MACHINING CHARACTERISTICS ANALYSIS ON EDM FOR INCONEL 718 MATERIAL USING COPPER ELECTRODE

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Abstract

Electrical discharge machining process (EDM), the process parameters such as pulse on time, pulse off time, peak current, flushing pressure along with tool geometry are of great importance because they adversely affect the accuracy of machined features[1]. This paper presents the influence of each input parameters for investigating the effect of individual parameters on MRR, TWR and SR on Inconel718 on machining with EDM using c. The experimental results show that the pulse on time and peak current are the influencing parameters directly proportional to MRR and inversely proportional to TWR, SR[2].

Keywords: *Electrical Discharge Machining (EDM), Material Removal Rate (MRR), Tool Wear Rate (TWR), Surface Roughness (SR)*

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1. INTRODUCTION

EDM is the process of machining hard metals which are cannot be machined using conventional machining process. This method was developed in the late 1940[s], has been accepted worldwide as a standard process in manufacturing of forming tools. EDM find a wide application in the machining of hard metals[1]. EDM is mainly used in industries like prototype production, coinage die making and in small hole drilling.

In EDM the main factors that influence the machining process are peak current and pulse on time, which shows greater influence in optimizing the other parameters like SR, TWR, MRR though it is difficult to explain the influence of peak current and pulse on time on those parameters[3].

Inconel718 is a high nickel content alloy.. Inconel718 was developed to meet the need for a nickel-base alloy suitable for manufacture into complex shaped components subject to a combination of high temperature, high stress, and high temperature corrosion. The inconel718 material is mainly used in aerospace, missile and marine industries.

In this research copper electrode tool is made into circular, square, rectangle and circle shape which is machined by wire cut EDM to get accurate dimensions.

2. MATERIALS AND METHODS

Inconel718 material is made into sheets of required dimensions using wire cut EDM process. Then the drilling process (through hole operation) is done on Inconel718 material using copper electrode of different shapes circle, triangle, rectangle and square. The machining is done on grade EMS 5050 of EDM machine, kerosene used as a dielectric fluid. The input parameters are peak current(4,9,12,17A), pulse on time(10,25,40,60µs), pulse off time (3,5,7,9µs) and flushing pressure(23,20,29,18kgf/cm^2) with the tool shapes of circle, triangle, square and rectangle are chosen , other parameters are kept constant. Based on the number of input parameters and their levels L16 orthogonal array is selected and the parameters are arranged according to the array as shown in table.1.

After the machining process both tool and work piece should be cleaned using air gun to remove dust particles and dielectric fluid then both the tool and work piece should be weighed using precise weighing machine. The output responses of MRR, TWR and SR[4] are calculated after conduct the experiments as per L16 orthogonal array.

3. RESULTS

From table 1 we can understand that the material removal rate is high when the peak current is at 17A, T_{ON} is at 40µs, T_{OFF} is at 5µs with circular shaped electrode having flushing pressure 0of 20 kgf/cm^2. Hence the optimum parameters are noted

When we consider TWR it is minimum when T_{ON} is 10µs,T_{OFF} IS 9µs, peak current is at 4A with flushing pressure 18 kgf/cm^2,with the circle as best shape.

If we consider surface roughness it is found to be minimum when T_{ON} is 10µs, T_{OFF} 3µs which is having a peak current of 4A with flushing pressure 18kgf/cm^2,having best shape as circle.

4. CONCLUSION

When EDM process is considered the MRR is to be at maximum, where TWR, SR is to be minimum. Finally for an optimum machining T_{ON} is to be 40µs , T_{OFF} is to be 3µs, with the flushing pressure is at 23 kgf/cm^2, having peak current of 12 A

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Table 1: Result Analysis

Exp.No	Pulse on time	Pulse off time	Current	Flushing pressure	Tool geometry	Output parameters			
	T_{ON}	T_{OFF}	A	P	geometry	MRR	TWR	SR	Machining time
	µS	µS	Ampere	Kgf/cm^2	Geo	mm^3/min	mm^3/min	µm	Minute
1	10	3	4	18	circle	0.299	0.025	2.601	842
2	10	5	9	19	square	8.042	0.819	3.634	32.8
3	10	7	12	20	rectangle	11.07	0.702	3.405	22.61
4	10	9	17	23	triangle	21.37	3.008	3.437	11.77
5	25	3	9	20	triangle	1.697	0.017	3.256	147.5
6	25	5	4	23	rectangle	6.069	0	4.748	41.44
7	25	7	17	19	square	23.824	0.243	6.437	10.05
8	25	9	12	19	circle	13.201	0.128	4.993	19.05
9	40	3	12	23	square	1.479	0.014	2.708	170.1
10	40	5	17	20	circle	7.184	0	4.679	17.85
11	40	7	4	19	triangle	40.547	0.394	5.771	6.2
12	40	9	9	18	rectangle	27.694	0.135	4.146	9.04
13	60	3	9	19	rectangle	0.213	0.008	3.01	1173.55
14	60	5	17	18	triangle	18.416	0.089	4.154	13.66
15	60	7	9	23	circle	22.971	0.112	3.844	10.9
16	60	9	4	20	square	26.334	0.128	3.845	9.51

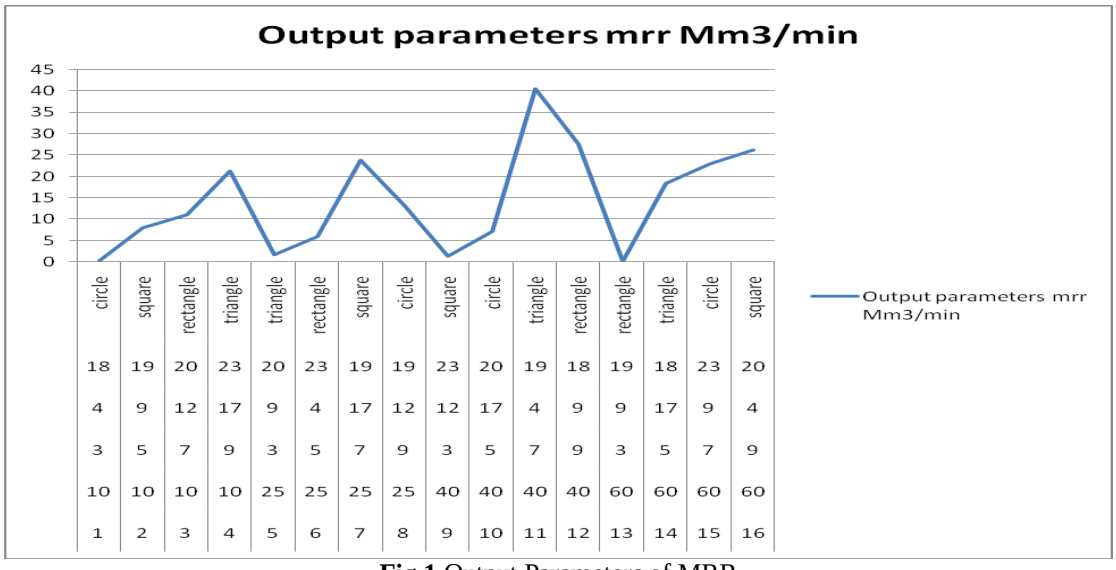

Fig.1 Output Parameters of MRR

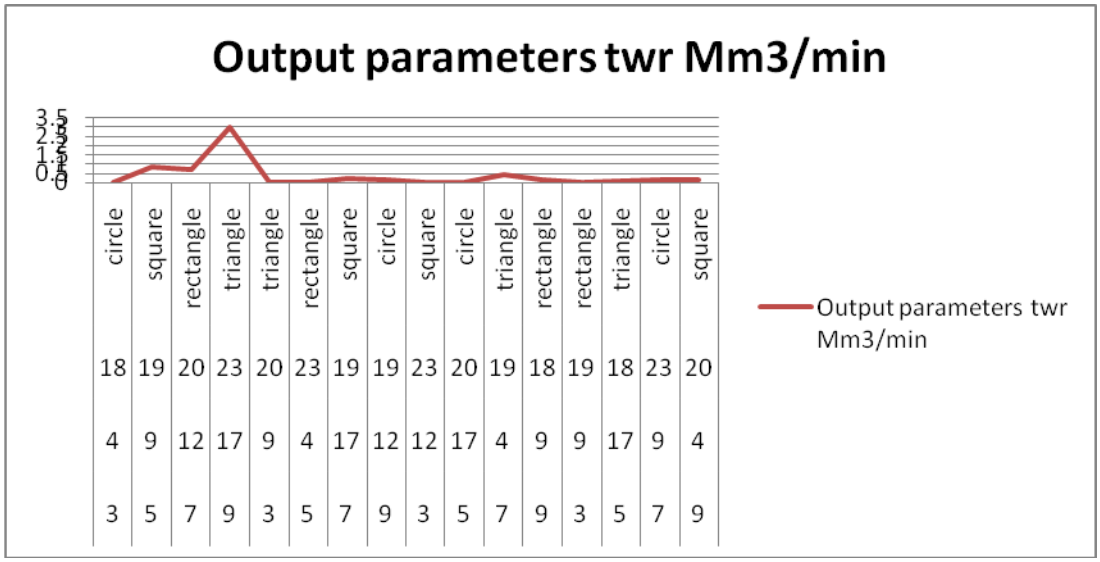

Fig.2 Output Parameters of TWR

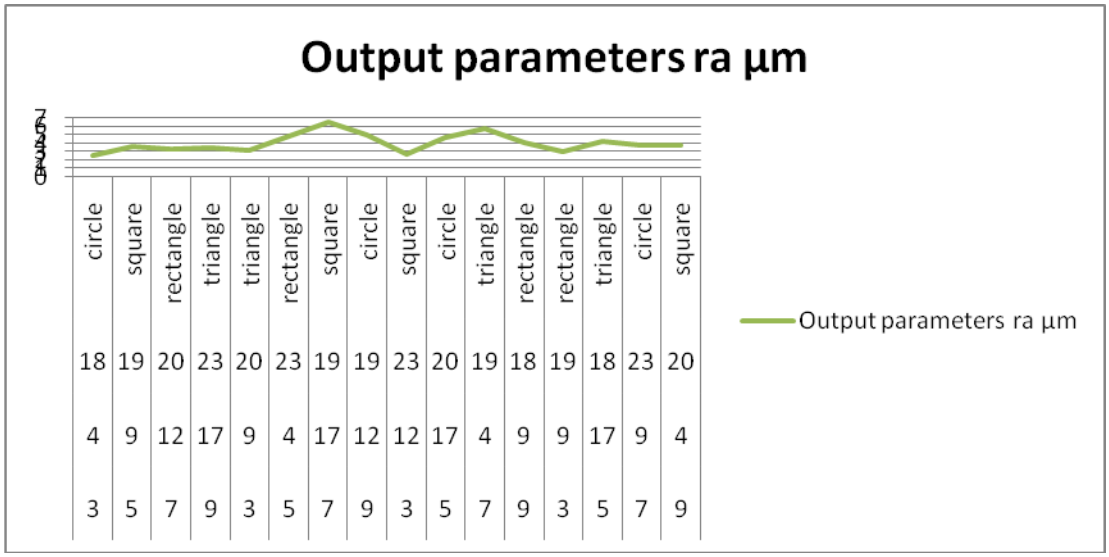

Fig.3 Output Parameters of SR