is because of its more stable welding procedure as well as the conclusions are as shown in: that is able to attributed to the smaller duty cycle of the low-energy pulse as well as lower peak currenes. The PDD welding current curves are typical of a double hump shape, as well as the PP-GMAB ratio is lower, which implies the welding cycle is more robust. [9].

F. Varol et al. 2016 Engineered impact of welding current on gas metal arc brazing 304 stainless steel & EN 10292 galvanized steel plates with 1 mm thick S Copper 6100(CuAl8) copper wire. Argon was used as gas shielding operations, as well as gas flow speed as 12 L / min was used to braze. Seven separate welding currents such as 40, 45, 50, 55, 60, 65, and 70 A were used to conduct brasing operations. Tensile strengths of joints were tested after the brazing operations, as well as micro- as well as macro-structures of joints were reviewed to see the joining ability of 304 stainless steel as well as EN 10292 steels utilising various initial intensity utilizing gas metal arc brazing method. They braced 10292 galvanized steel as well as 304 stainless steel. It was found that, with the rise in current strength, force increased. The tests found that much of the tensile research specimens were galvanized Steel broken from the base metal EN 10292. No fracturing was found in the joint region when analysing the effects of the bending examination. With the bypass current added, the base metal 's heat intake was reduced, contributing to a reduction in the amount of fusion and the HAZ field. MIG-brazing process produced lower heat intake as contrasted with other forms of fusion. While using 65, 70 A current intensities, the molten metal wetted the Steel easier. [27].

Chuang Cai et al. 2016 Investigated results on welding properties of the multiple gas flow activities of three separate shielding gas nozzles for narrow-gap laser-TIG hybrid welding of thick-section Steel. Owing to the unpredictable as well as high speed of shielding gas, erratic droplet transition activity with spatters as well as welding current wave was found during usage of the straight-trapezium shielding gas nozzle. The weld with a mass of pores on the surface in a wick allocation was developed and use a straight trapezoidal nozzle, because as during weld metal the part of the molten pool would not be adequately confined. Stable droplet transfer activity as well as current wave was performed; skilled welds were achieved with almost no pores at the surface that use the square-outlet nozzle with boss or circle outlet nozzle with boss. The transition actions of droplets and the presence of welds is studied compared. The three nozzles' protecting gas flow behaviors have been identified. The major findings are as follows: because of instability as well as high speed of the shielding gas, erratic droplet transition activity with spatter was observed when using straight-trapezium shielding gas nozzle. A mass of pores emerged at the weld surface through the usage of the straight-trapezium nozzle in the honeycomb delivery, because the aft portion of the molten pool cannot be efficiently covered. [4].

C.W. Dong et al. 2016 Studied an innovative manufacturing system for extra shielding gas to account for welding flaws that frequently arise as air is subjected to high temperature solids as well as liquid phase welds. This approach modifies the new pulsed TIG welding system correctly by inserting an airflow regulation section of shielding gas for mitigation, so that weld forming of the high-temperature, solid-liquid process from the welding torch nozzle can be manually interfered with and secondary gas safety of the weld surface can be added. This adapted welding tool with additional airflow is then used as the base material for conducting bead-on-plate pulsed TIG welding experiments utilizing austenitic stainless-steel model 18-8. The analysis of weld microstructure and physical properties shows that not only is weld forming dramatically enhanced after adding a certain amount of shielding gas for reimbursement, but even the weld surface is timely monitored and covered. [5].

N. Ghosh et al. 2016 The welding properties of the material is analyzed & the welding parameters are controlled by technique. To study, an orthogonal array, signal to noise ratio (S/N), as well as variance analysis (ANOVA) are utilized. The welding inspectors were also on the hunt for improved welding efficiency. Experiments as well as studies in current work have tested the effect of current, gas flow rate & nozzle to plate gap on weld efficiency in metal gas arc welding of Austenitic stainless Steel AISI 316L.Many rates of current, gas flow rate, as well as nozzle to plate gap have been produced of butt welded joints. The determined outcome is in the form of input from each component, from which optimum thresholds for maximal tensile strength as well as percentage elongation are defined. Limited research. The worst outcome for Sample No. 7 was obtained in tensile testing. The objective of Taguchi's single objective optimization is to maximize the ultimate tensile strength (UTS) as well as percentage elongation (PE) individually, i.e. separately. The S / N ratio definition of Taguchi is used, and it is observed that I optimal condition for maximum UTS (ii) optimal condition for maximum PE. Confirmatory experiments have been checked on the optimal conditions defined by single-objective optimization methods [6].

Nakhaei et al. 2016 Developed a two-pipeline system for applying Ar + CO2 mixed gas as the outermost surface, whereas pure argon has been used as an internal layor to avoid any tungsten electrode consumption. The findings showed that the proportion of active gas with in molten pool contributed to a shift throughout the surface tension coefficient of temperature, such that the convection of Marangoni transforms inward and creates a shallow weld region. The rise in gas flow rate results in a decline in weld performance due to the rise in oxygen levels mostly in weld pool and the creation of a thicker layer of oxide upon the welded surface.

Badheka et al. 2016 records the microstructural characteristics of two types of steels, carbon steel and stainless Steel (SS 304) welded utilizing an activated flux-TIG (A-TIG) and TIG i.e. inert tungsten inert gas methods. In A-TIG welding of dissimilar welding among carbon to stainless Steel, activated fluxes like ZnO, MnO2, and TiO2 are successful. It is found that joint performance, mechanical strength of A-TIG welds is greater than average TIG Welds. This research aims to create a correlation among observable mechanical activity (strength and hardness) and welded specimen microstructural properties.

Nabendu Ghosh et al. 2017 Studied as well as evaluated the results of welding parameters in MIG welding of AISI409 ferritic stainless materials: welding current, gas flow rate as well as nozzle to plate size, ultimate tensile strength (UTS) but percentage elongation (PE) Experiments were performed as per Taguchi system L9 orthogonal series. To identify surface as well as sub-surface faults of welded specimens, the visual inspection as well as the X-ray radiographic test was also taken place. UTS as well as PE observed data were interpreted, mentioned and analysed using Taguchi methodology as well as signal-to-noise ratio analysis. The analysis has drawn some concluding remarks. Visual inspection consequences point to that undercut as well as blow holes were established in a few

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samples, uneven deposition as well as excessive penetration in some samples as well. Comparison is made between findings between visual examination and X-ray radiographic examinations, any accuracy is basis. Results of ANOVA studies show that parameters of the welding method have no major effect on both responses. UTS and PE. Tests of confirmatory studies verify the existence of the optimized findings obtained by Taguchi process. [7].

EszterKalacska et al. 2017 Investigated welding procedure of various kinds of AHSS in dissimilar joint welding. The TWIP as well as TRIP (transformation induced plasticity) steel sheets were welded together to simulate the mass production of thin steel sheet constructions utilizing automated metal inert gas welding procedure. The welding parameters have been optimized successfully for welded joints on butts. Visual examination, tensile testing, as well as quantitative metallography as well as measurement of hardness were investigated into the joints. The joints' TRIP steel side displayed improved micro hardness by an improved fraction of bainite and martensite up to (450-500 HV0.1). The tensile specimen displayed ductile conduct macroscopically, and split in the austenitic weld content. The following results can be taken from the above-mentioned investigations: Given the improvement in bainite to martensite ratio in the TRIP 800 steel HAZ as well as the rise in strength, the welded joint is ductile, it has a significant plastic bend before fracture. [11].

R. Prabhu et al. 2017 The effect of procedure parameters on the ferrite number was studied during the Pulsed Metal inert gas (MIG) welding process in austenitic stainless steel 317L cladding. The number of ferrites was calculated using Fisher's ferrite array. From the variance method research, it is evident that the mathematical model that was developed was substantial. The numerical model developed is helpful for controlling and determining the content of the ferrite number. The direct property of input procedure parameters as well as their interaction is presented graphically. For the creation of mathematical models, a five-level, three-factor design matrix centered on a central composite rotatable plan technique was utilized to predict the ferrite amount used to clad austenitic 317L stainless Steel deposited utilizing pulsed MIG welding technique. ANOVA recognizes major causes. With 95 per cent confidence level, the model values are adequate. With the enlarge in welding speed, the number of ferrites reduces continually due to decreased deposition of the filler material over the base metal. The number of ferrites decreases therefore with the rise of the welding current [18].

Casalino et al. 2018 Throughout this analysis, stainless steels AISI 410 and AISI 304 were soldered together with a hybrid welding method for fibre-TIG. Weldability was assessed by analysis of the mechanical properties and the microstructure. The analysts examine the impact of welding parameters, like laser line power (ratio of feed rate and laser power) and the arc current. The defects and microstructure of Welds were evaluated and compared to the fracture form, residual stress, and the tensile test. It was also defined with respect to the weld line in both longitudinal and normal dimensions. It illustrated and commented mostly on disparity found on both sides of the weld.

Cheng et al. 2018 Employing double-sided arc welding (DSAW) MIG-TIG with copper filler material, the TC4 alloy (Ti)/304 stainless steel (SS) plates were joined and further investigated. By controlling the welding parameters various join modes, i.e. welding-brazing mode (SS welding-Ti brazing, Ti welding-SS brazing), fusion welding mode, and brazing mode, were achieved. The joints' mechanical characteristics and interfacial microstructures have been studied. The findings demonstrate that the joining mode strongly affects the mechanical properties and the interfacial microstructures.

Maruthi et al. 2018 Made an effort to research the embrittlement of low temperatures on SS 304LN TIG Welds. The micro-structural analysis and mechanical property testing assessed the behavior of low temperature embrittlement based on aged samples at (400, 350, 300° C) over 10,000 hours. Mechanical testing requires testing for Impact and Harness. Measurement of Delta ferrite was performed to see some delta ferrite transformation. The surfaces were characterized by fracture utilizing SEM. Increased hardness with a rise in ageing temperature and a decline in the content of delta ferrite at 400 ° C and 350 ° C clearly show that ageing temperature can affect the kinetics of delta ferrite transformation. SEM did not demonstrate any delta ferrite transformation. Ageing treatment was found to have a significant effect on the toughness of the impact.

3. CONCLUSION

advancement of processes, the new welding process started to produce high temperatures in the concentrated region well before the end of the 19th century. In general, a heat source is required to produce a high-temperature zone and to melt raw material welding, although two metal pieces can be welded without much increase in temperature. Differing views, as well as techniques, are adopted, but there is still a continuous search for new and better methods of welding. The demand for the novel welding materials having large thickness components enhances, mere gas flame welding, usually are welding engineer known, which is not satisfactory and improved as the development in tungsten inert gas welding, metal welding, laser in addition to electron beam welding

4. REFERNCES

[1] Abdul wahab H. Khuder and Esam J. Ebraheam, "Study the factors effecting on welding joint of dissimilar metals", Al-Khwarizmi engineering journal, April (2011), Vol 7, No. 1, pp.-76-81.

[2] Bharwal S. and Vyas C., International Journal of Advanced Mechanical Engineering. ISSN 2250-3234 Volume 4, Number 6 (2014), pp. 695-700 Weldability Issue of AISI 202 SS (Stainless Steel) Grade with GTAW Process Compared to AISI 304 SS Grade

[3] Bharwal S., Vyas C., "Weldability Issue of AISI 202 SS (Stainless Steel) Grade with GTAW Process Compared to AISI 304 SS Grade", International Journal of Advanced Mechanical Engineering. ISSN 2250-3234 Volume 4, Number 6 (2014), pp. 695-700.

[4] Cai C., Li L., Tai L, "Narrow-gap laser-MIG hybrid welding of thick-section steel with different shielding gas nozzles", Int J Adv Manuf Technol.

[5] Dong C.W., Xue J.X., Jiang X.M., "Effects of Additional Compensation Shielding Gas on Stainless Steel Pulse MIG Welding", 2016 IEEE International Workshop on Advanced Robotics and its Social Impacts (ARSO) Shanghai, China, July 8-10, 2016

[6] Ghosh N., Pal P.K., Nandi G., "Parametric optimization of MIG welding on 316L austenitic stainless steel by Taguchi method", Archives of Material science and Engineering, Volume 79 Issue 1 May 2016 Pages 27-36.

[7] Ghosh N., Rudrapati R., Pradip Pal K, Nandi G., "Parametric Optimization of Gas Metal Arc Welding Process by using Taguchi method on Ferritic Stainless Steel AISI 409", Materials Today: Proceedings 4 (2017) 2213–2221.

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[8] https://ewi.org/gas-metal-arc-welding-basics-travel-speed-and-contact-to-work-distance-ctwd/

[9] Jianxiong Li, Huan Li, Chaoqun Huang, Ting Xiang, Yanbing Ni,vHuiliang Wei., "Welding process characteristics of pulse on pulse MIG arc brazing of aluminum alloy to stainless steel", Int J Adv Manuf Technol

[10] Jianxiong Li, Huan Li, Huiliang Wei, Ying Gao., "Effect of torch position and angle on welding quality and welding process stability in Pulse on Pulse MIG welding–brazing of aluminum alloy to stainless steel", Int J Adv Manuf Technol.

[11] Kalácska E., Kornél M., Eniko R., Fábián, Russo S., Materials Science Forum ISSN: 1662-9752, Vol. 885, pp 80-85 .

[12] Khan E.A.A., Debroy T., "Alloying Element Vaporization and Weld Pool Temperature during Laser Welding of AISI 202 Stainless Steel", Metallurgical Transactions b volume 15B, December 1984—641.

[13] Kumar A., Sundarrajan S. "Optimization of pulsed TIG welding process parameters on mechanical properties of AA 5456 Aluminum alloy weldments", Materials and Design, Vol.30, (2009) p.p.1288–1297.

[14] Lim J.Y., JinYoon M., Kim S.Y., Shin H.S., Kim T.G., "Mechanical properties of CO2 /MIG welded structural rolled steel and stainless steel", Journal of Mechanical Science and Technology 29 (1) (2015) 103~108 .

[15] Lothongkum G, Viyanit E, Bhandhubanyong P. Study on the effects of pulsed TIG welding parameters on delta-ferrite content, shape factor and bead quality in orbital welding

[16] Miao Y., Xu X., Wu B., Han D., Zeng Y., Wang T., "Effects of bypass current on arc characteristics and metal transfer behaviour during MIG–TIG double sided arc welding", Journal of Materials Processing Technology 224 (2015) 40–48.

[17] Monika K., Bala Chennaiah M., Nanda Kumar P. and Prahalada Rao P., "The Effect of Heat input on the Mechanical Properties of MIG Welded Dissimilar Joints". International Journal of Engineering Research & Technology, (2013), vol 2, pp. 1406-1413.

[18] Prabhu R., Alwarsamy T., "Effect of process parameters on ferrite number in cladding of 317L stainless steel by pulsed MIG welding", Journal of Mechanical Science and Technology 31 (3) (2017) 1341~1347.

[19] Pradip D. Chaudhari and Nitin N. More, "Effect of welding process parameters on tensile strength", IOSR journal of engineering, May (2014), Vol. 04, Issue 05, pp.-01-05.

[20] Raafal M. Molak, Krystian Paradowski, Measurement of mechanical properties in 316L stainless steel welded joint, Int. J. Pressure vessels an piping, 86 (2009) 43-47.

[21] Radhakrishnan V.M., "Welding Technology & Design", McGraw Hill, New York (2006).

[22] Singh L., Kumar R, Gupta N and Mayur Goyal M. "To investigate the effect of tig welding parameters on 5083 aluminium alloy weldability", Mechanica Confab ISSN: 2320-2491, Vol. 2, No. 4 (2013).

[23] Singh L., Vinay Shah V. and Singh N.K. "To study The influence of TIG Welding Parameters On Weld Characteristics Of 5083 Aluminum Alloy", ISSN: 2319-5967 International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2 (2013).

[24] Sudhakaran R., Murugan V., Sivasakthive P.S., "Optimization of process parameters to minimize angular distortion in gas tungsten arc welded stainless steel 202 grade plates using particle swarm optimization", Journal of Engineering Science and Technology Vol. 7, No. 2 (2012) 195 – 208.

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