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Review Article

A Brief Review on Parameters Effectuating Welding Characteristics of Joints Prepared using MIG Welding

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A B S T R A C T

The selection and management of input process parameters is a frequent problem for Metal Inert Gas (MIG) welding during the welding of mild steel, which also affects the weld quality. Across different sectors, such as automotive, aerospace, and various other industries, MIG welding is widely applicable. Through the careful selection of the input welding parameters, the weld linkages can be optimized and the reliability of the joint formed further improves This paper looks briefly at the various types of studies carried out by various researchers considering significant input process parameters which affect the response outputs obtained on basis of weld quality, mechanical and metallurgical properties. Herein, the experimental studies reviewed have exhibited that the most effective parameter for optimizing weld qualities is the voltage applied, current, speed of welding, and wire-feed speed.

Keywords: Metal Inert Gas (MIG) Welding, Process Parameters, Weld Joints, Weld Qualities

Introduction

Due to the advent of automation and mechanization in welding, high quality of weld bead can be obtained only by proper selection of procedure for welding. An optimum procedure for welding needs to be established for fabrication using arc welding. At most of the instances, these procedures are pre-specified and are no more systematic than the reference manual. Since arc welding began due to its worldwide importance, attempts have always been made to predict the results by varying the inputs of controlled variables (elements of a welding procedure) against output characteristics (weld bead geometry dimensions). The studies include both theoretical studies dependent on heat flow theory, along with empirical studies.

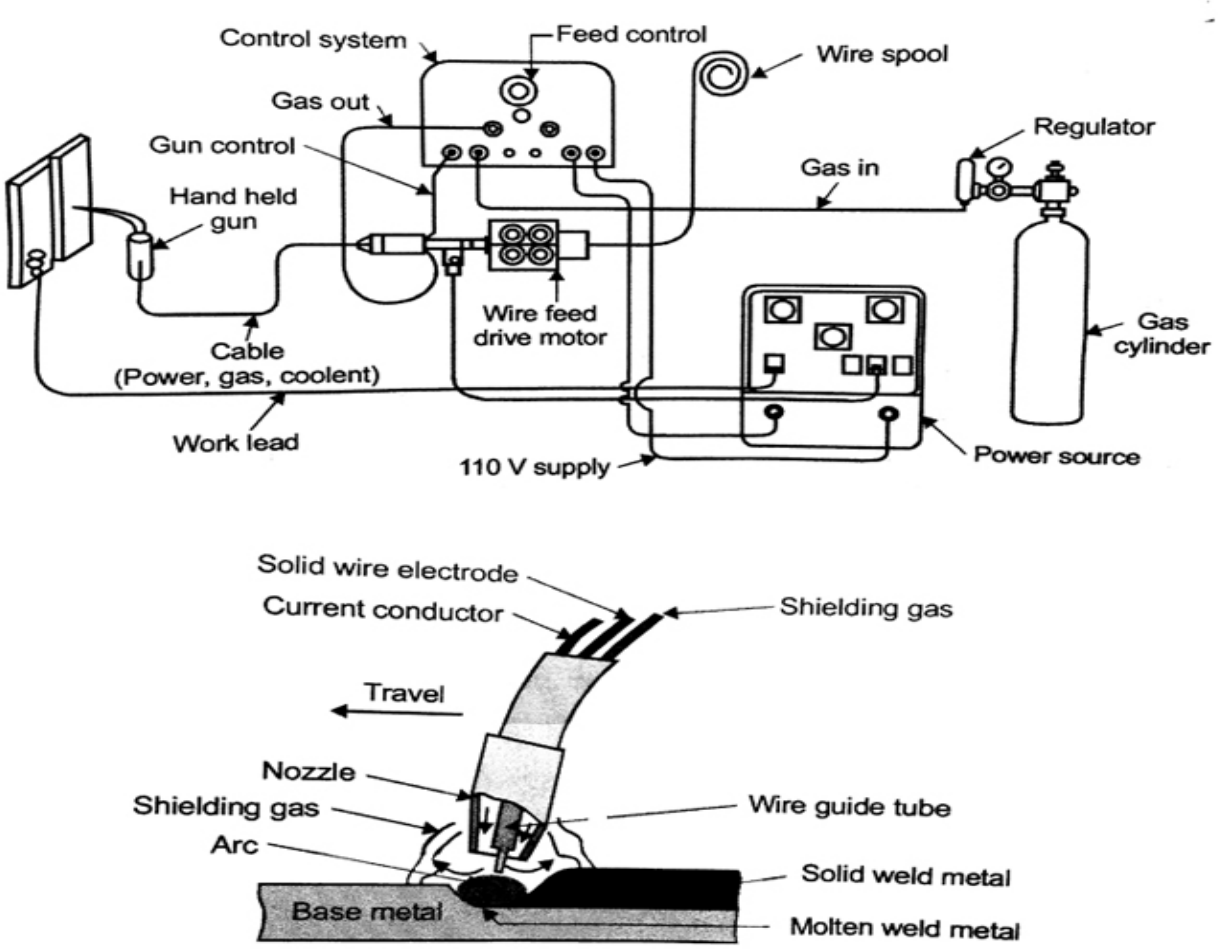

Figure 1.MIG Welding Technique

Table 1

Sr. No.	Author	Problem Statement/ Title	Material/ Steel Grade	Method	Findings
1	Aoki A et al. in 2019 [1]	Development of novel MIG welding process with duplex current feeding	950 MPa class steel	Duplex current feeding process. DCF_MIGW was developed which was able to control the wire-feed speed and the welding current separately	This result showed the ability to feed larger welding current as compared to the conventional systems for the same welding system
2	Jogi B et al. in 2018 [2]	Metal Inert Gas (MIG) Welding Process Optimization using Teaching-Learning Based Optimization (TLBO) Algorithm	AISI 1018 mild steel	Taguchi's L27 orthogonal array	Made a study to find out the most significant parameters for MIG welding. The study showed that both welding current and voltage are significant parameters

3	Jie Y. et al. in 2015 [3]	Influence of welding speed on the fatigue of friction stir welds, and comparison with MIG and TIG	Al–Mg–Si alloy 6082	Taguchi's L27 orthogonal array	The study concluded that the average current for MIG welding is in the range of 90 A with a current difference of 40 A
4	Zheng Y. et al. in 2017 [4]	An investigation on butt joints of Ti6Al4V and 5A06 using MIG/TIG double-side welding-brazing	Ti6Al4V and 5A06 double side welding	Phase identification was analyzed via X-ray diffraction (XRD)	Investigated on dual side welding and made a statement stating MIG welding is excellent for double-side welding. When the wire-feed speed is high. The results were proven with tensile tests too
5	Tarng Y.S et al in 2009 [5]	The use of grey-based Taguchi methods to determine submerged arc welding process parameters in hardfacing	A martensitic stainless steel was welded with dimensions 30 mm X 80 mm X 120 mm	Use of grey-based Taguchi methods	The results showed that Taguchi's technique can help us very effectively in finding out the effective parameters for optimizing the weld parameters
6	J.P. Ganjigatti et al. in 2007 [6]	Global versus cluster-wise regression analyses for prediction of bead geometry in the MIG welding process	Structural mild steel (plates) having composition: C—0.10, Mn—0.9, Si—0.04, S—0.032, P—0.032 and dimensions of 150 mm×75 mm×8 mm	Input-output relations of the MIG-welding using regression analysis	The results showed that cluster wise regression analysis is a better method than the global approach for predicting weld-bead geometric parameters
7	Aloraier A. et al. in 2004 [7]	Eliminating post-weld heat treatment in repair welding by temper bead technique: role bead sequence in metallurgical changes	Mild steel plates with carbon of 0.22%	Fluxed core welding process	The microstructure and the hardness of the HAZ were improved by depositing second welding bead deposits

8	Lung K et al. in 2007 [8]	Optimizing multiple quality characteristics via Taguchi method-based Grey analysis	Titanium alloy	Taguchi method based on Grey analysis	The optimized results obtained in this study clearly showed an increase in the tensile zone and a decrease in the heat-affected zone
9	Juang S. et al. in 2002 [9]	Process parameter selection for optimizing the weld pool geometry in the tungsten inert gas welding of stainless steel	Stainless steel	Taguchi method used to analyze the impact of weld characteristics on the weld products	The results showed that back width and back height were greatly improved by this approach
10	Hee-keun L. et al. in 2015 [10]	Effect of plasma current on surface defects of plasma-MIG welding in cryogenic aluminum alloys	Al 5083 plates and Al 5183 wire were employed as a base metal and welding consumable	MIG weld characteristics were studied using high-speed imaging and metallurgy analysis	The result showed that strong plasma forces are generated by changing the metal transfer mode

Literature Survey

A literature review was made of all the literature available, and following were the findings which were mostly related to the topic:

According to the comprehensive literature review, the following welding parameters are found to be most significant:

Welding voltage: When the weld is being made, the electrical amperage of the welding current is put into action. It can be noted from the power source meter, but still, a separate voltmeter can be used.

Welding Speed: Welding speed puts a substantial impact on the shape and penetration of the weld. The linear speed at which the arc moves is the arc travel speed.

Wire feed speed and current: Wire feed speed and diameter ultimately set the current. It is the most primary parameter and has to be chosen in relation to plate thickness and welding speed along with the weld quality.

A lot of literature survey was done and the above papers were short-listed to be most related to the topic under consideration.

Conclusion

From the above literature it is very clear that in order to guarantee a high-strength mild steel joint, apart from design optimization of failure mode for improving quality, it is necessary to consider the most significant parameters for MIG welding which are voltage, wire-feed speed, welding speed, and current. The welding speed can be controlled by the workers in case of manual MIG welding. It can also be said that the best MIG welds can be achieved by experienced welders' at the most appropriate parameters.

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