

Experimental Investigation of Machining Time and Surface Roughness of AA6082 by Using Different Drill Bits with Various Cutting Environments

A. Madhan kumar¹, K.Balajee², B.Dhiwakar², S.Gokulakannan², V.Navin²

Research Scholar, Assistant Professor, Department of Mechanical Engineering, New Prince Shri Bhavani College of Engg & Tech, Gowrivakkam, Chennai, Tamil nadu, India¹

U.G. Student, Department of Mechanical Engineering, New Prince Shri Bhavani College of Engg & Tech, Gowrivakkam, Chennai, Tamil nadu, India²

ABSTRACT: Aluminium alloy (AA) are becoming potential engineering materials offering excellent combination of properties such as high specific strength, high specific stiffness, electrical and thermal conductivities, low coefficient of thermal expansion and wear resistance. Aluminium Alloy are being used in varieties of applications in automobile, mining and mineral, aerospace, defence and other related sectors automobile sector, Al composites are used for making various components such as brake drum, cylinder liners, cylinder blocks, drive shaft etc. In aerospace industries. One of the main requirements considered to obtain metallurgical weld ability was to reduce at maximum the heat input to limit the possible interfacial reaction among molten aluminium matrix. The present paper is an experimental study aiming to analyse the effects of drilling parameters on hole quality by surface roughness and machining time in aluminium alloy AA6082 utilize different drilling bits of HSS and Carbide, diameter of 10mm with using different process parameters such as spindle speed, feed and coolants. The main aim of this project is to optimize the best parameter to shrink the machining time.

KEYWORDS: Machining Time, Cutting Environments, Surface Roughness, Aluminium Alloy.

I. INTRODUCTION

Drilling is easily the most common machining process. One estimate is that 75% of all metal-cutting material removed comes from drilling operations.

Drilling involves the creation of holes that are right circular cylinders. This is accomplished most typically by using a twist drill, something most readers will have seen before. The figure below illustrates a cross section of a hole being cut by a common twist drill

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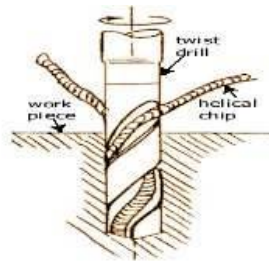


Fig1.1

The characteristics of drilling that set it apart from other powered metal cutting operations are:

1. The chips must exit out of the hole created by the cutting.
2. Chip exit can cause problems when chips are large and/or continuous.
3. The drill can wander upon entrance and for deep holes.
4. For deep holes in large work pieces, coolant may need to be delivered through the drill shaft to the cutting front.
5. Of the powered metal cutting processes, drilling on a drill press is the most likely to be performed by Someone who is not a machinist.

Drill Press Work Area

A view of the metal-cutting area of a drill press is shown below. The work piece is held in place by a C-clamp since cutting forces can be quite large. It is dangerous to hold a work piece by hand during drilling since cutting forces can unpredictably get quite large and wrench the part away. Wood is often used underneath the part so that the drill bit can overshoot without damaging the table. The table also has holes for drill overshoot as well as weight reduction. A three-jaw chuck is used since three points determine a circle in two dimensions. Four-jaw chucks are rarely seen since offset of the bit is not necessary. The next section contains of chucks. To get an idea of the differing configurations of three and four-jaw chucks, please see the equivalent lathe chucks.

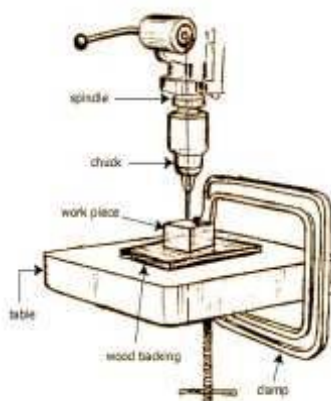


Fig1.2

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II. EXPERIMENTAL PROCEDURE

The drilling tests are carried out on Vertical Milling Machine names as ESTEAM under dry condition. The aluminium alloy of AA 6082 was mounting on the particular machine area; size of aluminium alloy 250 X 260 X 12mm drilled using HSS and Carbide drill bits mentioned below. The aim of this experimental and analytical work is to identify suitable parameters, the monitoring of which enable the prediction of surface roughness for drilled holes approach technique Orthogonal Array L54. It has its own ability in determining the output and decision making in condition of holes monitoring which determines and maintain the quality of drilled surface to its highest standard of the product. Finally, the entire experimental work of quality holes is to be optimized within the range of experimental values.

Chemical composition of AA6082

Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti
0.81	0.20	0.05	0.66	0.66	0.001	0.03	0.009



(a)



(b)



(c)

Fig. 2.(a) Milling Machine (b) HSS drill bit 10 mm (c) Carbide drill bit 10 mm

Surface Roughness Tester

Drilling operation is evaluated based on the performance characteristics such as surface roughness, material removal rate (MRR), tool wear, tool life, cutting force, hole diameter error, power consumption and are strongly correlated with the cutting parameters such as cutting speed, feed, depth of cut, and tool geometry (Chryssolouris G et.al, 1990, Chua MS et.al, 1993, Yang H et.al,1998, Paulo davim.J et.al,2003),which are determined based on experience or by the use of a handbook (Graham T et.al, 2008). In this context, three parameters speed, feed and drill tool diameter are selected as controllable parameters and parameters like surface roughness(R a),

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(a)



(b)

Fig.3.(a) Surface Roughness Tester



(a)



(b)

Fig.4.(a) Drill Machines (b)Drill Hole

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III. EXPERIMENTAL RESULTS

MACHINING DETAILS FOR 10MM DRILLING USING HSS DRILL BIT

S.no	Hole no	Speed	Feed	Drilling time (secs)	Coolant	Average time
1.	1	540	2	23.21	Coconut oil And kerosene	11.99
2.	2	540	3	20.15		
3.	3	540	4	17.48		
4.	4	910	2	16.5		
5.	5	910	3	9.26		
6.	6	910	4	6.32		
7.	7	1500	2	7.25		
8.	8	1500	3	5.13		
9.	9	1500	4	4.02		
10.	10	540	2	13.26	Caster oil	9.8
11.	11	540	3	12.14		
12.	12	540	4	10.46		
13.	13	910	2	9.34		
14.	14	910	3	8.29		
15.	15	910	4	7.17		
16.	16	1500	2	11.35		
17.	17	1500	3	10.41		
18.	18	1500	4	8.19		
19.	19	540	2	15.30	Machine coolant	10.4
20.	20	540	3	9.23		
21.	21	540	4	8.44		
22.	22	910	2	14.38		
23.	23	910	3	12.06		
24.	24	910	4	10.52		
25.	25	1500	2	9.55		
26.	26	1500	3	9.03		
27.	27	1500	4	8.50		
Total average time =13.55seconds						

Parameters and their Levels

S. no	Parameter	Levels
1.	Spindle speed(rpm)	(a)540(b) 910(c) 1500
2.	Feed(mm)	(a)2(b) 4(c) 6
3.	Coolants	(a)Kerosene and coconut oil (b)Machine coolant Castor oil

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Machining details for 10mm drilling using CARBIDE drill bit

S.no	Hole no	Speed	Feed	Drilling time (secs)	Coolant	Average time
1.	1	540	2	15	Coconut oil And kerosene	12.17
2.	2	540	3	14.075		
3.	3	540	4	12.77		
4.	4	910	2	12.92		
5.	5	910	3	11.77		
6.	6	910	4	11.45		
7.	7	1500	2	11.10		
8.	8	1500	3	10.20		
9.	9	1500	4	9.60		
10.	10	540	2	17.50		
11.	11	540	3	16.97		
12.	12	540	4	16.32		
13.	13	910	2	14.82		
14.	14	910	3	14.08		
15.	15	910	4	14.03		
16.	16	1500	2	13.75		
17.	17	1500	3	13.31		
18.	18	1500	4	12.93	Caster oil	10.4
19.	19	540	2	19.77		
20.	20	540	3	16.21		
21.	21	540	4	15.30		
22.	22	910	2	16.01		
23.	23	910	3	14.40		
24.	24	910	4	12.67		
25.	25	1500	2	15.78		
26.	26	1500	3	16.20		
27.	27	1500	4	16.47		
Total average time =14.3seconds						

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Graph form machining time of HSS 10mm drill bit and Carbide 10mm drill bit

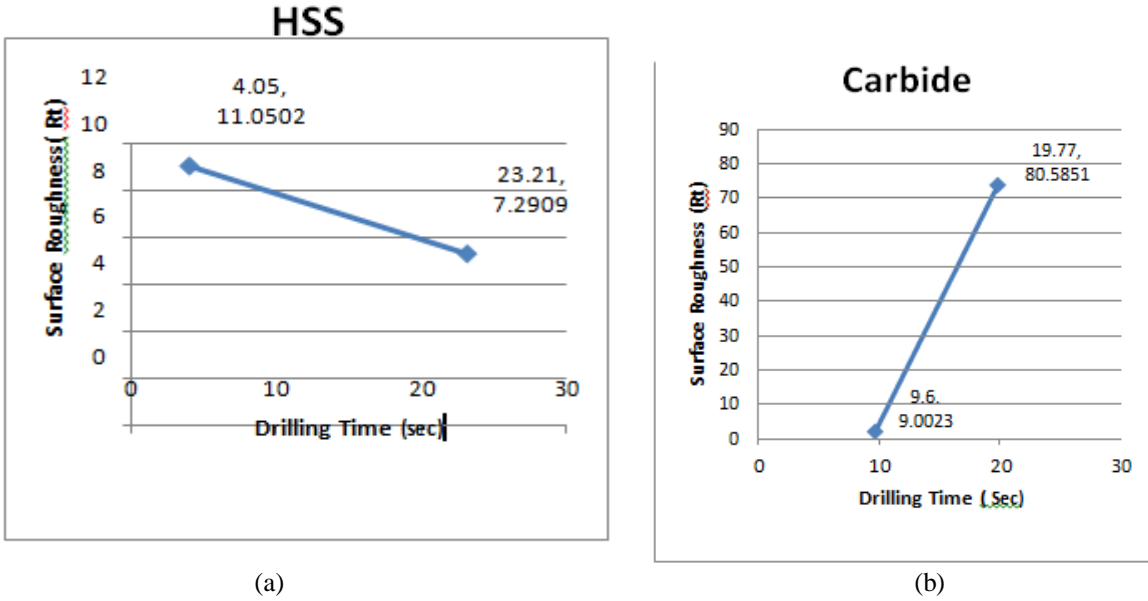
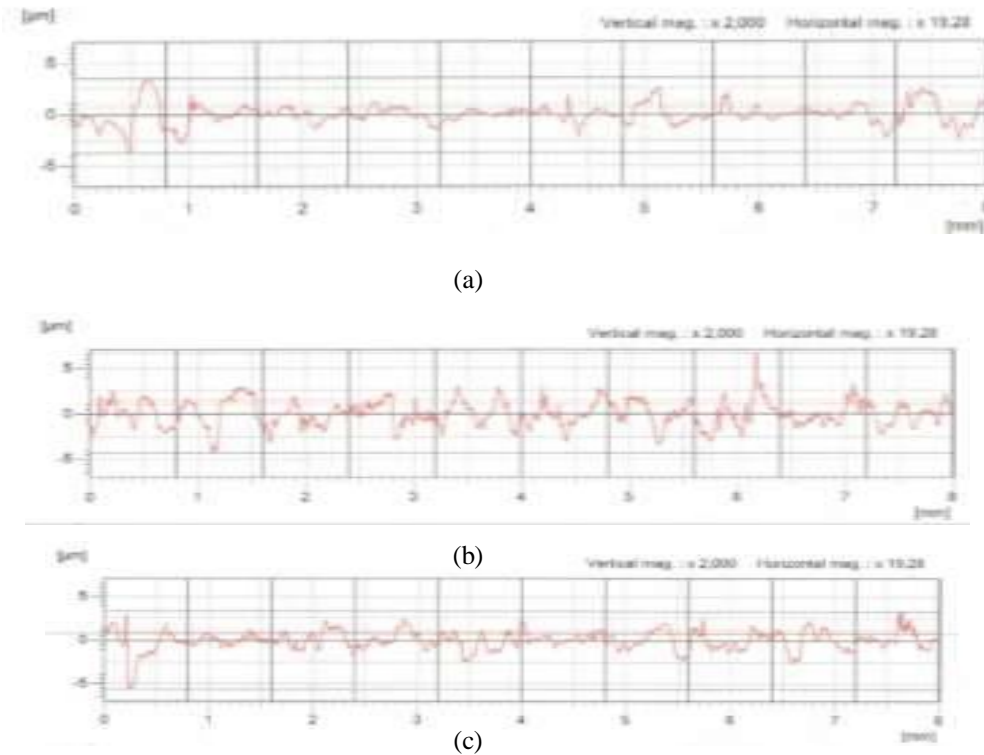


Fig.5. Graph form machining time (a) HSS (b) Carbide

Surface Roughness Graph for Drilling using HSS and Carbide

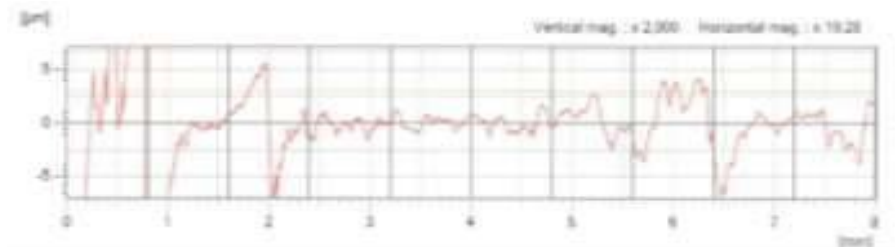


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(d)

Fig.5. Surface Roughness graph (a)[HSS]–Hole1 (b) [HSS]–Hole9 (c) [Carbide]–Hole9 (d) [Carbide]–Hole19

IV. CONCLUSION

We concluded the optimized Machining time and Maximum Surface Roughness by using the 10mm diameter drill bits. In our project we estimate the drilling time along with the surface roughness of the selected holes. Finally the drill bit of HSS to optimize the best parameter of hole no-1and9 comparatively the carbide drill bit. In this HSS the best suitable drill bit to reduce the drilling time and increase the surface roughness.

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