A Review on Welding of CRCA Steel Material Using Spot Welding

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***Abstract*- The various types of spot welding are available one of which is spot welding which is employed in manufacturing of automobiles, aircraft, steel household furniture, steel containers etcetera. For comparison, the process parameters are varied by varying different weld material to get optimization. There are several materials available for spot welding in which steel has higher electrical resistivity and lower thermal conductivity than copper. The material used for experiment is CRCA which is low carbon steel and most suitable for spot welding. Several materials have been used in experimental studies and processing activities to investigate and improve upon the process parameters in spot welding. This paper presents a review of the effect of changes in process parameters in spot welding.**

Index Terms- Welding, Metal plate, Automation, Voltage , Current, Optimization.

I. INTRODUCTION

The word welding is ought to cover a wide range of fusing technique. Today there are many types of welding available which are used in all the industries for the production of its production in some form or others. Welding is very popular, easy way and fastest method of fabrication to join workpieces in one format. The studies carried out in the field of welding have given several methods to weld metal sheets of same or dissimilar types. Resistance spot welding is a process in which contacting metal surface points are joined by the heat obtained from resistance to electric current. Work-pieces are held together under pressure exerted by electrodes. Spot welding involves three stages; the first of which involves the electrodes being brought to the surface of the metal and applying a slight amount of pressure. The current from the electrodes is then applied briefly after which the current is removed but the electrodes remain in place for the material to cool. Weld times range from 0.01 sec to 0.63 sec depending on the thickness of the metal, the electrode force and the diameter of the electrodes themselves. The equipment used in the spot welding process consists of tool holders and electrodes. The tool holders function as a mechanism to hold the electrodes firmly in place and also support optional water hoses that cool the electrodes during welding. Tool holding methods include a paddle-type, light duty, universal, and regular offset. The electrodes generally are made of a low resistance alloy, usually copper, and are designed in many different shapes and sizes depending on the application needed. The two materials being welded together are known as the workpieces and must conduct electricity. The width of the workpieces is limited by the throat length of the welding apparatus and ranges typically from 5 to 50 inches (13 to 130 cm). Work piece thickness can range from 0.008 to 1.25 inches (0.20 to 32 mm). After the current is removed from the work piece, it is cooled via the coolant holes in the center of the electrodes. Both water and a brine solution may be used as coolants in spot welding mechanisms.

II LITERATURE REVIEW

Mr.Manoj Raut & Mr.Vishal Achwal et al. [1] This experiment was based on the optimization of spot welding process parameters to find out the maximum tensile shear strength of the spot welded joint. The mild steel sheets of 0.8 mm and 1 mm of dimensions 25 mm × 150 mm have used as the work piece. The Taguchi Method of L18 orthogonal array has used to

perform the experiment. All the specimens are spot welded using the taguchi design of experiment. Then the tensile shear strength of work pieces is found out using a tensile testing machine. An optimum parameter combination for the maximum tensile shear strength was obtained by using the analysis of Signal-to-Noise (S/N) ratio. The confirmation tests indicated that it is possible to increase tensile shear strength significantly by using the suitable parameters. The experimental results confirmed the validity of the used Taguchi method for enhancing the welding performance and optimizing the welding parameters in resistance spot welding operations. The experimental results show that the welding parameters are the important factors for the strength of the welded joint. which may increase or decrease the strength of the welding joint so we can say that the combination of the suitable parameters is necessary for the maximum strength of the spot welded joint.

G. Gopinath et al. [2] They have studied that to get high tensile strength, the optimal parameters are current – 30amps, Voltage – 220V and Welding Time – 6secs. Structural analysis is done at different loads. By observing the result, the stress values are less than the respective yield stress value of Aluminum alloy at both loads. The tensile strength values obtained from experimental are less than that of analytical stress values at respective loads.

A. K. Pandey,M. I. Khan, K. M. Moeed et al. [3] The response of S/N ratio with respect to tensile strength indicates the welding current to be the most significant parameter that controls the weld tensile strength where's the holding time and pressure are comparatively less significant in this regard.

Shailesh kumar Vishwakarma, Anurag Shrivastav et al. [4] Optimum results have been obtaining by Taguchi method using a medium current of 6.8 KA, the medium pressure of 0.79KPa and high holding time of 5 seconds.The response of S/N ratio with respect to nugget diameter also indicates the welding current to be the most significant parameter that controls the nugget diameter where's the pressure and welding time are comparatively less significant in this regard.

Thong chai, Arun chai et al. [5] The results were MSE (Mean Squared Error) and accuracy equal to0.054 and 95%, respectively. Calculating a reliable estimation of shear strength enables parameter settings to achieve high weld quality and reduces both the setting time process and the sample testing.

Arvintham Armugam, Mohd Amizi Nor et al. [6] The optimum welding schedule obtained from this work is a combination of 3 kN of electrode force, time of 15 cycles and 9 kA welding current. The optimum welding schedule showed impro-vement in the weld characteristics compared to the welding schedules currently being used.

Norasiah Mohammad, Yupiter HP Manurung, Mohammad Hafidzi1 et al. [7] A multi-objective optimization has been applied with simultaneous consideration of multiple response (radius of weld nugget and width of HAZ) using Taguchi method to optimize the multiple quality characteristics in RSW process. Based on the modeling and optimization results, some of the conclusions are like Multiple characteristics such as radius of weld nugget and width of HAZ can be simultaneously considered using multi-objective Taguchi method also the contribution of different control factors is welding current (73.91%), weld time (16.72%) and hold time (7.14%).

A.G.Thakur, T.E.Rao et al. [8] This paper has presented an investigation on the optimization and the effect of welding parameters on the tensile shear strength of spot welded galvanized steel sheets. The level of importance of the welding parameters on the tensile shear strength is determined by using ANOVA. Based on the ANOVA method, the highly effective parameters on tensile shear strength were found as welding current and welding time, whereas electrode force and electrode diameter were less effective factors. The results showed that welding current was about two times more important than the second factor weld time for controlling the tensile shear strength. An optimum parameter combination for the maximum tensile shear strength was obtained by using the analysis of S/N ratio. The confirmation tests indicated that it is possible to increase tensile shear strength significantly (13.43 %) by using the proposed statistical technique. The experimental results confirmed the validity of Taguchi method for enhancing the welding performance and optimizing the welding parameters in resistance spot welding operations.

Shaikh shafee & Dr.B.Balu Naik et al. [9] This study has presented an experimental investigation on the optimization and the effect of RSW process

parameters on the tensile shear strength and direct tensile strength of spot welded CR3 steel sheets. The level of importance of the RSW parameters on the quality characteristics are determined by ANOVA. Based on ANOVA method, the highly effective parameters on tensile shear strength were found as welding current and welding time and the highly effective parameters on direct tensile strength were found as welding current and welding time, whereas electrode force was less effective factor for 0.8 mm thickness of sheets. Similarly for 1.0 mm thickness of sheets the highly effective parameters on tensile shear strength were found as welding current and electrode force and the highly effective parameters on direct tensile strength were found as welding current and electrode force, whereas welding time was less effective factor. An optimum parameter‘s combination for the maximum tensile shear strength and direct tensile strength was obtained by using the analysis of signal to noise (S/N) ratio. The confirmation tests indicated that it is possible to increase tensile shear strength significantly by using the proposed statistical technique. The experimental results confirmed the validity of the used Taguchi method for enhancing the welding performance and optimizing the welding parameters in resistance spot welding operations. Further study could consider on different materials, different thicknesses and more factors (e.g. Electrode geometry, etc.) in the research to see how the factors would affect the present and other quality characteristics such as fatigue strength, peel strength etc.

Mr. Nagsen D. Jadhav, Mr. Rahul A. Patil, Mr. Rajshekhar R. Patil et al. [10] This paper investigates the development of weld zone in resistance spot welding (RSW) which focuses on weld nuggets and strength. In order to study the significance of process parameters i.e. namely welding current, total cycle time and electrode force to get desired weld quality in resistance spot welding the weld quality based on weld nugget and weld strength. The experimentation is conducted for Stainless Steel (SS-204) plate thickness of 16 gauges. Whereas optimum welding parameters are investigated using the Taguchi method with L9 orthogonal array. A significant level of the welding parameters was further obtained by using analysis of variance (ANOVA).This study helps us to find out optimum value for three parameters for resistance spot welding for16 gauge. Optimum value of the response variables are obtained through the conformation test with 95 % confidence level.

III. CONCLUSION

Depending upon the study of this paper, it can be concluded that, spot welding is the basic method of welding from which various other welding methods are developed like projection welding, resistance butt welding, resistance steam welding etcetera. As there is no standered data for process parameter is available from the American welding society which comes under the resistance welding manufacturer’s association. Every time according to thickness and type of material to be welded, company does the trial and error basis experiment for optimizing the process parameter using resistance spot welding method. Hence resistance spot welding is good approach to improve the process parameters like current, voltage, electrode force, weld time etcetera.

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