International Journal of Research
Available at
https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 07 Issue 06
June 2020

Investigation On Wire Cut Edm Process Of Ancomposite Material On Sr And Mrr By Varying The Parameters To Optimize The Machining Parameters

Puppala Bhanu Venkata Anil Kumar received the B.Tech degree in mechanical engineering from Aditya Engineering College, JNTU, Kakinada, Andhra Pradesh, India, in 2018 year and perusing M.Tech in Advance manufacturing systems from Pydah College of engineering, JNTU, Kakinada, Andhra Pradesh, India.

Mr. P. RamBabu M.Tech. Asst.Prof. Department of Mechanical engineering from Pydah college of engineering, JNTU, Kakinada, Andhra Pradesh, India.

ABSTRACT

The objective of the current thesis is to investigate the effects of the different process in Wire cut EDM process parameters on the surface quality, maximum material removal rates and obtain the optimal sets of process parameters so that the quality and MRR of machined parts can be optimized. Experiments are conducted on the composite material (Al 6061 (90.5%) + SCi (7.5%) + Graphite (2%)) pieces by varying parameters. The process parameters varied and their respective values are Pulse Time on - 100µsec, 150 µsec, 200µsec & Pulse Time off – 52µsec, 56µsec, 60µsec, Servo Voltage – 30V, 50V, 70V and Wire Feed – 2mm/min, 3mm/min, 4mm/min. Other parameters are kept constant such as Wire diameter - 0.3mm, Peak Current – 1.1Amp, Coolant is Distilled water, Wire Tension – 7Kgf. The optimization is done by using Taguchi technique considering L09 orthogonal array. Optimization is done in Minitab software.

INTRODUCTION

A machining technique is usually used for hard metals, electric discharge machining (usually called ”EDM Machining”) sorts it likely to figure with metals that olden machining method machining are unsuccessful. A critical purpose to recall with Electric discharge machining is that it is all entirely work with things that which are electrically semiconducting.

That which are sensible Electric Discharge Machining equipment it is likely possible to chop tiny odd shaped angles, expanded contours or cavities in toughened steel likewise as exotic metals like Ti, hastelloy, kevlar, Inconel, and some of the inorganic compound.

The methods of electric discharge machining is frequently employed in the tool and die business for mold making, therefore in the current years electric discharge machining has been an essential half for producing model and manufactured elements. That this is frequently seen within the area and natural philosophy industries where as production quantities halt low

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 07 Issue 06
June 2020

Fig: Wire cut EDM Machine

LITERATURE REVIEW

Within the paper by Atul Kumar, etal [2], variation of cutting performance with pulse on time, pulse off time, open voltage, feed rate override, wire feed, servo voltage, wire tension and flushing pressure were through an experiment investigated in wire spark machining (WEDM) method. Brass wire with zero.25mm diameter and Skd sixty one steel with 10mm thickness were used as tool and work materials within the experiments. The cutting performance outputs thought-about during this study were material removal rate (MRR) and surface roughness. Experimentation has been completed by exploitation Taguchi L18 (21 completely different conditions of parameters. optimum mixtures of parameters were obtained by this system. The study shows that with the minimum variety of experiments the entire downside are often resolved when put next to full factorial style. The results obtained area unit analyzed for the choice of associate optimum combination of WEDM parameters for correct machining of Skd sixty one alloy to attain higher surface end. Additionally the importance of the cutting parameters on the cutting performance outputs is decided by exploitation analysis of variance (ANOVA) L37 orthogonal array.

OBJECTIVE

Here in this thesis we are going to investigate the effect of various parameters used in wire cut EDM process on MRR and surface roughness to obtained the optimal set of parameters on the machined work piece

So here the experiments are conducted on the composite work piece material using the respective parameters i.e., pulse on time - 100µsec, 150 µsec, 200µsec & Pulse Time off – 52µsec, 56µsec, 60µsec, servo voltage – 30V, 50V, 70V & Wire Feed – 2mm/min, 3mm/min, 4mm/min. Other parameters are kept constant such as Wire dia - 0.3mm; peak current – 1.14Amp and Coolant is Distilled water, Wire Tension – 7Kgf. So the optimization process is done using taguchi technique using Minitab software.

EXPERIMENTAL SETUP AND PROCEDURE

The selected work piece materials for this research work are composite work piece material. Experiments have been conducted on **Wire Cut EDM**. The machine details are:
WIRE EDM CNC SPRINT CUT 734 (ELECTRANICA SPRINT CUT 734), Make: ELECTRIONCA LTD, PUNE

ACCORDING TO THE TAGUCHI METHOD HERE THE BELOW TABLE REPRESENTS THE L09 ORTHOGONAL ARRAY

JOB NO	PULSE TIME ON (µsec)	PULSE TIME OFF (µsec)	SERVO VOLTAGE (V)	WIRE FEED (mm/min)
1	100	52	30	2
2	100	56	50	3
3	100	60	70	4
4	150	52	50	4
5	150	56	70	2
6	150	60	30	3
7	200	52	70	3
8	200	56	30	4
9	200	60	50	2

Table: Generated L09 Orthogonal array through Taguchi method

EXPERIMENTATION PHOTOS

Wire Cut EDM Machine

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 07 Issue 06
June 2020

Fig – Parameters display panel


Piece before Machining

Machining of Piece

Final machined pieces

Hardness tested work piece

THE OBSERVED SURFACE ROUGHNESS VALUES IN TESTING

JOB NO	PULSE TIME ON (µsec)	PULSE TIME OFF (µsec)	SERVO VOLTAGE (V)	WIRE FEED (mm/min)	SURFACE ROUGHNESS 1 µm	SURFACE ROUGHNESS 2 µm
1	100	52	30	2	3.84	3.46
2	100	56	50	3	3.71	3.42
3	100	60	70	4	3.46	3.27
4	150	52	50	4	3.87	3.67
5	150	56	70	2	3.79	3.64
6	150	60	30	3	3.60	2.97
7	200	52	70	3	4.12	4.40
8	200	56	30	4	4.04	4.69
9	200	60	50	2	3.35	3.45

Table: L09 parameters of surface roughness

OBSERVED MRR VALUES

JOB NO	PULSE TIME ON	PULSE TIME OFF	SERVO VOLTAGE	WIRE FEED (mm/min)	MRR (mm^3/sec)

	(µsec)	(µsec)	(V)		
1	100	52	30	2	330.36
2	100	56	50	3	293.85
3	100	60	70	4	297.93
4	150	52	50	4	312.15
5	150	56	70	2	346.19
6	150	60	30	3	302.18
7	200	52	70	3	259.77
8	200	56	30	4	252.93
9	200	60	50	2	249.59

Table: L09 parameters of MRR

OPTIMIZATION PROCESS OF MACHINING PARAMETERS FOR MRR USING MINITAB SOFTWARE

As here we are having 3 parameters for the 4 process machining parameters we are selecting this

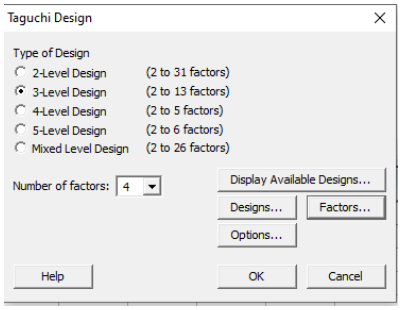


Fig Types of designs icon

Now we have to select the design factors option to enter the various machining and process parameters being used for the machining process

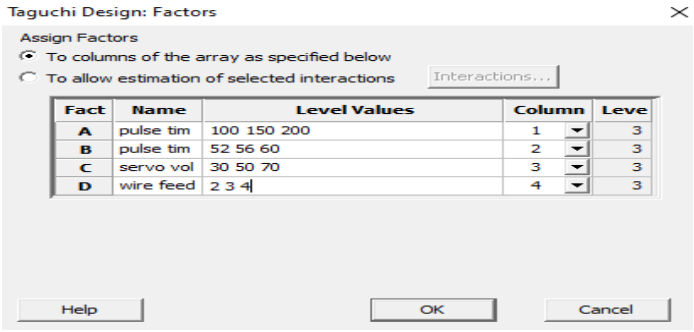
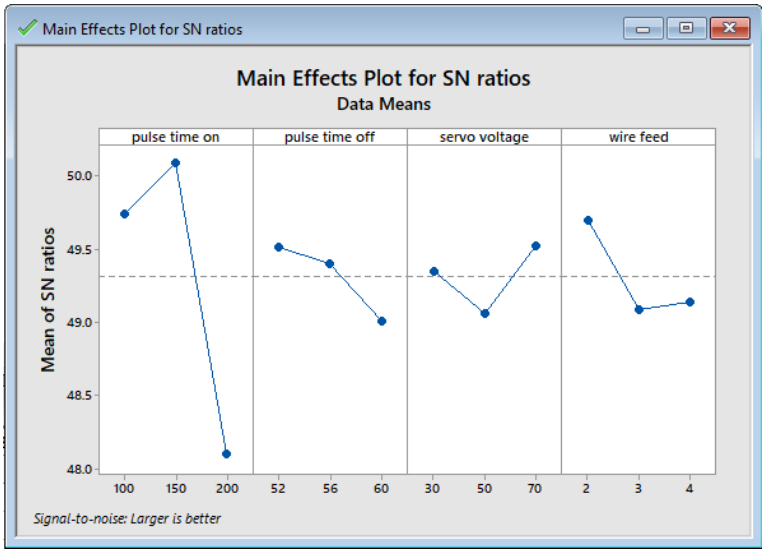
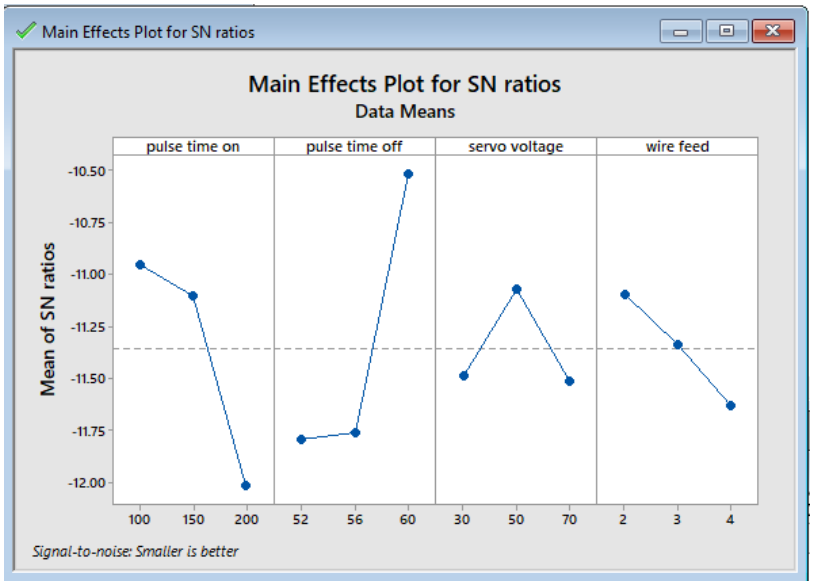


Fig Taguchi Design Factors

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 07 Issue 06
June 2020



Graph Main Effects Plot of SR for SN Ratios



Graph 4.3 Main Effects Plot of MRR for SN Ratios

CONCLUSION

Here in this thesis we are going to investigate the effect of various parameters used in wire cut EDM process on MRR and surface roughness to obtained the optimal set of parameters on the machined work piece. So here the experiments are conducted on the composite work piece material using the respective parameters i.e., pulse on time - 100µsec, 150 µsec, 200µsec & Pulse Time off – 52µsec, 56µsec, 60µsec, servo voltage – 30V, 50V, 70V & Wire Feed – 2mm/min, 3mm/min, 4mm/min. Other parameters are kept constant such as Wire dia - 0.3mm; peak current – 1.14Amp and Coolant is Distilled water, Wire Tension – 7Kgf. So the optimization process is done using taguchi technique using Minitab software.

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 07 Issue 06
June 2020

So finally for the taguchi method, for the MRR here the optimal result is pulse on time is at 150µsec, pulse off time is at 52µsec, servo voltage should be set at 70V and wire feed has to be at 2mm/min
So when we consider the SR MRR here the optimal result is pulse on time is at 100µsec, pulse off time is at 60µsec, servo voltage should be set at 50V and wire feed has to be at 2mm/min
So when we have verified the hardness of this composite material (Al 6061 (90.5%) + SCi (7.5%) + Graphite (2%)) here we have achieved 110BHN, when compared with the base material aluminum alloy block ranges form 75 – 89BHN.

REFERENCES

1. Evaluation of Optimal Parameters for machining with Wire cut EDM Using Grey-Taguchi Method by S V Subrahmanyam, M. M. M. Sarcar
2. Performance Analysis of Wire Electric Discharge Machining (W-EDM) by Atul Kumar, DR.D.K.Singh
3. Analysis of Process Parameters in Wire EDM with Stainless Steel Using Single Objective Taguchi Method and Multi Objective Grey Relational Grade by M. Durairaja, D. Sudharsunb, N. Swamynathan
4. Optimization of process parameters of micro wire EDM by Ricky Agarwal
5. A Study to Achieve a Fine Surface Finish in Wire-EDM by J.T. Huang, Y.S. Liao and Y.H. Chen
6. Rajurkar K.P., Scott D, Boyina S., "Analysis and Optimization of Parameter Combination in Wire Electrical Discharge Machining", International Journal of Production Research, Vol. 29, No. 11, 1991, PP 2189- 2207.
7. Y. S. Tarng., Ma S.C., Chung L.K., "Determination of Optimal Cutting Parameters in Wire Electrical Discharge Machining", International Journal of Machine Tools and Manufacture, Vol. 35, No. 12, 1995, PP. 1693-1701.
8. J.Prohaszka, A.G. Mamalis and N.M.Vaxevanidis, "The effect of electrode material on machinability in wire electro-discharge machining", Journal of Materials Processing technology, 69, 1997, PP 233-237.
9. (A) Y.S. Liao, Y.Y. Chu and M.T. Yan, Study of wire breaking process and monitoring of WEDM, International Journal of Machine Tools & Manufacture, 37 (1997) pp. 555-567. (B) Y.S Liao , J.T.Huang, A study on the machining parameter optimization of WEDM, Journal of Material Processing Technology,71(1997) pp. 487-493
10. Jose Marafona, Catherine Wykes., "A new method of optimizing MRR using EDM with Copper–tungsten electrodes". International journal of Machine tools and manufacturing. Vol. 40, 22 June 1999, PP 153-164.