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Examination of Surface Roughness Using Different Machining Parameter in EDM

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ABSTRACT: *Electrical discharge machining (EDM) is one of the important non-traditional machining processes and it is widely accepted as a standard machining process in the manufacture of forming tools to produce molds and dies. Since its introduction to manufacturing industry in late 1940s, EDM became a well-known machining method. The method is based on removing material from a work piece by means of a series of repeated electrical discharges, produced by electric pulse generators at short intervals, between an electrode (tool) and a part being machined in dielectric fluid medium.This paper describe the efeect of different materials on surface roughness produced. Paper helps in choosing right type of electrode material for specific purpose.*

Keyword: *Current, EDM, surface roughness.*

I. INTRODUCTION

Electric discharge machining (EDM) is one of the most popular non-traditional material removal processes and has became a basic machining method for the manufacturing industries of aerospace, automotive, nuclear, medical and die-mold production. The theory of the process was established by two Soviet scientists B.R. and N.I. Lazarenko in the middle of 1940s. They invented the relaxation circuit and a simple servo controller tool that helped to maintain the gap width between the tool and the profitable and produced first EDM machine in 1950s.

Major development of EDM was observed when computer numerical control systems were applied for the machine tool industry. Thus, the EDM process became automatic and unattended machining method [1]. The process uses thermal energy to generate heat that melts and vaporizes the work piece by ionization within the dielectric medium. The electrical discharges generate impulsive pressure by dielectric explosion to remove the melted material. Thus, the amount of removed material can be effectively controlled to produce complex and precise machine components. However, the melted material is flushed away incompletely and the remaining material resolidifies to form discharge craters. As a result, machined surface has micro cracks and pores caused by high temperature gradient which reduces surface finish quality there have been many published studies considering surface finish of machined materials by EDM. It was noticed that various machining parameters influenced surface roughness and setting possible combination of these parameters was difficult to produce optimum surface quality. The influences of some machining parameters such as pulsed current [2–9], pulse time [2–6,8,9], pulse pause time [2,5,9], voltage [4,6], dielectric liquid pressure [4,6,8,10] and electrode material [11] have been examined. The present study examines the effects of current, and electrode material on surface roughness in the AISI D3 tool steel.

II. EXPERIMENTAL PROCEDURES

The experimental study was carried out on CNC EDM machine as shown in Fig. 3.1 available at central tool room, Ludhiana. The machine is manufactured by electrical machine tool limited, Pune. This machine is completely computerized. This machine performs its function automatically after the required parameters are entered in the program. The control panels of CNC EDM having following components like graphical desktop, keyboard, voltmeter and ammeter. In this machine a mild steel tank is used in which the dielectric fluid flow. The tank was sufficiently filled with the dielectric fluid (Kerosene oil).

The work piece was held in the fixture assembly and the electrode was held in the clamping device .Fig 1 is showing electric discharge machine available at central tool room Ludhiana.

Fig1. CNC EDM Machine (CTR Ludhiana)

Each experiment was performed for fix time period of 20 min using the input process parameters as shown in Table 3.5 using four different types of electrodes i.e. Cu, cryogenic treated Cu, Br and cryogenic treated Br.

A cylindrical pure copper with a diameter of 22mmwas used as an electrode. Table 1 is showing the Input process parameters of EDM

Table 1. Input process parameters of EDM

Supply voltage	110V
Working time	20minutes
Total size	16mm
Tool material	Copper, Brass, Cryogenic copper, cryogenic Brass
Work material	H13 Di-Steel
Current	4A,8A

III. EXPERIMENTAL RESULTS AND DISCUSSION

First part of the experimental study carried out for machined workpiece surface finish quality.

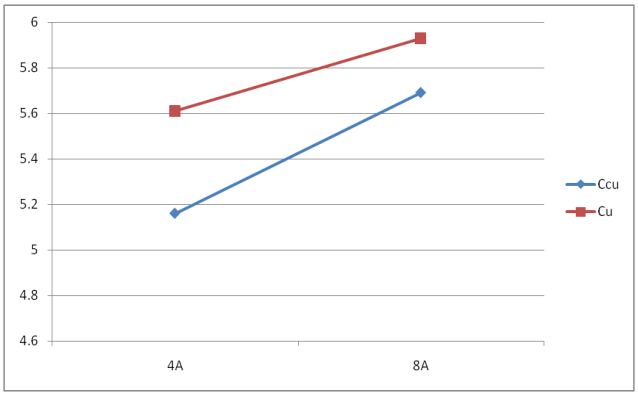

Fig1. Surface roughness of cryogenic treated copper electrode and copper electrode

The SR produced by using four different types of electrodes is shown in the Fig. 4.2. It is observed that the brass electrode gives the better surface finish as compare to the copper electrode. Among the brass electrode and cryogenic treated brass electrode, the cryogenic treated brass electrode has given better surface finish. This may be due to fact that cryogenic treatment of the brass resulted in improving the thermal conductivity [12]. Due to which heat generated at the tool work piece interface gets dissipated at a faster rate. This results in lowering the value of heat at the tool electrode interface, which further resulted in producing small creators on the work piece surface, as a rest of which better surface is produced. Among the copper and cryogenic treated copper electrode the cryogenic treated electrode has given better surface finish. The reason for this is same as that for the brass electrode

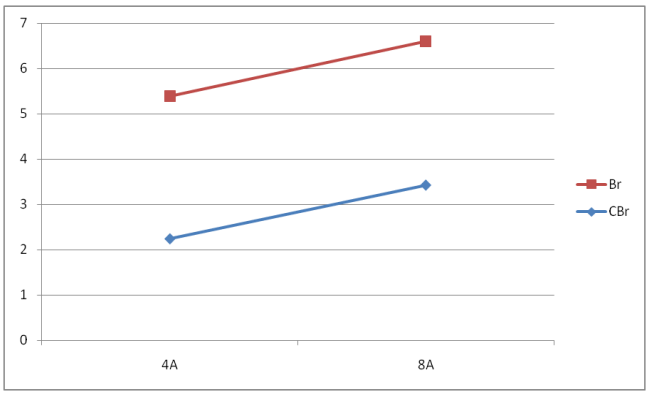

Fig2. Surface roughness of cryogenic treated Brass electrode and Brass electrode

Surface roughness results were noticed for electrode surface roughness. It was observed that the surface roughness of electrode was better when applying smaller pulsed current and pulse time. When pulsed current and pulse time increased, electrode surface presented a higher surface roughness. Pulsed current had an effect on surface roughness of electrode at low pulse time, but the influence of pulse time was more significant than pulsed current at higher pulse times. The effect of pulse pause time was insignificant.

IV. CONCLUSION

- Surface roughness increased with increasing pulsed current and pulse time
- Increasing wear on electrode surface is unavoidable during EDM process. Therefore, work piece surface roughness will be increasing due to wear rate on electrode.
- Wear on electrode surface is unavoidable during EDM process. Surface roughness of machined work piece would increase when surface quality of electrode decreases due to pulsed current density.

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