REVIEW: PARAMETRIC OPTIMIZATION OF EDM MACHINE USING TAGHUCHI & ANOVA TECHNIQUE

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***Abstract** -This paper represents the overall review on Electric Discharge Machining (EDM). The invention of new materials need a development of new machining process regarding high hardness of material and make a effective machining process. So EDM is mainly used for those materials which are very difficult to machine with conventional machining process. In today's competitive environment, the companies all around the world are trying to increase their profits without increasing the sales price of their products. This can only be done through minimizing the losses that are occurring during production. The reduction in production time, step up profits an Optimization of process. Parameters have a very major role for enhancement of productivity. Therefore, an experimental work for the optimization of parameters can solve the above problems. In last decade, the researcher has found different way to improve the parameters of EDM process. So this paper reviews the different effective research in field of EDM process to find optimum parameters for machining process with Taguchi technique.*

Keyword – Electric discharge machining (EDM), process parameters, optimization, Taguchi Technique.

1. INTRODUCTION

An Electric Discharge Machining is a thermo-electric, spark erode non- traditional operation. EDM machine have large used in the manufacturing die cavity with large components, small deep diameter hole and various intricate holes and other high precision part [1]. In conventional machining process tool have large hardness than the work piece material [2]. So for machining process use high hardness material like nickel based alloy and titanium alloy by the small and large scale industry and with traditional operation their machining are not so much high but the results into poor surface finish and less tool material life[2]. Moreover EDM machining used for machining the difficult contours and cavity [3]. This machining is successfully operated to those materials which are electrical conductivity.

1.1 WORKING

Electrical spark machining is a Thermo-electric non-traditional machining processes. Local melting of the material and content of the work piece is removed through evaporation. Electric sparks caused by sparks between two electrode surfaces are generated between the two electrodes via an electrode dielectric a short distance from each other and are held at a large potential gap is set up across them. Localized high temperature areas are formed Work piece material in the local area melts and evaporates. Waste molten and vaporized material between the electrode and work piece a spacing of debris particles carried by the dielectric flow. To resist an excessive this heating, electricity is supplied as short pulse. Spark is where the gap between tool and the work piece surface is the smallest.

A spark material, the difference increases to a different point on the surface of the material shifts the position of the spark is removed later. In this way many sparks work piece- equipment at various locations on the entire surface of the gap are the same. Sparks caused by the removal of material, after some time interval of an equal distance across the gap across the tool material and the work piece is formed. Device is held steady; the machining will stop at this level. But if the device in the direction of the work piece is continuously fed more material is removed and the process is repeated. It has achieved the required depth of cut until the tool is fed. Finally, the device size replica of a cavity is formed on the same work. The work piece and work tool as the electrode in electrical circuits. Pulsed power from a separate power supply unit is supplied to the electrodes. Work piece feed speed appropriate to the device generally shown in Figure 1 between tool and work piece during machining to maintain a constant gap distance is provide. .

1.2 PRINICIPAL OF ELECTRICAL DISCHARGE MACHINING

EDM has a controlled removal of metal through the electric spark erosion is used to extract the metal. In the process, the cutting tool to cut an electrical spark (Erode) finished work piece part production to the desired size as is used. The process of removing metal electrode to the work piece through a pulsing (on / off) of the high frequency current is performed by applying electrical charge. This removes the metal work piece at a controlled rate (impaired) is very small.

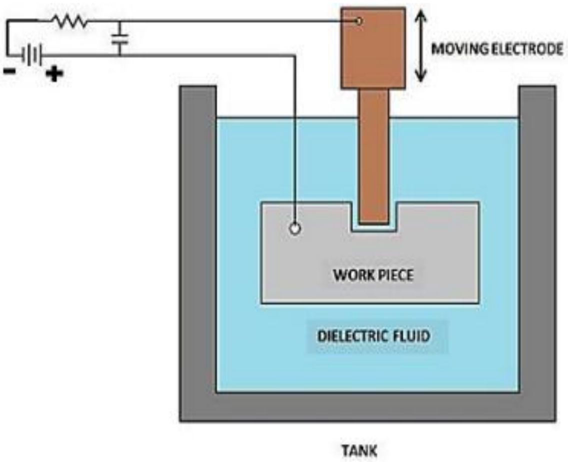

Figure 1

2. LITERATURE REVIEW

Modi et al. (2015) studied EDM process parameters so that the whole process is affected by the electrical and non-electrical. The project work rotating equipment metal removal rate (MRR) to improve and to monitor its impact on surface finish is used.RSM and Taguchi method is used to optimization the design.

Pradhan et al. (2014) stated that Electrical discharge machining is typically performed based on material removal rate (MRR), tool wear rate (TWR), relative wear ratio (RWR) and surface roughness (SR) is assessed on. EDM machining process performance measures that affect important parameters of the discharging current, Ton time, pulse off time, gap, and are duty cycle. A considerable amount of work MRR, TWR, RWR based on EDM performance measurement, and different materials have been reported by researchers at the SR.

Singh et al. (2013) studied the impact on operating parameters such as pulse-time work piece and cryogenic and non-cryogenic DM electrode using steel such as metal removal rate (MRR) and tool wear ratio (TWR) as a response to copper content and pulse time. Cryogenic treatment is increasing material removal rates and tool wear is used to reduce the rate. It was found that the tool wear rate increase with the pulse treatment cryogenic and non-cryogenic copper electrode, both electrodes is decreased. Tool wear rate increases with increasing pulse off time. With the increase in time for the 100 μs pulse of 50 μs and 20 μs to 15 μs pulse of time with increasing material removal rate increased material removal rate has decreased.

Singh et al. (2012) MRR achieved material different than the material work equipment, such as copper and brass D3 mainly achieved using electrodes. The parameters chosen for the study / off time pulse to pulse. They concluded that the MRR brass electrodes increase with increasing pulse on time. He also found time to MRR copper electrode decreases significantly with the decrease in pulse.

Ponappa et al. (2010) investigated that EDM well geometrically complex parts that are extremely hard materials or traditional machining processes for machining difficult-to-machine building have established election. Regardless of machine stiffness electrically conductive thermal energy into the soil using its unique feature, die, and the automotive, aerospace and manufacturing of components for surgery has its distinct advantages.

Sharma et al. (2010) studied Evaluate the effects of machining alloy aluminum powder MRR, TWR,% wear rate, by SR using EDM with reverse polarity. The input parameters of the study are the size of grains of concentration and aluminum powder. They found alluminium powder, surface roughness and wear rate decreases%, but increases the concentration of TWR and with the increase in MRR.

Lajis et al. (2009) reported using the Taguchi method using tungsten carbide ceramic cutting electrical discharge machining (EDM) with a graphite electrode. Taguchi method to prepare the experimental layout, machining characteristics to analyze the impact of each parameter, and thus the peak current, voltage, pulse duration and interval time as the optimal choice for each parameter to predict EDM is used. It has been found that these parameters metal removal rate (MRR), electrode wear rate (EWR) and surface roughness (SR) as such have a significant effect on the machining characteristics. Taguchi method analysis shows that, in general, peak current significantly, EWR and SR affects the pulse duration mainly affects the MRR.

Payal (2008) has investigated the parameters of the surface roughness (SR) material removal parameters with regard to the structural analysis of surfaces affected. Practical work in copper, brass and dielectric fluid tools with kerosene as graphite electrode was held at the N-31 tool steel. Using data collected during material removal rate (MRR) and SR has been used to produce responses in relation to. Detailed analysis of the structural features of machined surface scanning electron microscope (SEM) and optical microscope using electrical discharge machining (EDM) mode by surface micrographs by understanding was, it was observed that the molten mass surface samples were removed from the machined showed different patterns of different electrode mist.

Krishna et al. (2008) hybrid models and artificial neural networks and genetic algorithm optimization of surface roughness in using electric discharge machining is developed. They found that EDM machining, constant voltage surface finish considerably reduces the current increases.

Khanra et al. (2007) added different amounts of Cu and as a tool for the machining of mild steel materials testing developed by Cubic ZrB2- overall. The results show that overall more MRR ZrB2-40 wt% Cu is commonly used to remove the device with a rate lower than the Cube tool. But the cut and the average surface roughness over the full cube is found to be low in terms of equipment.

Duowon et al. (2006) suggested that in EDM operation with pieces of work equipment (electrodes) in the vicinity of the plasma channel experience an intense local heating. The high energy density of the electrode material by heating the workpiece and a part of local melting and erosion would result. Good surface quality with high material removal rate is desirable, electrode erosion is unwanted. If the device power supplies and pulse width parameters such as the choice of an appropriate selection and polarity were investigated.

J.L et al. (2002) studied that Tick alum alloy, which is hard-cut material, EDM can be effectively machined. Proper selection of machining parameters of a high material removal rates, better surface finish, and can result in lower electrode wear ratio. -45 C to -45 C EDM electrodes with different materials on various aspects of surface integrity EDM parameters have been completed to determine the effect.

Li et al. (2001) studied EDM machining in the machining parameters on the characteristics of the effects of tungsten carbide. Such characteristics of EDM material removal rate (MRR), relative wear ratio (RWR) and surface roughness (Ra) as production machining parameters inevitably view. EDM machining process parameters, namely the electrode material, polarity, open circuit voltage, peak current, pulse duration, pulse interval and the input parameters are flushing pressure.

Lee et al. (2000) have shown that the efficient standards and other EDM parameters are the pulse duration, current pulse on the surface integrity of the material. Therefore, these two principles EDM parameters were selected for this study also full factorial design experiments these parameters were established

Year	Author	Contribution	Work material	Tool material	Parameters	Methodology	Response
2016	Mohit kumar	Machining on c-45 steel	C-45	copper	Current ,Ton , Gap voltage	Taguchi	MRR, SR
2015	Modi,and Jignesh Patel,	Optimization of process parameter of EDM: review	air hardening tool steel	----------	Current , voltages pulse on , pulse off,	RSM. Taguchi	MRR. TWR, SR
2014	Sk pradhan	Parameters optimization of EDM	-----------	Copper	Current, gap, pulse current, Ton, Toff , duty cycle	Taguchi	MRR. TWR, SR
2013	Harprret singh	Effect of pulse on / off time	AISI D3 steel	Brass , copper	Pulse on , pulse off	Taguchi	MRR. TWR
2012	Harpreet singh, Amandeep singh	The impact on operating parameters on EDM	AISI D3 steel	cryogenic , non-cryogenic copper electrode	Pulse on , pulse off	Taguchi	MRR. TWR
2011	Mahesh popat	Investigation of Process Parameters for EDM	EN 31	Brass	Current , pulse on time , pulse off time	Taguchi	SR, TWR, MRR
2010	S. Prabhu	AFM surface investigation	Inconel 825	Copper	voltage, pulse duration ,pulse current	RSM	SR
2010	Sanjeev Kumar	Effect on EDM with powder mixed dielectric	OHNS die steel	Copper	Sparking gap, voltage, current, Ton	Taguchi	SR
2009	MA Lajis	Implementation Taguchi on EDM	Tungsten Carbide	Graphite	Current, voltage , pulse duration	Taguchi	EWR, MRR, SR
2009	K. Ponappa	Effect of process parameters on EDM	Nano alumina composite	Brass hollow tubuler electrode	Ton, Toff, Voltage , speed	Taguchi	SR
2007	Ak. Khanra, B.R bhattchria	Performance of ZrB2-Cu composite on EDM	Mild steel	Cu, ZrB@-Cu	Duty Cycle , Ton , Toff, current, voltage	Taguchi	MRR, EWR
2006	D Duowen	Cutting parameters in EDM	Brass	EN-8	Power supply ,polarity,	Taguchi	MRR. TWR
2005	Kun Ling wu, Bling Hwa Yan	Improvement on SKD steel	SKD-11	Copper	polarity, peak-current, auxiliary current pulse duration, servo	RSM	SR, MRR, TWR
2002	Pei Jan Wang ,Kuo- Ming Tsai	Semi empirical model on tool and work removal rate	EK-2,AISID2,AISI HI3	Gr (ISEM- 8) and Ag-w	Peak-current, pulseduration ,electricalpolarity, properties of materi	Taguchi	MRR, TWR
2001	JL lin ,CL Lin	Optimize EDM with multiple performance characteristics	SKD 11 alloy steel	Copper	Polarity, current , voltage , dielectric	Orthogonal array	MRR, TWR

3. CONCLUSION

Literature reveals findings on Electro Discharge Machining of various materials. Most of the work is reported to study the parameters like Peak current, Pulse on time, pulse off time and voltage to find out Surface roughness, Material removal rate (MRR) and Tool wear ratio (TWR) using different types of tools and with the help of design of experiments and statistical optimization techniques. From the above referred paper some conclusion come out side and decided to further work to optimize and analyse the given below process parameters on EDM.

I. Different parameters (dimensional accuracy, flushing pressure etc.) of the process can be examined for the machining of En-24 steel with Taguchi technique.
II. Surface roughness can be improve with reverse polarity.

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