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"Influence of Wire-EDM process parameters on material removal rate (MRR) of EN-24"

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ABSTRACT: Due to the advancement of mechanical industry, the demands for alloy materials with high hardness, impact resistance and toughness are increasing. The Wire-EDM machine is specialized in cutting complex contours that are difficult cut using traditional cutting methods. Wire-EDM is a non-contact non-conventional process that produces high quality product that is difficult to achieve by using of conventional processes. The present study on Wire-EDM performed on EN-24 using copper wire as electrode is conducted to establish the influence of process parameters on material removal rate. The experimental results concluded that MRR is influenced by current more than pulse on time and voltage. current is the most significant factor for MRR. The MRR also increases with increase in pulse in time but the rate is low as compare to current.

Keywords: Wire-EDM, EN-24, MRR

I. INTRODUCTION

EDM or electric discharge machining is achieved when a discharge take place between two points of the anode and cathode, the intense heat is generated near the zone melts and evaporates the materials in the sparking zone. For improving the cutting process, the workpiece and the tool are submerged in a dielectric fluid (hydrocarbon or mineral oils). It can be improved when , both the electrodes are made of the same material, the electrode connected to positive terminal, material erodes at a faster rate from the workpiece. Due to this reason, generally workpiece are made up of anode. A gap, is maintained between the tool and the workpiece surfaces are known as contact off distance. This results in uniform material removal all over the surface, and finally workpiece conforms to the tool surface. This machining method plays its important roles for very hard metals which are not possible to machine from conventional machining methods. It has been widely used, especially for cutting complicated shape or cavities that are difficult to produce with conventional machining methods. However, one critical limitation of the EDM process, workpiece should be electrically conductive. Materials that can be machined by using EDM include nickel-based alloys (such as aerospace materials), very hard tool steels, High speed steels, conductive composites, conductive ceramics, etc.

fig.(1) Wire-EDM

ADVANTAGES OF WEDM

- Extremely hard materials can be machined to very close tolerances.
- A good surface finish can be obtained.
- Very fine holes can be easily drilled by using EDM machine.
- There is no mechanical contact between tool and the work piece. Therefore delicate sections and weak materials can also be machined without any distortion.

DISADVANTAGES OF WEDM

- The slow rate of material removal.
- Power consumption is very high.
- Excessive tool wear occur during machining.

- Electrically non-conductive materials can be machined only with specific setup of process.

PROBLEM FORMULATION

On the basis of above study parameters peak current (Ip), gap voltage (V) and pulse on time (Ton) are selected for this work to analyze the material removal rate, tool wear rate and surface roughness using machining parameters selected as Ton, Ip and V using Taguchi L9 orthogonal array

- To find influence on MRR with Ton, Ip and V.

WORK PIECE MATERIAL

The material used for this work is EN-24 STEEL specification of 36 cm length and 16 mm diameter.

Table 1.0 Properties of EN-24 material

Density (g/cm³)	Melting point (°C)	Yeild strength (MPa)	Elastic modulus (GPa)	Possion's Ratio	Brinell Hardness
7.87	1421	470	190	0.28	215

fig.(2) EN-24 alloy steel

TOOL MATERIAL

The tool material used for this work is 100% brass wire. The tool was prepared of diametor of 0.25mm.

Material Removal Rate

MRR = (Work piece weight loss (gm)) X 1000 / (Density (gm/cc) X Machining Time)

II. RESULT AND DISCUSSION

calculation of MRR (mm^3/min)

Exp. No	Current (A)	Pulse-on-time (μsec)	Voltage	MRR(mm³/min)
1	1	10	100	0.0787
2	1	15	125	0.1705
3	1	20	150	0.2046
4	4	10	125	0.2325
5	4	15	150	0.2842
6	4	20	100	0.3410
7	7	10	150	0.4650
8	7	15	100	0.6394
9	7	20	125	0.7673

III. CONCLUSION

Following conclusions are made:

· MRR tends to increase at a high rate than pulse on time and voltage. Current is the most significant factor for MRR. The MRR also increases with increase in pulse on time, but the rate is low as compared to that of current. The discharge energy is higher at higher levels of pulse on time thus we get higher material removal rate. For lower pulse on time, the discharge energy is insufficient thus the material removal rate is low. Higher the current, intensity of spark is increased and thus metal removal rate increases. In the case of voltage, initially the MRR tends to increase, but further increase in its value tends to degrade the MRR. The MRR increases with increase in gap voltage and then it starts to decrease. This is due to increase in gap voltage result in higher discharge energy per spark because of large ionization of dielectric between working gap. Consequently, the MRR increases. However, a too high voltage result in high discharge energy per spark which causes unfavorable break down of dielectric and large amount of debris between the working gap which unable the material removal rate increases.

REFERENCES

[1]. **Deepu P.Nair, Dr. Binu C.Yeldose, Dr. Cibu K. Varghese,** "Investigation of Surface Roughness on M300 Steel Machined By EDM", International Journal

of Engineering and Innovative Technology (IJEIT) Volume 4, Issue 2, August 2014.

[2]. **Amoljit S. Gill, Sanjeev Kumar,** "Surface Roughness Evaluation for EDM of En31 with Cu-Cr-Ni Powder Metallurgy Tool", International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering Vol:8, No:7, 2014.

[3]. **Harpuneet Singh, "**Investigating the Effect of Copper Chromium and Aluminum Electrodes on EN-31 Die Steel on Electric Discharge Machine Using Positive Polarity", Proceedings of the World Congress on Engineering 2012 Vol III WCE 2012, July 4 - 6, 2012, London, U.K.

[4]. **K.H. Ho and S.T. Newman**, "State of the art of electrical discharge machining (EDM)", International Journal of Machine Tools and Manufacture 43 (2003) 1287-1300.

[5]. **Sandeep Malik,** "optimization of machining parameters on EN24 Alloy Steel on wire electric discharge machining by the help of RSM", International journal of advanced research in IT and engineering, ISSN: 2278-6244 Vol.3 on March 2014

[6]. **Sheril Cyriac and prof. sharos. H** "An experiment on wire EDM for optimization of surface roughness on EN 24 steel by using Taguchi method" International journal of engineering & technology (IJERT) ISSN: 2278-0181 vol.4 issued 08, August-2015

[7]. **Rajesh Kumar, Krishana Kant, Varun Gandhi and Mohit Bector,** "performance study of wire cut electric discharge machining process by using Taguchi's parameter design approach", International Journal of Engineering Invention. E-ISSN: 2278,P-ISSN: 2319-6491 Volume 2, Issue 2 (January 2013) PP: 38-47

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