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Analysis of Welding Parameters of MIAB Welding for T91 Material

S. Eswaran[1], R. S. Madhan Mohan[2], S. Naveen Prasad[2], G. Peruncheraladhan[2], G. Poovarasan[2]

[1]Assistant Professor, Department of Mechanical Engineering, Nandha Engineering College, Erode-52.
[2]UG Students, Department of Mechanical Engineering, Nandha Engineering College, Erode-52.

ABSTRACT

Magnetically Impelled Arc Butt Welding (MIAB) is a process of hybrid solid-state welding. It suites only for butt joining hollow cylindrical sections such as pipes and tubes. The MIAB welding equipment is robust and it is relatively simple in design, and requires low upset pressures compared to processes like Friction welding. In this process the rotating electric arc is used for heating the extremes of two tubes, which is impelled due to the electromagnetic force created by the interaction of arc current and magnetic field has been generated by external magnetic system. This paper presents the attempts made to design and develop a laboratory MIAB welding module operated hydraulically to realize the principle of the process. Trials are conducted with alloy steel tubes (44.5mmdiameter and 5.5mm, 4.5mm and 3.5mm thickness) by varying the various input parameters and subsequently recording the observations. The experimental procedure involves a series of trials to develop and evaluate the knowledge base for MIAB welding alloy steel tubes. Based on the penetration and bead of the weld the appropriate ranges of various input process parameters identified are presented.

INTRODUCTION

Welding

Welding is a materials joining process which produces materials joints by heating them to suitable temperatures with or without the application of pressure or by the application of pressure alone and with or without the use of filler material.

MIAB welding

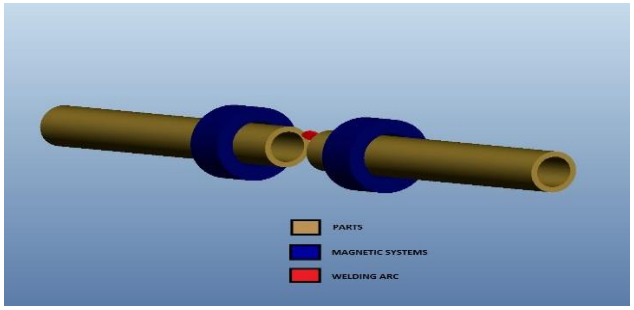

Fig. 1 MIAB Welding Process

Author for correspondence:
Department of Mechanical Engineering, Nandha College of Technology, Erode – 638052, Tamil Nadu, India

Magnetically Impelled Arc Butt (MIAB) welding is a type of pressure welding used for steel tubes and pipes. MIAB welding is a unique process in that it utilizes relatively simple equipment, but relies on very complex interactions between an arc and both an applied and induced magnetic field. This interaction is made even more complex by the changes that occur during the heating of the parts being welded.

C. T91Grade Steel Tubes

Fig.2 T91Grade steel tubes.

The properties of Grade 91 wholly opend on its chemical composition and microstructure. As per the chemical composition the minimum Carbon content should be 0.08%, minimum Niobium content should be 0.03% and minimum Nitrogen of 0.02% is specified to ensure adequate creep strength. It requires 9% Chromium, 1% Molybdenum and minimum 0.18% Vanadium with 0.3 0.6% Manganese, 0.02% Phosphorous maximum, 0.01% Sulfur maximum and 0.2-0.5% Silicon. If the Titanium is added Niobium level can be taken lower.

LITERATURE SURVEY

Abdul Khadeer Sk et al, The paper says that This paper describes a new development of circumferential welding of pipes. Circumferential butt welds are commonly used to join pipes in various industries, including power plants and automobile industries. Magnetically impelled arc butt welding process is a hybrid welding technique. It uses a rotating electric arc as its heat source and is known as efficient method for pipe welding. In this process heat is evolved prior to forging by an arc generated between two coaxially aligned pipes, this arc rapidly rotates along the circumferential edges of the pipes to be welded due to the electromagnetic force exerted by the interaction of arc current and magnetic field generated by the external magnetic system. The entire weld over the full joint thickness is made in one single operation, instead of using several passes as in conventional welding. The main emphasis of this review is to describe the different works carried out in the past which help full for providing the information for the future development of research work. Present study exposes the different works that has been done in the past for improving the weld quality [1].

Arungalai vendan et al, The paper says that magnetically impelled arc butt welding is a unique forge welding process in which an arc is drawn in the gap between the two tubes to be welded in order to raise them to a high temperature to allow forging to form a solid state weld. In this case the arc is rotated with a high speed around the weld line by an electromagnetic force resulting from the intraction of the magnetic field and the arc current this paper presents the details of the results and the conclusion of the experimental trials conducted on the MIAB module designed and developed based on the principle further nonlinear electromagnetic analysis has been performed to determine the magnetic field and electromagnetic force distribution in MIAB process using finite element package ansys. Typical results of this analysis pertaining to magnetic field are compared with the experimental data for steel tubes (outer diameter 47mm and thickness of 2mm) it is observed then the results from finite element analysis and the experimental trials are in excellent agreement the

proposed three dimensional finite element method module for electromagnetic force distribution facilities comprehensive understanding of the arc rotation process in MIAB welding [2].

Arungalai vendan et al, The paper says that Magnetically Impelled Arc Butt Welding (MIAB) is a hybrid solid-state welding process suitable for butt joining hollow cylindrical sections such as pipes and tubes. This process uses an rotating electric arc for heating the extremes of two tubes, which is impelled due to the electromagnetic force created by the interaction of arc current and magnetic field generated by external magnetic system. This paper presents the attempts made to design and develop a laboratory MIAB welding module operated pneumatically to realize the principle of the process. Trials are conducted with alloy steel tubes (48 mm diameter and 6 mm thickness) by varying the various input parameters and subsequently recording the observations. Based on the basic understanding of the process and its parameters, a pivotal attempt is undertaken to weld alloy steel tubes of boilers with specially made MIAB welding equipment (MD1). Investigations are carried out on MIAB welding machine (MD1) after preliminary experimentation to understand the basic mechanisms involved in MIAB welding process. The experimental procedure involves a series of trials to develop and evaluate the knowledge base for MIAB welding alloy steel tubes. Based on the penetration and bead of the weld (observed through visual inspection), the appropriate ranges of various input process parameters identified are presented [3].

V. S. Kachinskiy et al, The paper says that Magnetically impelled arc butt welding is mainly used in the automotive industry for butt welding of tubes and tubular parts 8-100 mm in diameter and 0.8-6 mm wall thickness. To extend the range of MIAB welding applications research work was conducted on different hallow and solid parts, special attention being given to welding of parts, the cross section of which is commensurable with of the active spot diameter of the rotating arc [4].

Kuchuk-Yatsenko et al, The paper says that Over recent years investications have been carried out. At the E.O.Paton electric welding institute of the NAS of Ukraine, into the welding pipes and pipelines of upto 219mm diameter and upto 16mm wall thickness. Results have shown the feasibility of the practical application of magnetically impelled arc butt welding for welding pipes and pipelines. The MIAB welding process is characterised by high efficiency (time of welding is 20 to 50 seconds), minimum consumption of pipe parent metal and equal-to-wall thickness. Moreover, auxiliary welding consumable and shielding gas are not required [5].

PROBLEM IDENTIFICATION

Nowadays while using welding process time consumption is high. While using TIG welding for non- metallic materials the melting state of the pipe ends is affected by polarity. For reducing these problems we prefer the MIAB welding to reduce time and polarity. For these problems we conduct the experiment of Analysis of Welding Parameters of MIAB Welding for T91 Material. Because the to other welding process MIAB welding is more effective when compare.

METHODOLOGY

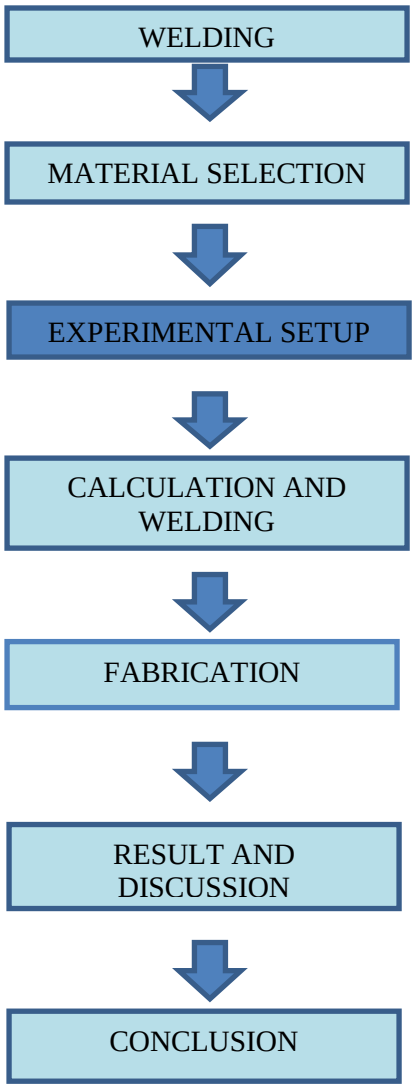

Fig. 3 Methodology flow chart

EXPERIMENTAL SETUP

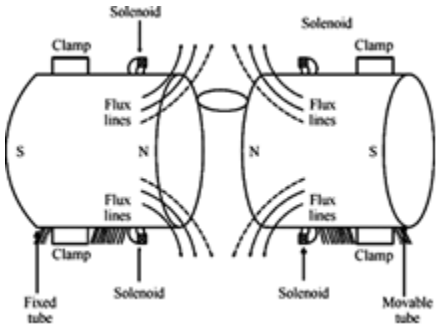

Fig. 4 Experimental Setup.

CONCLUSION

In this project we learned about MIAB welding for t91 material and its is observed that the materials can be welded using MIAB welding the different parameters where identified and based on these parameters weld is done in the respective t91 tubes and after welding process these tubes are tested based on three tests they are tensile test, hardness test and NDT based on these test results it is found that three parameter welded tubes are found to have good stability at the welding section.

REFERENCES

[1]. Abdul Khadeer Sk and Naseeb Khan. ”An Experimental Investigation of Magnetically Impelled Arc Butt Welding of Pipes”.International Journal of Current Engineering and Technology. 8, 2018, 535-540.

[2]. Nandakumar N 1, Nandhini P. “Investigating the characterization of Magnetically Impelled Arc Butt welding”. International Journal of Science Engineering and Technology Research (IJSETR).4, 2015, 3748–3750.

[3]. Siddharth Pant and Swati Bhardwaj. ”Properties and Welding Procedure for Grade 91 Alloy Steel”. International Journal of Engineering Research and Technology.6, 2013, 767-772.

[4]. Sivasankari, V.Balusamy, P.R. Venkateswaran, G.Buvanashekaran, K.Ganesh kumar.“ Characterization of magnetically impelled arc butt welded T11 tubes for high pressure applications “.International Research Journal of Engineering and Technology (IRJET). 5, 2018, 665-669.

[5]. Vishwas C. Patel, Prof. Dhavalkumar H. Patel.“Literature Review on Magnetically Impelled Arc Butt (MIAB) Welding“. International Research Journal of Engineering and Technology (IRJET).5, 2018, 665-669.