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EFFECT OF VIBRATION IN ARC WELDING USING SAE 1010 STAINLESS STEEL

[1]Dhruv Shailesh Gosani, [2]Pratik T Kikani,
[1]PG Student, [2]Assistance Professor at Department of Mechanical Engineering,
[1, 2]Mechanical Department,
[1, 2] Atmiya Institute of Engineering & Technology Rajkot, Gujarat, India

Abstract- In present work dynamic mechanical properties in arc welding technology, by applying mechanical vibrations during the welding in arc welding process. It has the advantages of not as much of investment, more suitable process, less fumes and shorter manufacturing time. Studies using steel (SAE1010) square butt joints. Studies have showing that welding of metals along with mechanical vibrations result in uniform and finer grain structures. The results from the present study show that the weld joints fabricated with vibratory condition were found to possess comparatively high hardness value and high ultimate tensile strength (UTS), without any considerable loss in the ductility. Metallographic studies conducted show that weld metals under vibratory condition infatuated comparatively finer microstructure and high hardness, due to the finer microstructure. This project has been planned to study the effect of vibration on mechanical properties like tensile strength ,hardness of weld specimen and micro structure process and application of the procedure present extensive scope for cost saving and defect free welding.

Index Terms— ARC welding, horizontal position –welding Position, material SAE 1010, with vibration.

I. INTRODUCTION

In manufacturing industries, welding is widely used for metal joining process. Metal arc welding is the most flexible fusion welding and also one of the most widely used welding process. The welding joints prepared by arc welding process generally offers good yield strength and hardness properties. The mechanical vibrations into the weld metal specimen during welding process improve the weld joint properties. In manual metal arc welding process an arc is drawn between a coated consumable electrode and the work piece. The metallic core wire is melted by the arc and is conveyed to the weld pieces pool. Slag is formed on the surface of the weld pieces pool and the slag is removed after each layer. Butt welding is used to connect parts which are nearly parallel to each other. Square Butt welding is an economical and consistent way of joining process using supplementary components.

Metal arc welding was performed on SAE 1010 stainless steel steady state vibration was produced and welding carried out in horizontal plan positions. In the proposed project vibratory set up is used for inducing mechanical vibrations in to the weld pool during welding.

Effect of vibration in welding.

Such vibrations can be cause by imbalances in the rotating parts, uneven friction, the meshing of gear teeth, etc. Careful designs and planed usually reduce unwanted vibrations. Vibrations are necessary for stress relief because vibrations induce micro strain in high stress regions.

The relative impact strength of the mild steel or base metal is affected by many variables including: the chemical analysis, micro structural constituents, and strength or hardness level and grain size.

Due to vibration refine grain structure and reduce air bubble formation and fewer fumes.

II. LITERATURE SURVEY

This review paper discusses the literature review carried out in order to identify the research gaps in the area of micro welding structural modifications for increasing the mechanical properties, so that the objectives be formulated to Complete using a systematically devised methodology/approach. Many researchers have analyzed the effect of vibrations on microstructure and mechanical properties of welded joints and have reached a basic conclusion that vibrations are able to alter/enhance the microstructure thus improving the mechanical properties of welds and cast elements due to the fundamental reason that mechanical properties of welds are influenced by the microstructure and grain size of Welding.

According to Alaa Raad Hussein et al. (2011) [2] studied the Improvement of the welding mechanical properties and the quality of the fusion metal is considered recently by using vibration during welding. In study, the effect of induced harmonic vibration during welding is employed to improve the welding mechanical properties and to reach the best shape of welding line on the surface. The vibration method is examined experimentally by using four values of mechanical frequency during welding on the

ductility, tensile strength and the homogeneity of the welding line. The frequencies were specified according to the natural frequency of the plate. The experimental results show that the vibration applied during welding generally improved the bend property of the welding line, as well as the tensile strength has been improved ,when compared with that one welded without vibration.

According to Jaskirat Singh et al. (2012) [3] working dynamic solidification technology, by applying mechanical vibrations during the solidification in SMAW process. It has the advantages of less investment, more convenient operation, less pollution and shorter manufacturing period. Studies using stainless steel (AISI202) butt joints. Heat input combinations were used to study the effect of mechanical vibrations on small and large sized fusion zone respectively. The results from the present study indicate that the weld joints fabricated with vibratory condition were found to possess relatively high yield strength (YS) and high ultimate tensile strength (UTS).Metallographic studies conducted show that weld metals under vibratory condition possessed relatively finer microstructure and hence high micro hardness, due to dendrite fragmentation.

According to Kuo Che-Wei, et al. (2007) [5] performed Gas Tungsten Arc Welding on AISI 304 stainless steel, steady state vibration was produced by a mass-eccentric motor. The vibration weld shows a very small ferrite structure, uniform composition distribution and less residual stress and less δ-ferrite content relative to the weld without vibration. The results show that the vibration reduces the cooling rate and improves the nucleation of δ-ferrite to form a grain refined structure.

Review of experiment of Burzic, Meri, et al. (2012) [6] studied the effect of vibration of residual stresses in butt-welded steel plates and on the impact energy in characteristic zones of a welded joint . Residual stress measurements are conducted both on butt-welded plates
that were not vibrated during welding on plates Simultaneously welded and vibrated. It is concluded that the vibration process noticeably decreases the level of stresses in the zone of butt weld . It is also concluded that crack initiation and crack propagation energy is improved.

According to the S. P. Tewari (1993) [7] studied the effects of welding specimen on tensile properties of medium carbon steel welds prepared under longitudinal oscillation vibration were investigated. In experiment workpieces were welded at different frequencies and amplitudes of longitudinal oscillation. Frequencies and amplitudes of oscillations were varied in the range of 0 to 400 Hz and 0to 40μm, respectively. Specimens were made for tension tests and microstructure examinations from stationary and oscillatory welded work pieces. . result of the experiment Improves mechanical properties significantly.

Hornsey, J.S. (2004) [10] found that the Vibratory stress relieving can be working for stabilisation of the size of suitable speciments prior to their machining and servicing as a replacement of stress relief annealing.

P Sakthivel and P Sivakumar (2014) [14] studied the effects of vibration on properties of welded joints. In figure 1 vibration setup of their experiment is show . Studies have revealed that welding of metals along with mechanical vibrations result in uniform and finer grains structures. The result of the hardness test and tensile test of weld specimen is show in table .

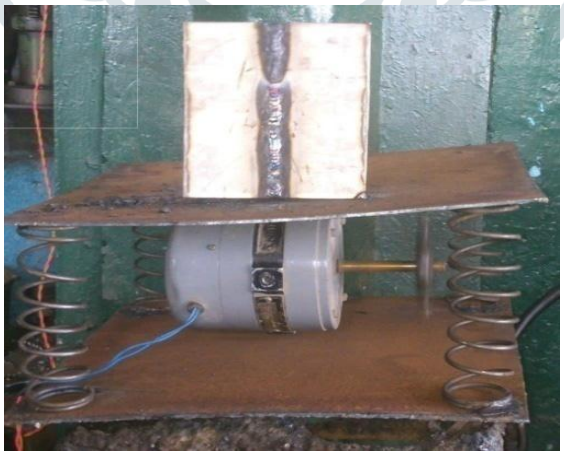

Fig 1 vibration setup [14]

Table :1 [14]

S.No.	Material	Scale	Minor load (kgf)	Rockwell Hardness Number (without vibration	Rockwell Hardness Number (with vibration)
1	SS 316	4	150	54	66
2	SS 316	4	150	51	70
3	SS 316	4	150	41	57
4	SS 316	4	150	54	58

Table :2 Yield Strength (MPa or N/mm^2) [14]

	WITHOUT VIBRATION	SPEED 800 RPM	SPEED 950 RPM	SPEED 1050 RPM
ARC WELDING	361.70	380	386.80	434.30

According to P Sakthivel and P Sivakumar (2014) [14] studied the effects of vibration on properties of welded joints result is clearly show the increasing the mechanical properties like hardness and tensile test .

III CONCLUSION

Researchers have investigated effect of different parameters on the quality characteristic of arc welding process. They have done experiment with different material as well as different process parameters to find the effect on output of arc welding process. But still there is chance to work in this field. Here according to experiment and research work a conclusion become that is if arc welding doing under vibration that time mechanical properties are improving without so much effect, cost and energy investment. Also in mass production welding with under auxiliary vibration setup process reduce numbers of welding rod that directly reduces cost and fumes of welding process.

IV PROBLEM STATEMENT:

- In arc welding at different condition sometimes lack of penetration generating in welding joint.
- During arc welding sometimes internal creak and porosity is generated .
- In welding joint uneven surface cause corrosion rate may also increase.
- During multi pass arc welding sometimes fusion is not proper and porosity is remaining inside the welding.
- Due to improper arc welding sometimes Air bubble is form inside the welding.

V OBJECTIV:

- To analyzed mechanical properties like tensile strength and harness of welding with different parameter like frequency of auxiliary mechanical vibration, voltage and current of welding.
- Design of experiment is analyzed the result from the experiment performance result and analyzed by regression analyzes.

VI PROJECT SCOPE:

- This research is focus in arc welding method under the mechanical auxiliary vibration. This focus area is done based on the following aspect:
- Most of the research on optimization work has been carried out on process parameters for improvement of strength and quality characteristic penetration , weld current, weld voltage.
- Some literature recently found on arc Welding for finding optimal value of process parameters like voltage current and vibration frequency by applying different design of experiment and has found great success so in future it can be used for this process too.

VII REFRENCES:

[1] Dwivedi, Shashi Prakash, et al., 'Effect of Process Parameters on Tensile strength of 1018 Mild Steel Joints Fabricated by Microwave Welding', Metallography, Microstructure, and Analysis February 2014, Volume 3, Issue 1, pp 58-69.
[2] Hussein, A. R., Jail N. A., Talib, A. R. A., Improvement of mechanical welding properties by using induced harmonic vibration, Journal of Applied Sciences, vol. 11, 2011, p. 348- 353.
[3] Singh, Jaskrit Singh, et al.., 'Influence of Vibrations in Arc Welding over Mechanical Properties and Microstructure of Butt-Welded-Joints' International Journal of Science & Technology, vol. 2, Issue 1, February 2012.
[4] Madhusudan, R. et al., 'Study on Effect of Weld Parameters On Mechanical And Micro Structural Properties Of Dissimilar Aluminium Alloys FS Welds' International Journal Of Mechanical And Production Engineering, 1/1 (2013), 25-30.
[5] Kuo, Che-Wei, et al., 'Characterization And Mechanism Of 304 Stainless Steel Vibration Welding', The Japan Institute Of Metals, 48/9 (2007), 2319-2323.
[6] Burzic, Meri, et al., 'Effect Of Vibration On The Variation Of Residual Stresses And Impact Energy In Butt-Welded Joints', Structure Integrity And Life, 12/3 (2012), 215-220.
[7] Tewari, S. P., Shanker, A., Effects of Longitudinal Vibration on Hardness of Weldment, Journal of Engineering Manufacture, vol. 207, no. B3, 1993, p. 173-177.
[8] PARMAR, R.S., 'Welding Engineering And Technology', (Kalyani BO Press, 2010) 135-145.
[9] Verma, Akanksha, et al., 'Vibratory Stress, Solidification and Microstructure of Weldments under Vibratory Welding Conditions-A Review', International Journal of Engineering Science And Technology, 3/6 (2011), 5215-5220.
[10] Hornsey, J.S., 'Vibratory Stress Relieving – It's Advantages as an Alternative to Thermal Treatment', VSR (Africa) (2004).
[11] Verma, Akanksha, et al., 'Vibratory Stress, Solidification And Microstructure of Weldments Under Vibratory Welding Conditions-A Review', International Journal of Engineering Science And Technology, 3/6 (2011), 5215-5220.
[12] Qinghua, Lu, 'Improving Welded Valve Quality By Vibratory Weld Conditioning', Materials Science and Engineering (2007) 246–253.
[13] Dvornak, M.J.,et al., 'Influence Of Solidification Kinetics On Aluminium Weld Grain Refinement', Welding Journal, 70/10 (1991), 271.
[14] P Sakthivel and P Sivakumar, 'Effect of Vibration in Tig And Arc Welding Using AISI 316 Stainless Steel', International Journal of Engineering, Research and Science & Technology, vol. 3, Issue 4, November 2014.
[15] Munsi, A.S.M.Y. and Waddell, A.J. and Walker, C.A. (2001), 'The effect of vibratory stress on the welding microstructure and residual stress distribution', Proceedings of the Institution of Mechanical Engineers, Journal of Materials: Design and Applications, 215 (2). pp. 99-111.