Utilizing a surface roughness tester, a novel improvement in surface roughness for the AA6020 was made utilizing tungsten carbide-coated tools.

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ABSTRACT

Aim: The main goal of this study is to identify the Surface Roughness using roughness tester, analyze how Tungsten Carbide Coated Drill Bit improves Surface Roughness for Novel AA6020, and compare the results to Uncoated Carbide Drill Bit. **Materials and Methods:** This investigation entails the AA6020 are two groups: The Experiential Groups (AA6020 samples drilled with Tungsten carbide coated drill bit) and the Control Groups (AA 6020 samples drilled with Uncoated Carbide Drill bit). According to g power calculations, the sample size is calculated to be 20 each group, for a total, with a length of 20mm and a diameter of 25mm, is employed in this study. In this study, there sample size of 40. The ASTM Standard is followed when performing the Surface Roughness Tester. **Results:** The average Surface Roughness, for Experimental Group (Novel AA6020 Drilled with Tungsten carbide coated Drill Bit) while the Control Group (Novel AA6020 Drilled with Uncoated Carbide drill bit) According to the Surface Roughness Data.When the findings of both groups are compared using the ANOVA test, it is clear the experiential group has a much lower Surface Roughness with significance level of 0.00 ($P<0.05$). **Conclusion:** Within the limitations of this study, we may conclude that AA6020 drilled with Tungsten carbide coated Drill Bit produces superior Surface Roughness than AA6020 Drilled with Uncoated Carbide Drill Bit.

Keywords: NovelAA6020**,** Tungsten Carbide Coated Drill, Uncoated Carbide Drill bit,CNC Drilling, SPSS Software, ANOVA Test.

INTRODUCTION

The workpiece Surface roughness is formed through a constant , sophisticated and methodology method .Surface quality can be affected by the use of different types of drilling setting (speed and Feed). Although many studies have been constructed on the surface roughness of machined components . There has yet to be a sufficient formula that can be applied for theoretical analysis.However , surface roughness can be assessed using mathematical and statistical methodologies .On CNC machining centre, the experiments for this study are carried out. Spindle speed and feed rate are the two most important things in the drilling process. Drill diameter, in addition to spindle speed and feed , has an impact on GFRP composites drilling. To correct the bottom and upper levels, a thorough investigation was conducted . Higher bounds of the variables,the experiments were carried out. It's based on a rotating

centre composites second order design RSM is an acronym for research,science and mathematics .Previously our team has a rich experience in working on various research projects across multiple disciplines(Hani et al. 2020)

Since the machining properties are superior to those of pure aluminum due to their unique metallurgical structure,aluminum alloys may be machined inexpensively, accurately and conveniently . Carbide tools are utilized for quick hole drilling because they have a longer life and are harder than the tools manufactured of high speed alloy (Esme 2015).

Machining Novel AA6020 and other alloys can be expensive, especially due to tool wear. However,because the feed rate varies with drilling diameter, For most aluminium alloys, it is recommended to use a feed rate up to double that used for drilling alloys . Twist drills are possibly the most commonly used hole making cutting equipment (Ficici 2020).To increase the quality of the machined surface, a good cutting tool should be able to limit the chance of chip adhesion and burr formation.,is considered as the best study. Previously our team has a rich experience in working on various research projects across multiple disciplines(Manikandan et al. 2021; Kulandaivel et al. 2020; A. Rajesh et al. 2020; Vimalraj et al. 2020)

A considerable amount of research has been published that looked into the capabilities of ANN approaches to discover the best cutting settings and develop credible models for predicting composite hole quality. For methodical experiments,taguchi orthogonal was used. The abrasive weight ,voltage,working gap, and solenoid speed of rotations were chosen as process parameters. The results of the experiments have been used to create a semiempirical model based on the buckingham-theorem to forecast temperature rises. The analytical and numerical model was verified by comparing it to confirmatory experiments done using various filtering settings from the primary different parameter studied.

MATERIALS AND METHODS

The manufacturing and machining for the investigation using the mechanical department of the resources done in Saveetha Industries,Saveetha School Of Engineering , Saveetha University , Saveetha Institute of Medical And Technical Science, Thandalam, Chennai, making use of facilities and equipment in the mechanical department. In this investigation , there are two Groups: The experimental groups (Novel AA6020 samples drilled with Tungsten carbide coated drill bit) and The Control Group (Novel AA6020 samples drilled with uncoated Carbide drill bit) . According to the g power calculation process , the sample size is calculated to be 20 per each group, the total sample size of 40. The g Power: 80% std devations is 0.3128 and mean value is 1.43(Ficici 2020).

The ASTM standards are followed when performing the surface roughness test.(Lu and Wang 2018). Table 1 shows the chemical composition of this investigation . This experiment was carried out using a super jobber CNC Drilling machine Fig.1 .

The Tungsten Carbide coated drill bit and Uncoated Carbide drill bits with a diameter of 8mm are used. In each group, a total number of 20 samples were taken. Fig. 4 and 5 shows the samples were drilled with Tungsten carbide coated drill

tool and uncoated carbide drill bits accordingly .

An Novel AA6020 rod with a diameter of 20 mm is divided to a length of 20 mm for machining tests in the control group (Kumar and Vinod Kumar 2011). After that, an Uncoated carbide drill instrument with an 8mm diameter is used to machine the specimen in the CNC drilling focus by modifying the speed rate. Fig. 2 shows the drilled specimens of an uncoated drill, which totaled 20 samples. The trail group's specimens were machined similarly to the control group with the exception of a Tungsten carbide coated drilled instrument with an 8mm breath was used.

These instruments were used to drill one complete sample.The drilled samples of Tungsten Carbide drill Bit are shown in Fig. 3. The comparison of surface roughness was determined using a surface roughness analyzer. The tests were carried out on a total of 20 samples in each group, according to ASTM D7127 - 17 standard.

Statistical Analysis

This fractal inquiry was carried out with the help of the SPSS programming group.For Statistical analysis, SPSS Software's ANOVA (Analysis of Variance)is employed (N. Rajesh et al. 2017)). The values from groups 1 and 2 have been plotted.Surface Roughness is a dependent variable,while Cutting Speed (M/min) and feed Rate (mm/rev) are independent variables

RESULTS

Throughout the Investigation of surface Surface Roughness machined testing of Tungsten Carbide Coated Drill Bit (Experimental Group) and samples of Uncoated Carbide DRill Bits were compared in this study (Control Groups) Fig. 6 depicts the surface roughness graph values for the experimental and control groups.The mean values of surface roughness for the experimental groups was found to be 1.863 μm. In Table 2 ,the mean value of surface roughness for the control group was found to be 1.182 μm. In comparison to the Control group, the experiencing group shows a higher level of surface roughness. Table 4 displays the results of the ANOVA in the SPSS software 2873.958 μm. The mean descriptive values of surface roughness for the Tungsten coated and Uncoated drill. The $p=0.00$ ($p<0.05$) has obtained a statistical significance value for this investigation. From the obtained values it clearly shows that the experiential group has better surface completion contrasted with the control group and it shows the outcomes acquired from the ANOVA test in SPSS software.

DISCUSSION

In comparison to the Uncoated Carbide Drill Bit (control group), the samples machined with Tungsten Carbide Coated Drill Bit (Experimental group) have better surface roughness completion. Table 3 shows the mean value of surface roughness value for the experimental group and control group are and respectively. Table 4 shows the result of the analysis of variance (ANOVA) for both groups. In the surface analyzer and statistical analysis ,it was also discovered that the experienced group's surface roughness mean is superior to the control groups.

Focused on the effect of cutting fluid utilization throughout a highly developed machining cycle, the AA6020 - T6 grade was stabilized.When compared

to the standard instrument, they discovered that devices with an inner cooling system are exceptionally successful . The aluminum compound is n't suitable for changing the mechanical properties of cutting instruments . Drilling uses grease at a low rate,while wet work is done at a low rate exceeding 300 i/h. By switching from wet to MQL it is possible to save money, just as it is possible to achieve the three main goals: wet cutting speed 400m/min provides various benefits of surface roughness ,Ra=0.2m, and MQL provides similar results. Dry drilling of 6020 series aluminium alloys with F=0.07 mm/rev, VC = 400m/min, and AP = 1.5mm obtained a surface roughness value of Ra=1.5m. During testing,the mean value of Ra and Rz were determined to be 0.44m and 2.73m,repectivity . Because a greater feed rate was used F=0.2 mm/fire up, a surface roughness was achieved that was higher than the characteristics found in this work Ra=1.0m and Rz=10m. F,which can be seen, was the most important barrier .

The burr is created at a rapid rate during aluminum machining,and it damages the material's surface,which is the reaserch's constraint. If the settings and tools in AA6020 are examined and refined in terms of supportability, the surface roughness polish can be improved as future work.

CONCLUSION

Within the limitations of the study, the recognition of surface roughness during CNC Drilling of tests utilizing the the mean value of the surface roughness for the experimental group and it is observed to be 1.74490 μm. and the mean value of surface roughness for the control group was observed to be 1.3015 μm. From the obtained results the AA 6020 samples machined using Tungsten carbide Drill bit has lower Surface roughness than the samples drilled utilized the Uncoated HSS Drill bit. As per the ANOVA test on the superficial level in surface roughness among the Uncoated HSS Drill and Tungsteb carbide Drill are drilled samples has a critical mean distinction of is observed.

DECLARATIONS:

Conflict of Interests

The authors of this paper declare no conflict of interest

Authors Contribution

Author RV assisted with data collection, data analysis, and manuscript writing. Author JKS was involved in the manuscript's conceptualization, data validation, and critical review.

Acknowledgment

The authors would like to thank Saveetha School of Engineering and Saveetha Institute of Medical and Technical Sciences (Formerly known as Saveetha University) for providing the infrastructure required to complete this research successfully.

Funding:

We are grateful to our financial sponsors for their assistance in completing this study.

1. Veekay process instruments Pvt. Ltd…
2. Saveetha School of Engineering.
3. Saveetha Institute of Medical and Technical Sciences.
4. Saveetha University.

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TABLE AND FIGURES

Table 1. Process parameter and levels for machining in CNC Drilling Center.

S.NO	PARAMETER	LEVELS			
		A	B	C	D
1	Speed (rpm)	800	1000	1500	1800
2	Feed Rate (mm/rev)	0.15	0.2	0.25	0.3

Table 2. Surface Roughness for Tungsten Carbide Coated and Uncoated Carbide Drill Bit

S.NO	SPEED (rpm)	FEED RATE (mm/rev)	SURFACE ROUGHNESS OF UNCOATED CARBIDE DRILL (µm)	SURFACE ROUGHNESS OF TUNGSTEN CARBIDE COATED DRILL (µm)
1	800	0.15	1.712	1.081
2	800	0.2	1.716	1.083
3	800	0.25	1.723	1.091
4	800	0.3	1.729	1.096
5	800	0.35	1.792	1.106
6	1000	0.15	1.781	1.151
7	1000	0.2	1.711	1.093
8	1000	0.25	1.732	1.112
9	1000	0.3	1.721	1.125
10	1000	0.35	1.716	1.139
11	1500	0.15	1.752	1.116
12	1500	0.2	1.863	1.149
13	1500	0.25	1.703	1.182
14	1500	0.3	1.744	1.119

15	1500	0.35	1.772	1.169
16	1800	0.15	1.769	1.181
17	1800	0.2	1.715	1.164
18	1800	0.25	1.737	1.166
19	1800	0.3	1.776	1.126
20	1800	0.35	1.734	1.172

Table 3. The mean descriptives obtained for surface roughness.

Descriptives								
Surface roughness								
	N	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**
					Lower Bound	**Upper Bound**		
Uncoated Carbide drill	20	1.74490	.038393	.008585	1.72693	1.76287	1.703	1.863
Tungsten Carbide Coated drill	20	1.3015	.033886	.007577	1.11519	1.14691	1.081	1.182
Total	40	1.43798	.312883	.049471	1.33791	1.53804	1.081	1.863

Table 4. One-way ANOVA test represents the significance value for Tungsten carbide coated drill and Uncoated carbide drill. It is observed that on performing One-Way ANOVA, there is a statistical significant difference for surface roughness ($p= 0.00$, $p<0.05$).

ANOVA					
SURFACE ROUGHNESS					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**

Between Groups	3.768	1	3.768	2873.958	.000
Within Groups	.050	38	.001		
Total	3.818	39			

Fig. 1. Super Jobber CNC drilling machine

Fig. 2. 8mm Uncoated tool.

Fig. 3. 8mm Tungsten Carbide coated tool.

Fig. 4. Samples machined using Uncoated tool.

Fig. 5. Samples machined using the Tungsten Carbide tool.

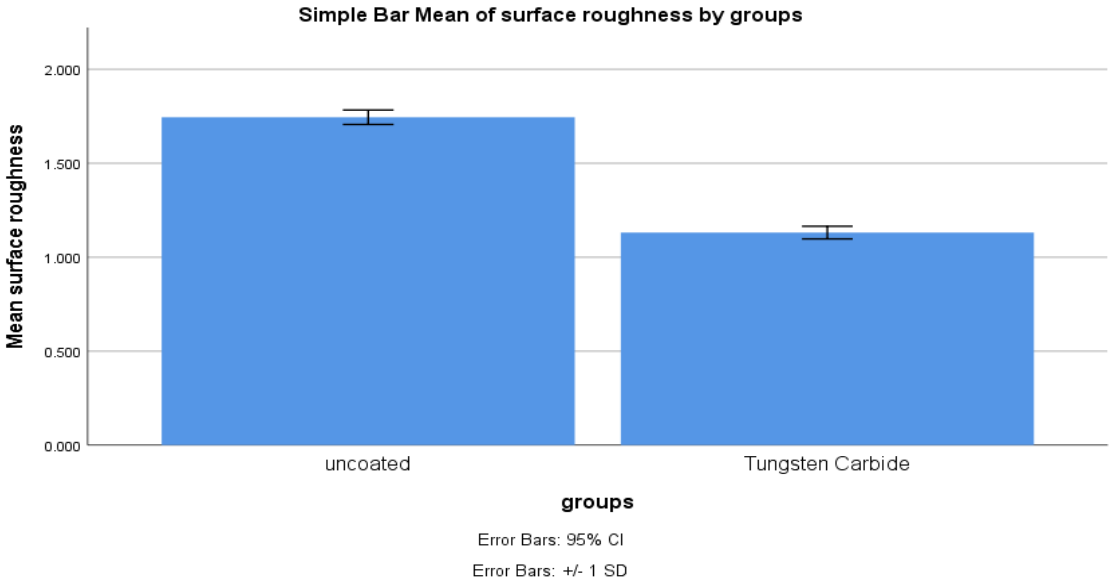

Fig. 6. Bar chart shows the comparison between mean values of surface roughness for samples machined by Tungsten Carbide drill and AA 6020 samples machined by Uncoated HSS drill. The obtained value of AA 6020 samples machined using Tungsten Carbide coated drill is higher than the AA 6020 samples machined using Uncoated drill. X-axis: Mean surface roughness of AA 6020 samples utilized with Tungsten carbide coated vs Uncoated drill. Y-axis: values of groups ± 1 SD.