RESEARCHERID
THOMSON REUTERS

ISSN: 2277-9655
[Mishra * *et al.*, 6(9): September, 2017] Impact Factor: 4.116
IC™ Value: 3.00 CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

EXPERIMENTAL STUDY OF PROCESS PARAMETERS IN EDM USING TOOL STEEL ELECTRODE

Peeyush Mishra[*1] & Dr. Lokendra Pal Singh[2]

[*1]M.Tech Scholar, Dept. of Mechanical Engineering, SHUATS, Allahabad, U.P., India

[2]Assistant Professor (Senior Grade), Dept. of Mechanical Engineering, SHUATS, Allahabad, U.P., India

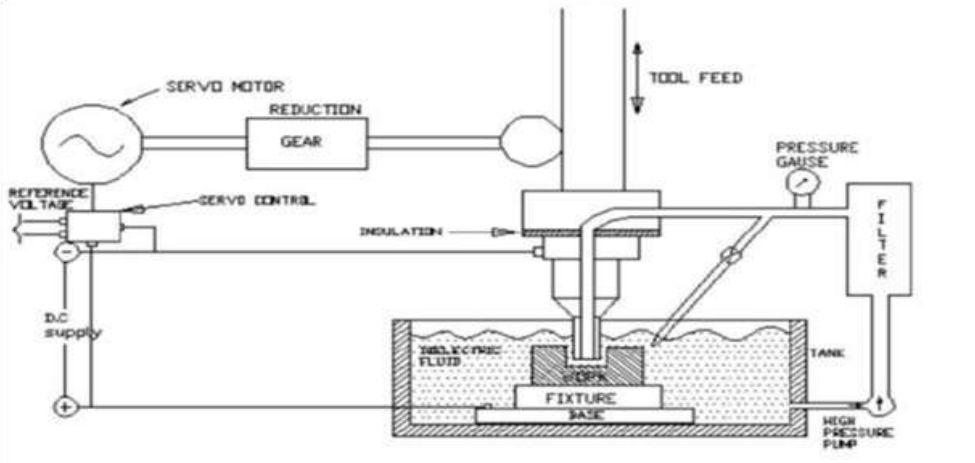
DOI: 10.5281/zenodo.891882

ABSTRACT

The correct selection of manufacturing conditions is one of the most important aspects to take into consideration in the majority of manufacturing processes and, particularly, in processes related to Electrical Discharge Machining (EDM). The Electric discharge machining process is finding out the effect of machining parameter such as discharge current, pulse on time and diameter of tool of tool steel material. Using U-shaped cu tool with internal flushing. A well-designed experimental scheme was used to reduce the total number of experiments. Parts of the experiment were conducted with the L18 orthogonal array based on the Taguchi method. Moreover, the signal-to-noise ratios associated with the observed values in the experiments were determined by which factor is most affected by the Responses of Material Removal Rate (MRR), Tool Wear Rate (TWR) and over cut (OC).

I. INTRODUCTION

The history of EDM Machining Techniques goes as far back as the 1770s when it was discovered by an English Scientist. However, Electrical Discharge Machining was not fully taken advantage of until 1943 when Russian scientists learned how the erosive effects of the technique could be controlled and used for machining purposes. Electro Discharge Machining (EDM) is an electro-thermal non-traditional machining Process, where electrical energy is used to generate electrical spark and material removal mainly occurs due to thermal energy of the spark. In this process the metal is removing from the work piece due to erosion case by rapidly recurring spark discharge taking place between the tool and work piece. Show the mechanical set up and electrical set up and electrical circuit for electro discharge machining.



Setup of Electrical Discharge Machining

In this figure it is shown the electric setup of the Electric discharge machining. The tool is mead cathode and work piece is anode. When the voltage across the gap becomes sufficiently high it discharges through the gap in the form of the spark in interval of from 10 of micro seconds. And positive ions and electrons are accelerated, producing a discharge channel that becomes conductive. It is just at this point when the spark jumps causing

collisions between ions and electrons and creating a channel of plasma. A sudden drop of the electric resistance of the previous channel allows that current density reaches very high values producing an increase of ionization and the creation of a powerful magnetic field. The moment spark occurs sufficiently pressure developed between work and tool as a result of which a very high temperature is reached and at such high pressure and temperature that some metal is melted and eroded.

II. LITTERATURE REVIEW

Dhar and Purohit [1] evaluates the effect of current (c), pulse-on time (p) and air gap voltage (v) on MRR, TWR, ROC of EDM with Al-4Cu-6Si alloy-10 wt. % SiCP composites. This experiment can be using the PS LEADER ZNC EDM machine and a cylindrical brass electrode of 30 mm diameter

Karthikeyan et .al [2] has presented the mathematical molding of EDM with aluminum-silicon carbide particulate composites. Mathematical equation is Y=f(V, I, T). And the effect of MRR, TWR, SR with Process parameters taken in to consideration were the current (I), the pulse duration (T) and the percent volume fraction of SiC (25 ^ size).

P. Narender Singh et al. [3] discuss the evolution of effect of the EDM current (C), Pulse ON-time (P) and flushing pressure (F) on MRR, TWR, taper (T), ROC, and surface roughness (SR) on machining as-cast Al-MMC with 10% SiCp

A. Soveja et al [4] have defined the experimental study of the surface laser texturing of TA6V alloy. The influence of the operating factors on the laser texturing process has been studied using two experimental approaches: Taguchi methodology and RSM. Empirical models have been developed.

III. MATERIALS AND METHODOLOGY

For this experiment the whole work was done on Electric Discharge Machine, model ELECTRONICA-ELECTRAPULS PS 50ZNC (die-sinking type) with servo-head (constant gap) and positive polarity for electrode was used to conduct the experiments. Commercial grade EDM oil (specific gravity= 0.763, freezing point= 94°C) was used as dielectric fluid. With internal flushing of U-shaped cu tool with a pressure of 0.2 kgf/cm^2 .Experiments were conducted with positive polarity of electrode. The pulsed discharge current was applied in various steps in positive mode.

Experiments were conducted according to Taguchi method by using the machining set up and the designed U-shaped tubular electrodes with internal flushing. The control parameters like diameter of electrode (D) , discharge current (Ip) and pulse duration (Ton) conductivity were varied to conduct 18 different experiments and the weights of the work piece and Tool and dimensional measurements of the cavity were taken for calculation of TWR and over cuts.

IV. RESULTS AND DISCUSSIONS

In the present study on the effect of machining responses are MRR, TWR and OC of the AISI P20 plastic mould steel component using the U-Shaped cu tool with internal flushing system tool have been investigated for EDM process.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

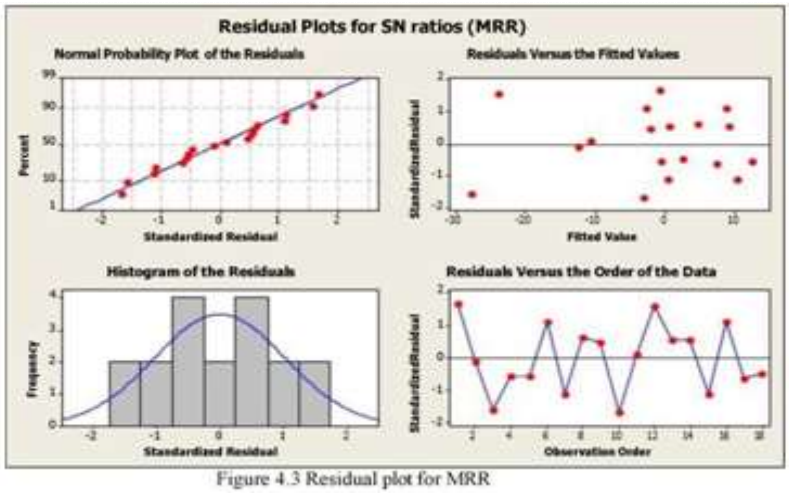
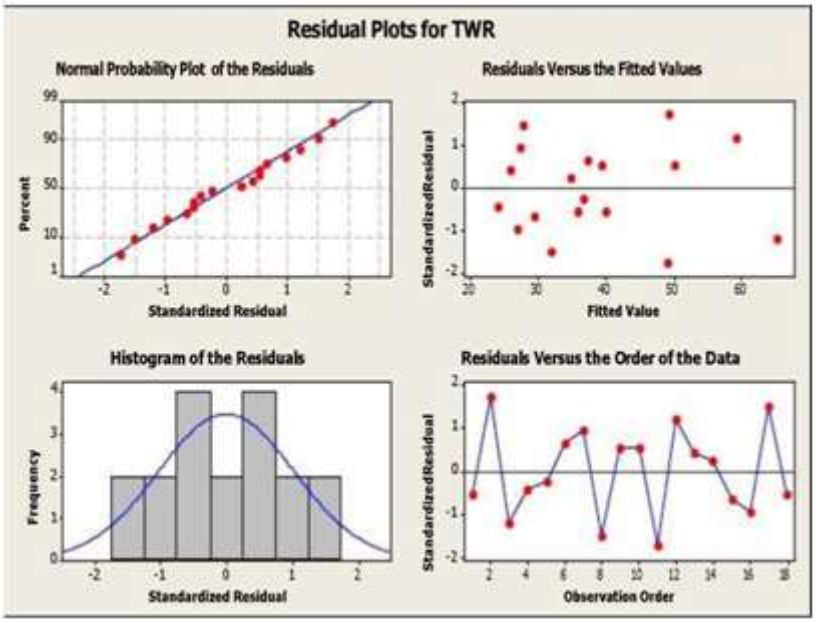
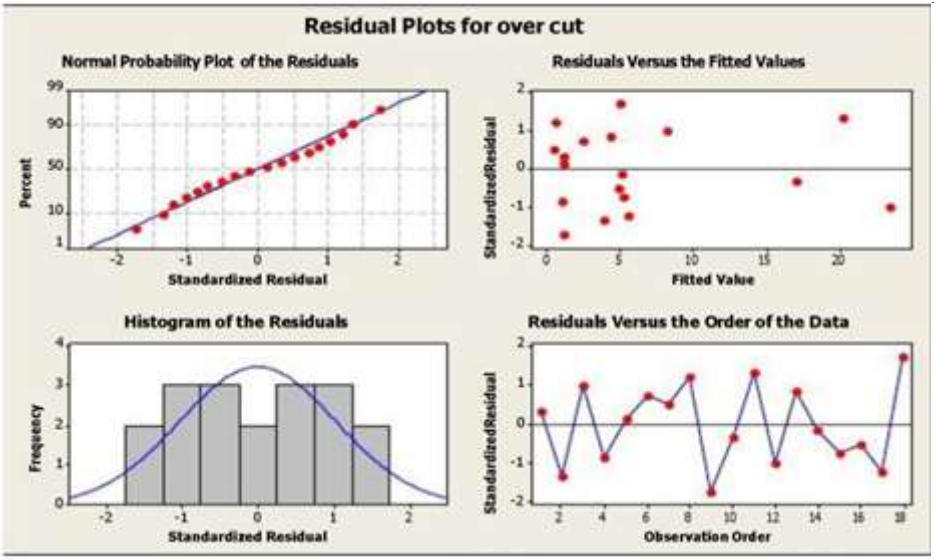


Figure 4.3 Residual plot for MRR



ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7



During the process of Electrical discharge machining, the influence of various machining parameter like Ip, Ton and Diameter of tool has significant effect on MRR, as shown in main effect plot for S/N ratio of MRR in above Fig The discharge current (Ip) is directly proportional to MRR in the range of 1 to 3A. This is expected because an increase in pulse current produces strong spark, which produces the higher temperature, causing more material to melt and erode from the work piece. Besides, it is clearly evident that the other factor does not influence much as compared to Ip. But, with increase in discharge current from 3A to 5A MRR increases slightly. However, MRR decreases monotonically with the increase in pulse on time..

The diameter of the tool has no significant effect on MRR. The interaction plot of MRR is shown in Fig 4.2, where each plot exhibits the interaction between three different machining parameters like Ip, Ton and dia. of tool. This implies that the effect of one factor is dependent upon another factor. It is well known fact that the spark energy increases with Ton and hence, MRR increases with Ton in the range of 300 to 400 ^s. MRR usually increases with Ton up to a maximum value after which that it starts to decrease. This is due to the fact that with higher Ton, the plasma formed between the Inter electrode gap (IEG) actually hinders the energy transfer and thus reduces MRR. In this experiment the value of pulse durations are 50, 500 and 1000 ^s which miss the peak values. So, the plotted graph of pulse duration vrs MRR, as show decreasing trend only.

V. CONCLUSION

The experiments were conducted under various parameters setting of Discharge Current (Ip), Pulse On-Time (Ton), and diameter of the tool. L-18 OA based on Taguchi design was performed for Minitab software was used for analysis the result and theses responses were partially validated experimentally.

(1) Finding the result of MRR discharge current is most influencing factor and then pulse duration time and the last is diameter of the tool. MRR increased with the discharge current (Ip). As the pulse duration extended, the MRR decreases monotonically
(2) In the case of Tool wear rate the most important factor is discharge current then pulse on time and after that diameter of tool.
(3) In the case of over cut the most important factor of discharge current then diameter of the tool and no effect on pulse on time .

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

VI. REFERENCES

[1] Dhar, s., Purohit, r., Saini, n., Sharma, a. and Kumar, G.H., 2007. Mathematical modeling of electric discharge machining of cast Al-4Cu-6Si alloy-10 wt.% sicp composites. Journal of Materials Processing Technology, 193(1-3), 24-29.
[2] Karthikeyan R, Lakshmi Narayanan, PR. and Naagarazan, R.S., 1999. Mathematical modeling for electric discharge machining of aluminium-silicon carbide particulate composites. Journal of Materials Processing Technology, 87(1-3), 59-63.
[3] El-Taweel, T.A., 2009. Multi-response optimization of EDM with Al-Cu-Si-tic P/M composite electrode. International Journal of Advanced Manufacturing Technology, 44(1-2), 100-113.
[4] Mohan, B., Rajadurai, A. and Satyanarayana, K.G., 2002. Effect of sic and rotation of electrode on electric discharge machining of Al-sic composite. Journal of Materials Processing Technology, 124(3), 297-304.
[5] Lin, y.-., Cheng, C.-., Su, B.-. and Hwang, L.-., 2006. Machining characteristics and optimization of machining parameters of SKH 57 high-speed steel using electrical-discharge machining based on Taguchi method. Materials and Manufacturing Processes, 21(8), 922-929.
[6] J. Simao, H.G. Lee, D.K. Aspinwall, R.C. Dewes, and E.M. Aspinwall 2003.Workpiece surface modification using electrical discharge machining,, 43 (2003) 121-128
[7] Singh, PN., Raghukandan, K., Rathinasabapathi, M And Pai, B.C., 2004. Electric discharge machining of Al-10%sicp as-cast metal matrix composites. Journal of Materials Processing Technology, 155-156(1-3), 1653-1657.
[8] Soveja, A., Cicala, E., Grevey, D. And Jouvard, J.M., 2008. Optimisation of TA6V alloy surface laser texturing using an experimental design approach. Optics and Lasers in Engineering, 46(9), 671-678.
[9] Yan, B.H., Wang, C.C., Chow, H.M. and Lin, Y.C., 2000. Feasibility study of rotary electrical discharge machining with ball burnishing for Al2O3/6061Al composite. International Journal of Machine Tools and Manufacture, 40(10), 1403-1421.
[10] Yan-Cherng Lin, Yuan-feng chen, Ching-tien Lin, AND Hsinn-jyh Tzeng Feasibility study of rotary electrical discharge machining with ball burnishing for Al2O3/6061Al composite 2008, vol.23: 391-399,.
[11] Lee, S.H. and Li, X.P, 2001. Study of the effect of machining parameters on the machining characteristics in electrical discharge machining of tungsten carbide. Journal of Materials Processing Technology, 115(3), 344-358.
[12] Puertas, I. And Luis, C.J., 2004. A study of optimization of machining parameters for electrical discharge machining of boron carbide. Materials and Manufacturing Processes, 19(6), 1041-1070.
[13] Wang, C.-. And Lin, Y.C., 2009. Feasibility study of electrical discharge machining for W/Cu composite. International Journal of Refractory Metals and Hard Materials, 27(5), 872-882.
[14] Tsai, H.C., Yan, B.H. and Huang, F.Y., 2003. EDM performance of Cr/Cu-based composite electrodes. International Journal of Machine Tools and Manufacture, 43(3), 245-252.
[15] Habib, S. S. (2009). Study of the parameters in electrical discharge machining through response surface methodology approach. Applied Mathematical Modelling, 33(12), 4397-4407.
[16] Saha, S.K. and Choudhury, S.K., 2009. Experimental investigation and empirical modeling of the dry electric discharge machining process. International Journal of Machine Tools and Manufacture, 49(3-4), 297-308.
[17] Bleys, P, Kruth and Lauwers, B., 2004. Sensing and compensation of tool wear in milling EDM. Journal of Materials Processing Technology, 149(1-3), 139-146
[18] Suzuki; Eiji United States Patent 6,396,022 May 28, 2002
[19] Lin and Tung-Han United States Patent 6,768,077 Lin July 27, 2004.
[20] Sohani, M.S., Gaitonde, V.N., Siddeswarappa, B. And Deshpande, A.S., 2009. Investigations into the effect of tool shapes with size factor consideration in sink electrical discharge machining (EDM) process. International Journal of Advanced Manufacturing Technology, , 1-15.

CITE AN ARTICLE

Mishra, P., & Singh, L. P., Dr. (2017). EXPERIMENTAL STUDY OF PROCESS PARAMETERS IN EDM USING TOOL STEEL ELECTRODE. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY*, *6*(9), 309-313. Retrieved September 15, 2017.