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OPTIMIZATION OF WIRE CUT EDM PROCESS PARAMETERS FOR COPPER AND ALUMINIUM PART: A REVIEW

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***Abstract* - The wire electrical discharge machine (WEDM) has become an important non- traditional machining process, based on thermo electric energy between the work piece and wire. Since the thermal energy produced in electrical discharge machining process is due to the applied electrical energy, it is very important to enhance the electrical process parameters to improve the process efficiency. The present study discusses about having an overview of the EDM process, modeling of process parameters, and optimization of process parameters such as parameters pulse ON time, pulse OFF time and wire feed rate on wire EDM of Copper and aluminum part performance measures such as, surface roughness and electrode wear rate. The effect of various parameters and setting of various parameters at their optimal levels is very much required for manufacturers.This study also discusses about controlling the electrical input process parameters, and empirical relationships between process parameters and optimization of process parameters in EDM process. From the review results, it has been observed that the efficacy of the machining process can be improved by optimize electrical process parameter, and only less attention has been given for enhancing such parameters.**

Keyword:- EDM, Optimization, MRR

I. INTRODUCTION

Electrical Discharge Machining (EDM) is nontraditional, no physical cutting forces between the tool and the workpiece, high precision metal removal process using thermal energy by Generate a spark to erode the work piece. The work piece must be a conductive electricity material which is submerged into the dielectric fluid for better erosion. EDM machine has wide application in production of die cavity with large components, deep small diameter whole and various intricate holes and other precision part.

II. PRINCIPLE OF WEDM

The WEDM machine tool comprises of a main worktable (X-Y) on which the work piece is clamped; an auxiliary table (U-V) and wire drive mechanism. The main table moves along X and Y-axis and it is driven by the D.C servo motors. The travelling wire is continuously fed from wire feed spool and collected on take up spool which moves though the work piece and is supported under tension between a pair of wire guides located at the opposite sides of the work piece. The lower wire guide is stationary whereas the upper wire guide, supported by the U-V table, can be displaced transversely along U and V-axis with respect to lower wire guide. The upper wire guide can also be positioned vertically along Zaxis by moving the quill.

A series of electrical pulses generated by the pulse generator unit is applied between the work piece and the travelling wire electrode, to cause the electro erosion of the work piece material. As the process proceeds, the X-Y controller displaces the worktable carrying the work piece transversely along a predetermined path programmed in the controller. While the machining operation is continuous, the machining zone is continuously flushed with water passing through the nozzle on both sides of work piece. Since water is used as a dielectric medium, it is very important that water does not ionize. Therefore, in order to prevent the ionization of water, an ion exchange resin is used in the dielectric distribution system to maintain the conductivity of water.

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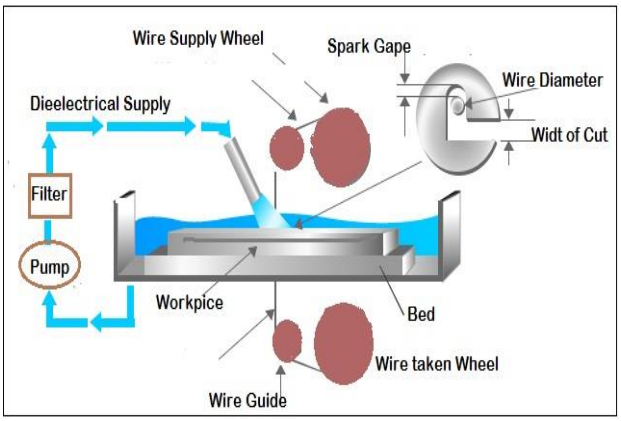

III. RESEARCH PROGRESS

a. In [1] Shivkant Tilekar et al 2014 have done their work which shows the optimization of response parameters by using ANOVA. The two response parameters are surface roughness and kerf width. Many researchers have done their researches on surface roughness and also on kerf width too. Because both parameters surface roughness and kerf width have crucial importance in Wire-cut EDM. This research work shows the effects of process parameters on kerf width and surface roughness of mild steel and aluminum.

b. In [2] S V Subrahmanyam et al 2013, demonstrate the optimized results of process parameters of Wire Electrical Discharge Machining of a work-piece in his research. For this work the researcher used H13 HOT DIE STEEL as the work-piece. Multiple response of the two parameters Material Removal Rate (MRR) and Surface Roughness (Ra) is observed with the help of Grey-Taguchi Method. Experiments were conducted by arranging input parameters with the help of Grey-Taguchi method. Three levels of experiments were obtained. And eight input parameters were used to make different combinations at these three levels. Now the data related to each response of surface roughness and Material Removal Rate (MRR) is measured for every experiment run.

c. In [3] Denial ghosiyeh et al 2013 discusses as it provides an effective solution for producing components made of difficult-to-machine materials like titanium, zirconium, etc., and intricate shapes, which are not possible by conventional machining methods. Due to large number of process parameters and responses lots of researchers have attempted to model this process.

d. In [4] C V S Parameshwara Rao et al 2009, done research on Wire-cut Electric Discharge Machine (WEDM) for better surface finish and dimensional accuracy. This research evaluates optimal parameters for brass electrodes. The study of the influence of optimal parameters on cutting speed, surface roughness, spark gap and material removal rate (MRR) is also done in this research work. Mathematical relations are obtained for cutting speed, spark gap and material removal rate (MRR) using Origin 8.0 software.

e. In [5] S V Subrahmanyam et al 2013 Discuses in their research on machine learning techniques in process modelling of WEDM, a standard method for predicting output measures based on the input parameters in WEDM is yet to be established, He has also researched, data mining technique applied to model the WEDM process, to select the input parameters for the desired output measures. The model was built trained, tested and validated with the Experimental data and with additional data. It is observed that the model built using data mining approach results-in with desired accuracy.

f. In[6] Pradeep Singh et al Investigated experimentally of Wire EDM to Optimize Dimensional Deviation of EN8 Steel, optimized is dimensional deviation and input parameters are wire feed, pulse off time and servo voltage They adopted theTaguchi method is used to optimize the parameter. 'L18' orthogonal array is used for statistical analysis. And MINITAB-17 software is used to get optimum values for the test and a confirmation experiment was done for validating the results.

g. In [7]Lokeswara Rao T. et al. Done their optimum cutting parameters for Titanium Grade5 (Ti-6Al-4V) on Wire-cut Electrical Machining Process (WEDM). To get output parameters of Volume Material Removal Rate (MRR) and Surface Roughness (Ra) are considered for improving the machining efficiency. A brass wire of 0.25mm diameter was applied as tool electrode to cut the specimen. They adopted the Taguchi's L25 orthogonal array (OA) under different conditions like pulse on, pulse off, peak current, wire tension, servo voltage and servo feed settings. Regression equation is developed for the VMRR and Ra. The optimum parameters are obtained by using Taguchi method

h. In [9] C.D. Shah at el 2013, discussed in their research to optimize the output process parameters during machining of Inconnel-600 by Wire cut EDM using response surface methodology (RSM). Four input parameters were taken for the study, which are Pulse-On time (TON), Pulse-Off time (TOFF), peak Current (IP) and Wire Feed rate (WF). These four parameters were chosen as variables for experimentation and a number of experimentations have been done by using Taguchi's Mixed L18 orthogonal array where each experiment performed on different

values of input parameters (pulse on time, pulse off time, peak current and wire feed rate).

i. In [10] Ravindranadh Bobbili at el 2015, Discussed four machining variables in their research: pulse-on time, pulse-off time, peak current and spark voltage. Taguchi technique planned for Experimentation. He used fore performance characteristics namely material removal rate (MRR), surface roughness (SR) and gap current (GC). Results showed that pulse-on time, peak current and spark voltage were significant variables to Grey relational grade. Variation of performance measures with process variables was modelled by using response surface method.

IV. CONCLUSION

Recent advancements in various aspects of electro discharge machining that reflect the state of the art in these processes is presented in this review paper. Researcher works on enhancement effects of three input parameters "on time, off time and wire feed rate" on two response parameters, "surface roughness and cutting speed" by experimental investigation. Various techniques like (ANOVA) technique, Minitab software, Grey relational analysis has been employed for increase of wire cut EDM efficiency, Dry EDM use of gas instead of oil electrolyte, PM-dielectric Electric Discharge Machining. It also plays a significant role in medical, optical, Jewellery, automotive and aeronautic industry & making a various mechanical component in manufacturing industries.

V. FUTURE SCOPE

The wire Cut EDM research area can be divided in different area just like Performance measurement improvement, Development in EDM, Control of process and optimizing the process parameter on different type of work piece material.

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