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Machining Process Parameters on Green Composite Material

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***Abstract:** In this work, the Abrasive water jet machining process on a natural fiber composite material has been discussed . the material as in nature fibere material. The natural fiber material has in a low weight material. In the material used in a light weight application. In the material mostly used in a automobile structural application. In the material not used in load condition application. In the material used in a unload condition material. The material was prepared by hand layup technique. The material was discussed about the machining character station of the process. For this process, the following parameters - standoff distance, abrasive flow rate, water pressure were determined. The output parameters considered are Material Remove rate and Surface roughness. in this condition the material removal rate will be increased and the surface roughness also increased. In the above condition was been solve the problem. The DOE was done by Mine tab software. Finally, the optimization result of the process has been conculded.*

Keywords : Delimitation; Vision Inspection System; Image software.

I. INTRODUCTION

In this paper discuss with Machining parameter of the Abrasive water jet machining process. Finally they have concluded the GRA process[1].The paper discussed with L27 Machining process parmeter studied. The have Discussed the hole taper and surface roughness parameter. Finally they have concluded with the DOE software forDiscussed process optimization [2] in this work discussed with the optimization and process parameter of the super alloys material. The haveDiscussed with GRA for process optimization. Finally they have concluded with the paper [3] This work discussed with the abrasive water jet machining taken as a three parameters.

The experimental done by Abrasive water jet Machining process finally they have concluded by GA Algorithm Process [4]in this process discussed with the Abrasive Water jet Machining for Glass fiber Reinforcement material. The material taper angle were discussed. Finally the surface roughness are measured[5].In this paper discussed with the filler material added in the natural fiber material. And the material cut done by water jet machining. TheDiscussed of MRR and suface roughness for added in the filler material.[6] in

this work discussed about the inconel material.

The material used in a high temperature application. The material process done by AWJM process. Finally the have concluded the process [7]In this paper discussed with banana and jute fiber natural fiber composite material machining process the haveDiscussed in a three values are in input parameter. And the output value discussed with MRR and Surface roughness.[8]In this paper discussed with natural fiber materialDiscussed on the awjm process. The machining process done by the hole taper angle and surface roughness[9] The work done by aluminum composite materialDiscussed on the abrasive water jet machining process. the three level of the input parameter and the discussed with the MRR and surface roughness of the material [10]

II. DOE PROCESS METHDOLOGY

The doe process methodology as shown in tables in the process block diagram as in a DOE Table. The tables consider as a no of variables the table shown in below

a) EXPERIMENTAL TABLESETUP

Table 1. Experimental Setup

S.NO.	CONTENT	SETUP-1	SETUP-2	SETUP-3
1	DIELECTRIC FLUID	EDM OIL	EDM OIL	EDM OIL
2	POWDER	NIL	SILICON CARBIDE	GRAPHENE
3	WORK PIECE	AL-SIC	AL-SIC	AL-SIC
4	WORK PIECE DIMENSIONS(MM)	117X55X20	117X55X20	117X55X20
5	TOOL	COPPER	COPPER	COPPER
6	TOOL DIAMETER	6MM	6MM	6MM

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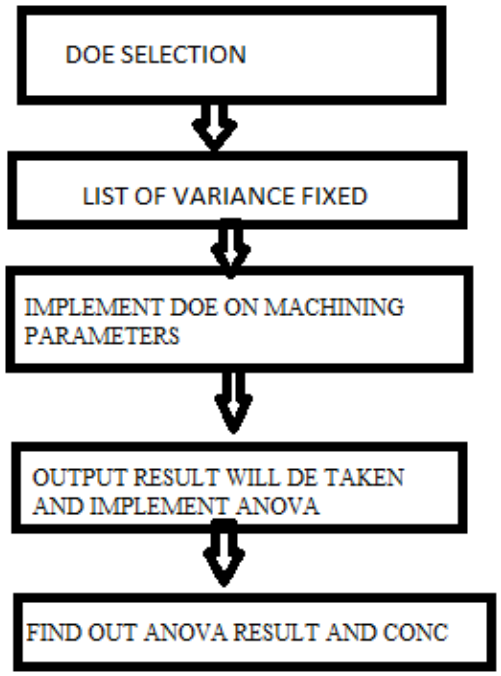
The table shown in a experimental set up in the block diagram. The set up shown that the variance of the process

b) Process Flow chart

The process flow chart shown in the folw chart. The chart with explained the process of the doe. The process chart with discuss about how the process will going on. Finally flow process has been concluded.



C. BLOCK DIAGRAM

The EDM shown in figure 1. Since the experiments require the work piece to be completely submerged in the dielectric fluid, a customized tank of mild steel having dimensions 180x180x100 mm was made. The image of the EDM machine is shown as below:

Fig 1.BLOCK DIAGRAM

III. DESIGN OF EXPERIMENTS

In the design of experiments for the following equation are use. The doeDiscussed of the MRR and Surface roughness

Smaller the better $\frac{S}{N} = -10log\frac{1}{n}(\sum y^2)$ (1)

Larger the Better $\frac{S}{N} = -log\frac{1}{n}(\sum\frac{1}{y^2})$ (2)

Table 1. Parameters used for Abrasive Water Jet Machining

Input Parameter	Level 1	Level 2	Level 3
Cutting Speed (mm/min)	1400	1600	1800
Abrasive Flow rate (g/min)	500	600	700
Stand-off-Distance (mm)	4	6	8

Table 2. Experimental Details performed according to Taguchi L_9 Orthogonal Array

Expt.No	Cutting Speed (mm/min)	Abrasive Flow rate(g/min)	Stand Off Distance (mm)
1	1400	500	4
2	1400	600	6
3	1400	700	8
4	1600	500	6
5	1600	600	8
6	1600	700	4
7	1800	500	8
8	1800	600	4
9	1800	700	6

IV. DISCUSSED TECHNIQUE

The images of the drilled portions were captured using high resolution capture technique in the Vision inspection system. The images were processed using RAPID-I to convert them into a viewable form with each hole focused to the required contour so that delimitation is visible to make the Discussed easy. The image processing is done using IMAGE J software in which the delaminated portion is traced using the tools available in the software. The entire delaminated area is calculated in terms of pixels using the software which enables the calculation of delaminating in the machined portion. Delimitation factor is calculated based on the area traced by the Image processing tool. Drilled hole area and the delaminated zone area is measured using the tools in the software. Delimitation factor (F_d) is defined as the ratio of delaminated area (A_{max})to that of the drilled hole area (A). The equation used for calculating delimitation factor is:

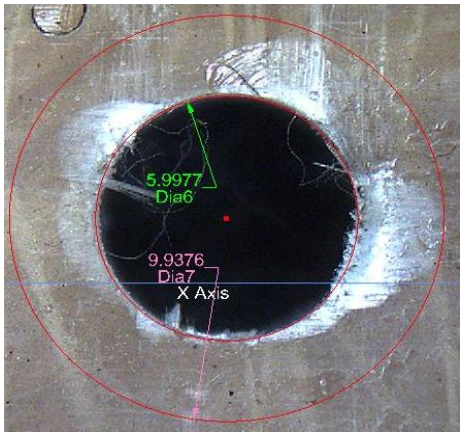


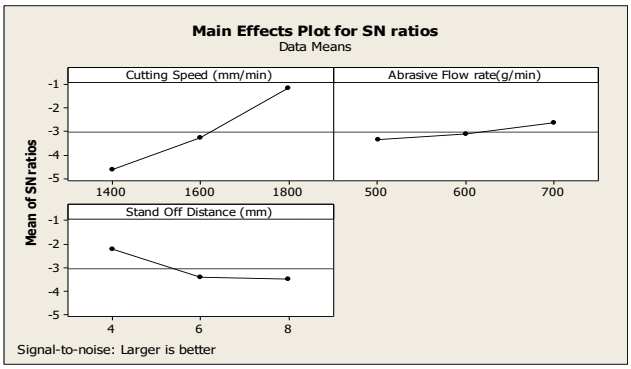
Fig.2. Processed images showing delamination

$$F_d = \frac{A_{max}}{A} \quad (3)$$

V. RESULTS Analysis

Table 3. Results for Material Removal Rate and Delamination Factor

Expt.No	MRR (g/s)	S/N Ratio for MRR	Delamination Factor	S/N Ratio for Delamination Factor
1	0.6072	-4.3334	1.2847	-2.1760
2	0.5643	-4.9698	1.2904	-2.2145
3	0.5875	-4.6198	1.3273	-2.4594
4	0.6384	-3.8981	1.4818	-3.4158
5	0.6296	-4.0187	1.5137	-3.6008
6	0.7989	-1.9502	1.3729	-2.7528
7	0.8105	-1.8249	1.719	-4.7055
8	0.9642	-0.3167	1.5369	-3.7329
9	0.858	-1.3303	1.6664	-4.4356



Level	Cutting Speed (mm/min)	Abrasive Flow rate(g/min)	Stand Off Distance (mm)
1	-4.641	-3.352	-2.200
2	-3.289	-3.102	-3.399
3	-1.157	-2.633	-3.488
Delta	3.484	0.719	1.288
Rank	1	3	2

Fig. 3. Mean Effect Flat of the SN Ratio

Regression Discussed: MRR versus Cutting Speed, Abrasive Flow Rate, Stand Off Distance

The regression equation is

MRR = - 0.464 + [0.000728 Cutting Speed]
+ [0.000314 Abrasive Flow rate] – [0.0286 Stand Off Distance]

Predictor	Coef	SE Coef	T	P
Constant	-0.4643	0.1882	-2.47	0.057
Cutting Speed (mm/min)	0.00072808	0.00008985	8.10	**0.000**
Abrasive Flow rate(g/min)	0.0003138	0.0001797	1.75	0.141
Stand Off Distance (mm)	-0.028558	0.008985	-3.18	**0.025**

S = 0.0440156 R-Sq = 94.0% R-Sq(adj) = 90.5%

Discussed of Variance

Source	DF	SS	MS	F	P
Regression	3	0.152709	0.050903	26.27	0.002
Residual Error	5	0.009687	0.001937		
Total	8	0.162396			

Source	DF	Seq SS
Cutting Speed (mm/min)	1	0.127225
Abrasive Flow rate(g/min)	1	0.005909
Stand Off Distance (mm)	1	0.019574

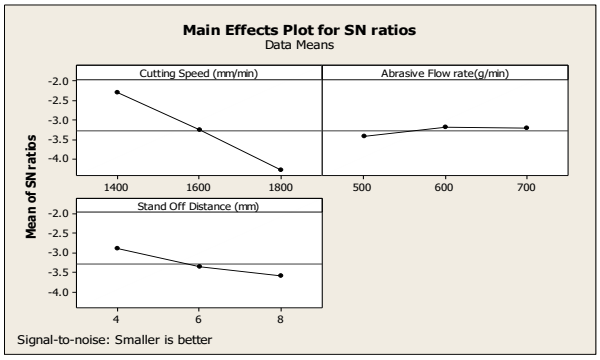


Fig. 4. Mean Effect Flat of the SN Ratio

Level	Cutting Speed (mm/min)	Abrasive Flow rate(g/min)	Stand Off Distance (mm)
1	-2.283	-3.432	-2.887
2	-3.256	-3.183	-3.355
3	-4.291	-3.216	-3.589
Delta	2.008	0.250	0.701
Rank	1	3	2

The regression equation is

Delamination Factor = 0.042 + 0.000850 Cutting Speed (mm/min)
- 0.000198 Abrasive Flow rate(g/min)
+ 0.0305 Stand Off Distance (mm)

Predictor	Coef	SE Coef	T	P
Constant	0.0422	0.1398	0.30	0.775
Cutting Speed (mm/min)	0.00084992	0.00006673	12.74	0.000
Abrasive Flow rate(g/min)	-0.0001982	0.0001335	-1.48	0.198
Stand Off Distance (mm)	0.030458	0.006673	4.56	0.006

S = 0.0326922 R-Sq = 97.4% R-Sq(adj) = 95.8%

Discussed of Variance

Source	DF	SS	MS	F	P
Regression	3	0.197987	0.065996	61.75	0.000
Residual Error	5	0.005344	0.001069		
Total	8	0.203331			

Source	DF	Seq SS
Cutting Speed (mm/min)	1	0.173366
Abrasive Flow rate(g/min)	1	0.002356
Stand Off Distance (mm)	1	0.022265

VI. CONCLUSIONS:

The Experiment was conducted on Natural Fiber Composite Material using abrasive water jet machining. The process parameter of cutting flow, stand off distance and abrasive speed were consider for ABWJ Machining process. The output response like MRR and Surface Roughness were measured. The Results were shown in the MRR increase and delaminating factor were decreased. The MRR increased due to Cutting Speed and Abrasive Flow rater Increased. Delimitation Factor Decreased due to Stand of distance increased. In generally machining character station Expected in above Results.

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