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Optimizing Conditions for Performing GMAW (TIG) Welding on Ultra 904L Specimens

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***Abstract*—** The traditional welding process involves the use of consumable electrodes, welding torch, power supply etc. The weld obtain by performing such welding process is of inferior quality so gradually various different processes of welding took the place of traditional welding methods and the most reliable among them is TIG welding. Since this technique is relatively slower and complex so research work is done to estimate and analyze optimum magnitude of current, voltage and gas discharge for such welding process.

***Keywords*—** TIG; GMAW; Welding; Coalescence.

I. Introduction

Welding is a fabrication process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material that cools to become a strong joint, with the use of combination of pressure, temperature and metallurgical conditions. Gas tungsten arc welding (GTAW), also known as tungsten inert gas (TIG) welding, is an arc welding process that uses a non consumable tungsten electrode to produce the weld. The weld area is protected from atmospheric contamination by a shielding gas (usually argon), and a filler material is normally used. A constant current power supply produces energy which is conducted across the arc through a column of highly ionized gas and plasma. GTAW is most commonly used to weld thin sections of stainless steels, non – ferrous materials such as aluminum, magnesium and copper alloys.

II. Problem Identification

Many industries use TIG welding for welding thin work pieces especially non ferrous metals. It is used extensively in the manufacture of space vehicles, aerospace industry, weld small diameters, thin walled tubing’s etc. In fact no other welding process permits the welding of so many alloys in so many product configurations, filler metal loss does not occur in such welding process. Because the resulting welds have same chemical integrity as the original base metals more closely. TIG welds are resistant to corrosion and cracking over long time periods, TIG welding is the welding procedure for critical welding operations like sealing spent nuclear fuel canisters before burial. However TIG welding is complex and difficult and relatively slower than other welding techniques, so an approach is required to find the optimum working conditions for performing the TIG welding, if optimum magnitude of current supply, voltage and inert gas flow is estimated then the process can be standardized and these difficulties can be overcome.

III. Methodology

The research work commence with the setting of the best input parameters of TIG welding for better joint strength of stainless steel (Ultra 904L). Result of the study will suggest the best setting of TIG welding input parameters for better joint strength of (Ultra 904L) for industrial applications. In the TIG process the energy necessary for melting the metal is supplied by an electric arc struck and maintained between tungsten electrode and the work piece, under inert gas atmosphere. The specimens are welded under DCEN (direct current electrode negative) mode. The shielding gas employed is Argon. A very stable arc and calm welding pool of small size is obtained, Spatter is absent, no flux is used.

IV. Results

The study is performed on 5 different specimens of case material (Ultra 904L) stainless steel using the different values of current, voltage and gas discharge, which is tabulated as shown to reach final conclusion.

TABLE 1

zzzz **Specimen designation**	**Ultra 904L Parameters.**				
	Current (Amp)	**Impedence (Ohm)**	**Potential Difference (V)**	**Tolerence**	**Argon Discharge (lit/min)**
1	50	±5	**10**	±5	15
2	80	±5	**16**	±5	15
3	110	±5	**22**	±5	15
4	140	±5	**28**	±5	15
5	170	±5	**36**	±5	**15**

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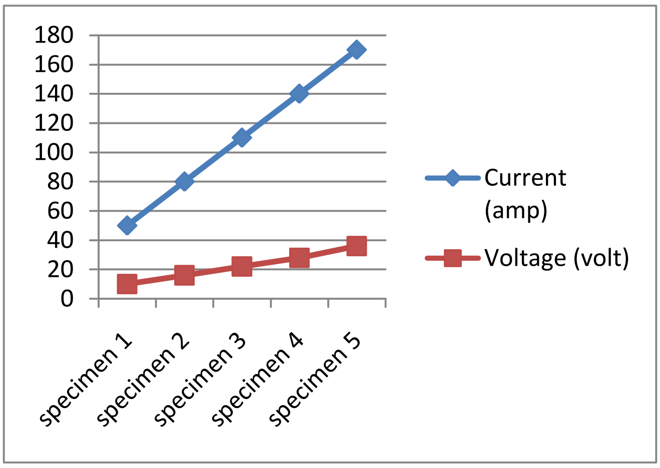

Fig. 1.

V. CONCLUSION

Experiments were conducted at different values of current (50,80,110, 140, 170) amp. Keeping the gas flow constant (15 lit/min) and different values of voltage (10, 16, 22, 28, 36) volts. Standard welding parameters were obtained corresponding to change in values of current and potential difference. It has been observed that welding joint not made properly below 50 amp and above 200 amp, burning of specimen started. So it is concluded by means of these graph that TIG welding should be done:

1. Current = 50 amp, Voltage = 10 volts, Inert gas discharge rate = 15 lit/min.
2. Current = 140 amp, Voltage = 28 volts, Inert gas discharge rate = 15 lit/min.

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