

Table 1. Workpiece material properties.

	Modulus of elasticity	Tensile stress
Matrix: Epoxy	2.06 - 2.15 GPa	80 - 85 MPa
Reinforcement: Carbon	75 - 80 GPa	400 - 450 MPa
	Density	Hardness (Rockwell)
Carbon fiber-reinforced epoxy	155 kg/m ³	70-75 HRB

Table 2. Test matrix and machining conditions

No.	Ultrasonic power	Rotation speed (rpm)	Feedrate (mm/s)
1	0	3000	0.5
2	20%	3000	0.5
3	40%	3000	0.5
4	60%	3000	0.5
5	80%	3000	0.5
6	40%	1000	0.5
7	40%	2000	0.5
8	40%	4000	0.5
9	40%	5000	0.5
10	40%	3000	0.1
11	40%	3000	0.2
12	40%	3000	0.3
13	40%	3000	0.4
14	40%	3000	0.6
15	40%	3000	0.7
16	40%	3000	0.8

Table 3. Experiment results on cutting force

Cutting force (N)							
No.	Run 1	Run 2	Run 3	No.	Run 1	Run 2	Run 3
1	141.5	145.2	143.3	9	101.9	109.8	117.6
2	139.4	141.6	137.8	10	111.3	113.2	115.0
3	128.3	132.0	135.8	11	98.1	97.7	98.4
4	132.1	124.5	128.3	12	113.2	120.7	105.6
5	113.2	118.8	118.8	13	116.2	122.2	123.7
6	211.7	188.2	211.5	14	133.9	139.6	133.9
7	156.8	164.7	172.5	15	152.1	150.9	149.8
8	128.0	123.0	125.4	16	169.8	158.4	169.8

Table 4. Experiment results on surface roughness

No.	Surface roughness value Ra near entrance (μm)			Surface roughness value Ra near exit (μm)		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
1	1.3	1.3	1.4	3.6	4.0	3.9
2	1.3	1.3	1.3	3.9	3.2	3.3
3	1.2	1.4	1.3	3.6	3.3	3.1
4	1.5	1.4	1.3	4.8	4.6	4.0
5	1.5	1.5	1.3	3.9	3.2	3.3
6	2.1	2.5	2.3	2.7	2.8	2.7
7	1.4	1.5	1.6	2.3	2.3	2.3
8	1.1	1.1	1.1	1.3	1.3	1.3
9	1.1	1.1	1.1	1.3	1.3	1.3
10	1.1	1.1	1.1	1.2	1.2	1.3
11	1.3	1.2	1.1	1.2	1.3	1.3
12	1.2	1.3	1.3	1.4	1.6	1.5
13	1.3	1.3	1.3	1.5	1.5	1.8
14	1.3	1.7	1.2	1.9	1.9	1.9
15	1.5	1.7	1.6	3.0	2.0	1.9
16	1.8	1.6	2.3	2.2	2.9	2.8