 ISSN: 2321-8169
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Analysis of EDM Process Parameters on Material Removal Rate of WC

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Abstract—thegoal of this examination is to analyses the impact of working parameters current, voltage and pulse on time on material removal rate (MRR) in Electrical Discharge Machining (EDM) of Tungsten carbide. The adequacy of EDM process with tungsten carbide is assessed by the material removal rate noted. Copper is most reasonable for use as the cathode terminal in EDM of Tungsten carbide. In this examination, trials are led on Tungsten carbide to observe the impact of the working parameters on Material removal rate. The analyses are directed by utilizing Taguchi, Design ofExperiments (DOE)procedure and investigation is affirmed by Analysis of Variance (ANOVA). This examination displayed the ideal machining condition which can be utilized for amplify MRR.

Keywords-*EDM Parameters, Material Removal Rate, Taguchi Method, ANOVA analysis*

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I. INTRODUCTION

At introduce, EDM is a far reaching strategy utilized as a part of industry for high exactness machining of a wide range of conductive materials, for example, metals, metallic compounds, graphite, or even some fired materials. The sufficient choice of fabricating conditions is a standout amongst the most essential angles to think about in the die sinking Electrical discharge machining (EDM) of conductive steel, as these conditions that are to decide such essential attributes material removal rate (MRR). The material utilized as a part of this investigation is a tungsten carbide or hard metal. Roughly half of all carbide generation is utilized for machining applications yet tungsten carbides are additionally being progressively utilized for non-machining applications, for example, mining, oil and gas boring, metal framing and ranger service instruments. [11, 12]

The objective of this work is to analyses the impact of working parameters current, voltage and pulse on time on material removal rate (MRR) in Electrical Discharge Machining (EDM) of Tungsten carbide.

II. LITERATURE REVIEW

Karthikeyanet al. [01] fabricated the aluminum-silicon carbide particulate composites and studied the impact of process parameters on MRR, TWR, SR in EDM of composites. They haveutilized three level full factorial plan for the experimentation work and checked model by the ANOVA. BiingHwaet al. [02] examined the possibility also, improvement of a turning EDM with ball polishing. They have connected three ZrO_2 balls as extra parts behind the terminal apparatus offer prompt polishing after the performance of EDM. Author revealed this EDM procedure approaches both a higher machining rate and a lower surface harshness. Lee et al. [03] demonstrated the impact of the machining parameter in EDM of tungsten carbide on the machining attributes. They have found the EDM procedure with tungsten carbide better machining exhibitions with the terminal as the cathode and the work piece as anode. Authors revealed the instrument with negative extremity gave the higher material removal rate, bring down tool wear and better surface finish. B. Mohan et al. [04] assessed the impact of the EDM parameters on metal removal rate, TWR, and SR, in the EDM of Al-SiC with 20-25 vol. % SiC. They have found the polarity of the terminal and volume percent of SiC, the MRR expanded with expanded in release percent. Tsai et al. [05] contemplated the electrodes made by powder metallurgy innovation. Authors revealed the recast layer was thinner and fewer cracks were present on the machined surface. P. Narender Singhet al. [06] studied the advancement of impact of the EDM current (C), Pulse ON-time (P) and flushing pressure (F) on MRR, TWR, taper(T), OC, and surface roughness (SR) on machining as-cast Al with 10% SiCp. They have utilized ELEKTRAPULS start disintegration machine and stream flushing of the dielectric liquid for this purpose. ANOVA was performed and the ideal levels for augmenting the reactions were set up. The impacts of the machining parameters (MRR, TWR and SR) in EDM on the machining qualities of fast steel were examined by Yan-Chernget al. [07]. Exploratory plan was utilized taguchi strategy. The trials were controlled by ANOVA and F - test. MRR increments with increase in peak current. Dhar and Purohit [08] assessed the impact of current (c), pulse on time (p) and gap voltage (v) on MRR, TWR, OC of EDM with Al–4Cu– 6Si alloy– 10 wt. % SiC_P composites. They have checked models by utilizing strategy ANOVA and also found the MRR, TWR and OC increment huge in a non-straight mold with increment in current. Yan-Cherng Lin et al. [09] accounted for Electrical Discharge Energy on Machining of Solidified Tungsten Carbide utilized an electrolytic copper terminal. The machining parameters of EDM were changed to investigate the impacts of electrical release vitality on the machining attributes, for example, MRR, EWR, and surface roughness. Tool electrode material, for example, Al– Cu– Si–Tic composite created by powder metallurgy (P/M) system also, utilized as work piece material CK45 steel was appeared by Taweelet al. [10]. The central composite second-order

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rotatable designwas used to design the investigations, and RSM was utilized for creating exploratory models. S. H. Tomadiet al. [11] contemplated the impact of the parameters such current, control supply voltage, pulse on time and pulse off time on Material removal rate (MRR) and Electrode wear (EW) in this examination. They have utilized STATISTICA software for analysis of experimental work. Puerto'set al. [12] studied the impact of the factors of intensity, pulse on time and duty factor over machining characteristics such as surface roughness, electrode wear and material removal rate.

III. EXPERIMENTAL PROCESS

A. *Work piece and electrode material*

In this trial Tungsten Carbide is chosen as the work piece material and copper terminals as cathode material. Tungsten carbide material is in rectangular frame with a size of 40 mm in width and 160 mm in length. Copper is in a round frame with a range of Ø8mm × 40 mm long. Copper is a typical base material since it is exceedingly conductive and solid.

B. *Assessment of MRR*

The Material removal rate is assessed as the proportion of the distinction of weight of the work piece before and after the machining to the machining time and density of the material.

C. *Test set up*

In this examination the entire work is done on Electrical Discharge Machining. On the basis of review EDM oil is utilized as dielectric liquid. The current is diverse in different strides in positive mode. This Electrical Discharge Machining (EDM) is utilized to machine on tungsten carbide for leading the Trials.

Figure 1- set up of Die Sinker EDM

IV. RESULTS AND DISCUSSION

A. *Material Removal Rate, MRR Analysis*

As indicated by figure2, it demonstrates that the higher current will gives the higher the estimation of MRR of tungsten carbide. Figure3 demonstrates that when the voltage is expanded, the MRR will take after expanded. Other than that, figure4 consequence of chart is the point at which the pulse on time is expanded, will take after increment. The outcomes acquired from the experimentation have been communicated as diagrams appeared in figure 2-4.

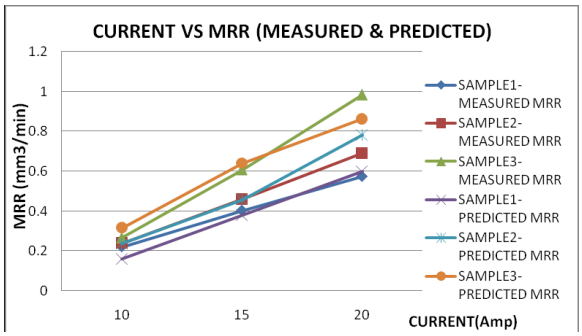

Figure 2- MRR (measured & predicted) Vs Current for 3 Samples

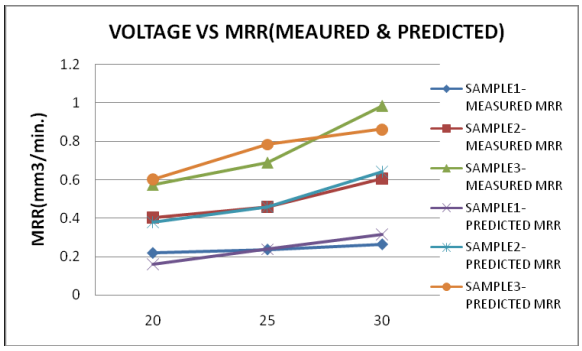

Figure 3- MRR (measured & predicted) Vs Voltage for 3 Samples

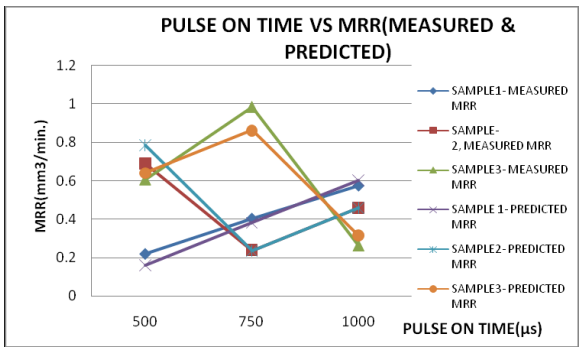

Figure 4- MRR (measured & predicted) Vs Pulse on time For 3 samples

V. CONCLUSION

This trial assesses the machining of Tungsten carbide with a Copper as Electrode. The Taguchi strategy Design of trial (DOE) is exceptionally helpful in the investigating the ideal condition of parameters, primary impact, and the importance of singular parameter to Material. In case of material removal rate, it was seen that current was the most influential factor while voltage and pulse on time were less influential factor on material removal rate of tungsten carbide.

ACKNOWLEDGMENT

Author is grateful to Hon'ble Principal Sir, Respected HOD Sir and all staff of Mechanical Engineering Department of Government College of

Engineering, Aurangabad for their support and guidance for this experimental work.

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