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Experimental Investigation To Optimize Process Parameters In Drilling Operation For Composite Materials

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Abstract: **Metal cutting is one of the most important processes in the field of material removal. Specific metal cuts in black, such as removing metal chips from a workpiece, to obtain a final product of the size, shape and surface properties required. The basic objective of metal cutting is to solve practical problems related to effective and accurate removal of metals from the workpiece. It has been recognized that reliable quantitative predictions of different technological performance measures, preferably in the form of comparisons, are necessary to develop improvement strategies for selecting cutting conditions in the planning of operations. In this thesis, experiments will be carried out to improve the surface quality of the glass fiber reinforced glass (GFRP) using the HSS (M2) drill bit 8 mm, 10 mm and 12 mm. The type is the nose tip of the bull. A series of experiments will be performed by changing the cutter parameters, speed, feed rate and cut depth. Speed of 500 rpm, feed rate of 0.04 mm / revolution, 95-degree bitmap, width of 0.8 mm for surface roughness, 1500 mph error rate, feed rate of 0.06 mm / revolution, point angle at 95 ° C The width of the 0.8 mm chisel is optimal. The Taguchi method is used to determine the effect of process parameters and to determine the relationship between speed, feed and cut depth in relation to the large machining factor, surface finish. Micro-validation checks appear to be good under the agreement with experimental data.**

Keywords: **ANOVA; Carbon Fiber Reinforced Plastics (CFRP); Delaminating; Drilling; Fly Ash; Grey Analysis; Surface Roughness; Thrust Force;**

I. INTRODUCTION

Drilling is a cutting process that uses a drill bit to cut the circular cross-section hole in the solids. The drilling tool is usually a rotary cutter, often a multipoint tool. The piece is pressed against the workpiece and turns in prices from hundreds to thousands of revolutions per minute. It forces the avant-garde against the workpiece and cuts the swarf out of the hole while being drilled [1]. In rock drilling, the hole is usually not made by circular motion, although the pulley is usually rotated. Instead, the hole is usually done by tapping a hole in the hole with short, repetitive movements. The work can be done from outside the hole (upper hammer drill) or inside the hole (borehole, DTH). Drill rigs are used for horizontal drilling called trenches.

1.1 drilling operation

1.1 Process: The well has sharp edges at the entrance gate and the edges of the exit panel (unless removed). Also, inside the hole usually has helical feeder labels [2]. Drilling can affect the mechanical properties of the workpiece by creating low residual pressure around the hole and a very thin layer of highly disruptive and turbulent material on the newly formed surface. This makes the workpiece more prone to corrosion and cracking deformation at the stressful surface. Termination can be done to avoid these adverse conditions.

1.2 Establishing a centering mark or feature before drilling, such as by: Casting, molding, or forging a mark into the workpiece

1.2.1 Center punching

Site Drill (such as Center Drill) Patch Place, which processes a certain area on casting or forging to create a finely defined face on a rough surface? Drilling Drill Positioning Limitation Using Drilling Drill Bit. The finished surface can be made for drilling from 32 to 500 microbes. The final pieces will generate surfaces close to 32 micro-edges, and will smell about 500 microspheres.

1.2.2 Spot drilling See also: Drill bits the center of the hole and drills the purpose of drilling the hole is to drill the hole, which will serve as a guide for drilling the final hole. The hole is only partially

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drilled in the segment because it is used only to guide the start of the next drilling process.

1.2.3 Center drilling See also: Bit Drill Center Concentrated Drilling Hole Drilling Center is a crowded tool that includes a rotary drill with 60 ° counters. Used to drill mid-point recesses in the workpiece that will be mounted between centers for transformation or grinding.

1.2.4 Deep hole drilling Drill Blast a few meters in the granite. Deep hole drilling is defined as a hole depth greater than ten times the diameter of the hole [3]. These types of holes require special equipment to maintain rigidity and tolerances. Other considerations are the round and surface finish.

II. EXPERIMENTAL INVESTIGATION

The experiments are done on the drilling machine with the following parameters:

WORK PIECE MATERIAL – GFRP (glass fiber reinforced polymer)

DRILL BIT DIA-8mm, 10 mm, 12mm

CUTTING SPEED – 1500rpm, 2000rpm, 2500rpm,

2.1 EXPERIMENTAL PHOTOS

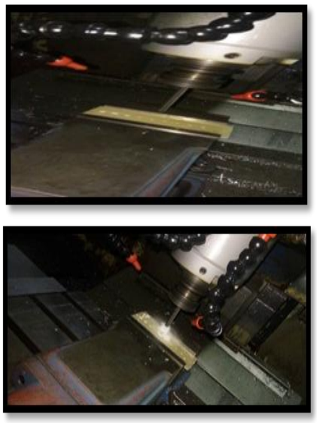


Fig 2.1 Drilling process

Fig 2.2 Final component

III. INPUT PARAMETERS

PROCESS PARAMETERS	LE VEL1	LEVEL2	LEVEL3
SPEED(rpm)	1500	2000	2500
DRILL BIT DIA(mm)	8	10	12
POINT ANGLE	116^0	118^0	120^0

JOB NO.	SPEED (rpm)	DRILL BIT DIA(mm)	POINT ANGLE (⁰)
1	800	8	116
2	800	10	118
3	800	12	120
4	1000	8	116
5	1000	10	118
6	1000	12	120
7	1200	8	116
8	1200	10	118
9	1200	12	120

3.1 SURFACE FINISH VALUES

JOB NO.	SPEED (rpm)	DRILL BIT DIA(mm)	POINT ANGLE (⁰)	Surface finish (R_a) µm
1	800	8	116	0.565
2	800	10	118	0.727
3	800	12	120	0.912
4	1000	8	116	1.05
5	1000	10	118	1.21
6	1000	12	120	1.64
7	1200	8	116	2.145
8	1200	10	118	2.521
9	1200	12	120	2.742

3.2 TAGUCHI PARAMETER DESIGN FOR TURNING PROCESS: In order to identify the process parameters affecting the selected machine quality characteristics of turning, the following process parameters are selected for

FACTORS	PROCESS PARAMETERS	LE VEL1	LEVEL2	LEVEL3
A	CUTTING SPEED(rpm)	600	1200	1800
B	FEED RATE (mm/rev)	200	250	300
C	DEPTH OF CUT(mm)	0.4	0.5	0.6

3.3 Results: Using randomization technique, specimen was turned and cutting forces were measured with the three – dimensional dynamometer. The experimental data for the cutting forces have been reported in Tables. Feed and radial forces being 'lower the better' type of machining quality characteristics, the S/N ratio for this type of response was and is given below:

IV. TAGUCHI ORTHOGONAL ARRAY

JOB NO.	SPINDLE SPEED (rpm)	FEED RATE (mm/min)	DEPTH OF CUT (mm)
1	600	200	0.4
2	600	250	0.5
3	600	300	0.6
4	1200	200	0.4
5	1200	250	0.5
6	1200	300	0.6
7	1800	200	0.4
8	1800	250	0.5
9	1800	300	0.6

4.1 OBSERVATION: The following are the observations made by running the experiments. The cutting forces are measured using dynamometer.

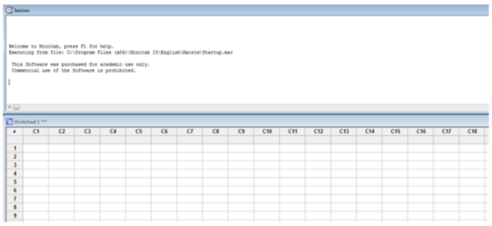
4.2 CUTTING FORCES, SURFACE FINISH

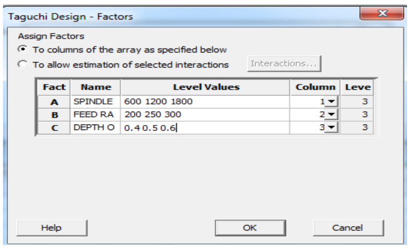
Surface finish (R_a) µm
0.62
0.78
0.91
1.21
1.46
1.94
2.41
2.84
3.12

4.3 OPTIMIZATION OF SURFACE FINISH USING MINITAB SOFTWARE

Design of Orthogonal Array: First Taguchi Orthogonal Array is designed in Minitab15 to calculate S/N ratio and Means which steps is given below:

FACTORS





4.4 OPTIMIZATION OF PARAMETERS

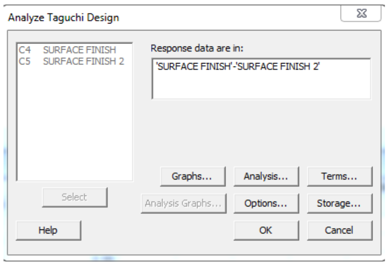
Worksheet 2 ***

↓	C1 SPINDLE SPEED	C2 FEED RATE	C3 DEPTH OF CUT
1	600	200	0.4
2	600	250	0.5
3	600	300	0.6
4	1200	200	0.5
5	1200	250	0.6
6	1200	300	0.4
7	1800	200	0.6
8	1800	250	0.4
9	1800	300	0.5

Worksheet 1 ***

↓	C1 SPINDLE SPEED	C2 FEED RATE	C3 DEPTH OF CUT	C4 SURFACE FINISH	C5 SURFACE FINISH 2
1	600	200	0.4	0.62	0.70
2	600	250	0.5	0.78	0.85
3	600	300	0.6	0.91	0.99
4	1200	200	0.5	1.21	1.30
5	1200	250	0.6	1.46	1.55
6	1200	300	0.4	1.94	2.10
7	1800	200	0.6	2.41	2.50
8	1800	250	0.4	2.84	2.93
9	1800	300	0.5	3.12	3.20

4.5 Analyze Taguchi Design – Select Responses



V. RESULTS

Taguchi emphasizes the importance of studying the response disorder by using the S / N ratio, which reduces the qualitative variability in quality due to an uncontrollable parameter. The cutting force is a quality feature with the concept of "younger - better". S / N ratio for smaller, better:

$$S/N = -10 * \log(\Sigma(Y^2)/n))$$

Where n is the number of measurements in a trial/row, in this case, n=1 and y is the measured value in a run/row. The S/N ratio values are calculated by taking into consideration above Eqn. with the help of software Minitab 17. The force values measured from the experiments and their corresponding S/N ratio values are listed in Table

Worksheet 1 ***

↓	C1 SPINDLE SPEED	C2 FEED RATE	C3 DEPTH OF CUT	C4 SURFACE FINISH	C5 SURFACE FINISH 2	C6 SNRA1	C7 MEAN1
1	600	200	0.4	0.62	0.70	-3.65701	0.660
2	600	250	0.5	0.78	0.85	-1.80088	0.815
3	600	300	0.6	0.91	0.99	-0.46863	0.950
4	1200	200	0.5	1.21	1.30	1.95612	1.255
5	1200	250	0.6	1.46	1.55	3.53908	1.505
6	1200	300	0.4	1.94	2.10	6.08659	2.020
7	1800	200	0.6	2.41	2.50	7.79665	2.455
8	1800	250	0.4	2.84	2.93	9.19975	2.885
9	1800	300	0.5	3.12	3.20	9.99165	3.160

5.1 Analysis and Discussion: Regardless of the category of the performance characteristics, a greater S/N value corresponds to a better performance. Therefore, the optimal level of the machining parameters is the level with the greatest value.

5.2 Spindle Speed: - The effect of parameters spindle speed on the surface finish is shown above figure for S/N ratio. So the optimum spindle speed is 1800 rpm.

5.3 Feed Rate: - The effect of parameters feed rate on the surface finish is shown above figure S/N ratio. So the optimum feed rate 250 mm/min.

5.4 Depth of Cut: - The effect of parameters depth of cut on the surface finish is shown above figure for S/N ratio. So, the optimum depth of cut is 0.6mm

VI. CONCLUSION

In this dissertation, try to use the Taguchi optimization technique to improve the drilling parameters during the raster fiber workpiece materials. Drill parameters are the speed and feed speed of the workpiece fiber. In this work, the optimum speed parameters are 800 rpm, 1000 rpm and 1200 rpm, the feed rate is 30mm / rev, 40mm / rev and 50mm / rev and the 1200 concentration angle. The experimental work is done by looking at Parameters above. Surface end values are validated. By observing the experimental results and taguchi, the following conclusions can be drawn: For a better surface finish, the optimum parameters are velocity - 1200rpm, feed-50mm / rev.

VII. REFERENCES

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