Experimental Study on Surface Roughness in MS Bar by using Double Point Cutting Tool in Turning

S.Vanangamudi
Research Scholar,
Department of Mechanical Engineering,
Bharath Institute of
Higher Education and Research,
Chennai – 600 073,India,
email: vanangamudi_s@yahoo.com

M.Pradeep Kumar
Associate Professor,
Department of Mechanical Engineering,
College of Engineering,
Anna University,
Chennai – 600 025,India

Abstract:-A special type of a tool is designed and made to have two cutting points for turning long workpieces and it may be termed as the double point cutting tool. The double point cutting tool has two cutting points which has the height difference of 0.5 mm and the distance between them is 6 mm . So that when the first cutting point takes 0.5 mm depth of cut and next to that the second cutting point also takes 0.5 mm depth of cut as the tool proceeds for turning. Hence the total machining time is reduced considerably. Surface finish depends on work material, tool material, type of tool, cutting speed, feed and so on. Investigation on Surface Roughness in Mild Steel bar after turning by using HSS Double Point Cutting Tool for different cutting conditions is presented in this Research article.

Keywords:- *double point cutting tool, machining time, Surface Roughness, work material, tool material, type of tool, cutting speed, feed*

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I. INTRODUCTION

A special type of a tool is designed and made to have two cutting points for turning long workpieces and it may be termed as the double point cutting tool. The double point cutting tool has two cutting points which has the height difference of 0.5 mm and the distance between them is 6 mm . So that when the first cutting point takes 0.5 mm depth of cut and next to that the second cutting point also takes 0.5 mm depth of cut as the tool proceeds for turning. Hence the total machining time is reduced considerably. Surface finish depends on work material, tool material, type of tool, cutting speed, feed and so on.

Special feature of the double point cutting tool over single point cutting is that the total machining time is reduced considerably. For reducing the diameter from 50 mm to 40 mm for the length 200 mm, the double point cutting tool takes only half of the time taken by the single point cutting tool when the depth of cut is 0.5 mm for different speed and feed conditions.

II. EXPERIMENTAL SETUP

Mild Steel Rod of 50 mm diameter and 300 mm long is used as Workpiece for turning. HSS Double Point Cutting tool which has two cutting points of the height difference of 0.5 mm and the distance between them is 6 mm is used as Cutting tool for turning . The purchased HSS tool bit has been ground to the required tool geometry by using Tool and Cutter grinding machine.

Taylor – Hobson Surtronic Surface Roughness Measuring Instrument has been used to measure the surface roughness of the MS bar for different speed and feed by keeping 0.5 mm depth of cut as constant.. A minimum Roughness of 5 microns and a maximum Roughness of 10.38 microns are recorded . Nine experiments have been conducted on the precision Centre Lathe by keeping the depth of cut 0.5 mm as constant for various feed and speed for measuring the Surface Roughness.

The double point cutting tool is fixed in the tool post by referring the dead centre of the tailstock and accordingly adjustment is made by keeping metal strips under the tool so that the cutting points coincide with the axis of the center i.e., axis of the workpiece. The MS workpiece of 50 mm diameter and 300 mm long is fixed in the three jaw chuck and the other end of the workpiece is supported by the tailstock.

III. EXPERIMENTATION

Figure: 1 shows that the double point tool is ready for turning. The depth of cut 05 mm is taken as constant value for the 1ST set of speed and different feed rate such as 135 rpm, 0.205 mm/rev, 0.238 mm/rev and 0.260 mm/rev and 2nd set of speed and different feed rate such as 215 rpm

0.205 mm/rev,0.238 mm/rev and 0.260 mm/rev and 3rd set of speed and different feed rate such as 325 rpm 0.205 mm/rev,0.238 mm/rev and 0.260 mm/rev respectively.

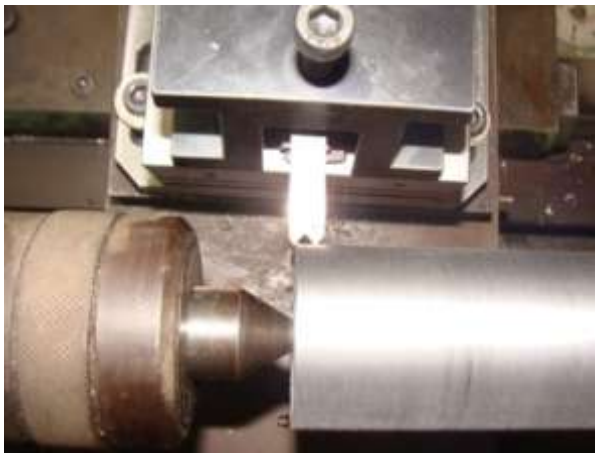

Figure : 1 Double Point Cutting Tool for Turning

Figure : 2 Double Point Cutting Tool does Turning

Figure: 3 Taylor – Hobson Surtronic Surface Roughness Measuring Instrument

After the turning operation the Taylor – Hobson Surtronic Surface Roughness Measuring Instrument is used for measuring the Roughness of the Surface of the workpiece by placing the same precisely on long V Block . Readings are recorded for the different portions of the workpiece for the different speed and feed the turning is done by considering the depth of cut 0.5 mm as constant. So totally nine measurement have been carried out and recorded.

IV. RESULTS AND DISCUSSION

The depth of cut 0.5 mm is kept constant for all the nine measurements.

First Surface :

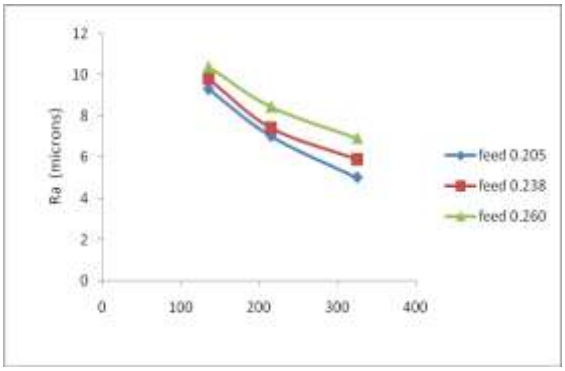

Figure : 4 Double Point Cutting Tool : First Surface : Speed (rpm) Vs Ra(microns)

I. Speed (N):

Case (i)

For the feed 0.205 mm/rev and the speed 325 rpm the Surface Roughness is recorded as 5.01 microns (best) . When the speed is decreased to 135 rpm , the Surface Roughness is increased and recorded as 9.3microns (bad).

Case(ii)

For the feed 0.238 mm/rev and the speed 325 rpm the Surface Roughness is recorded as 5.9 microns (better) . When the speed is decreased to 135 rpm , the Surface Roughness is increased and recorded as 9.8 microns (worse).

Case (iii)

For the feed 0.260 mm/rev and the speed 325 rpm the Surface Roughness is recorded as 6.92 microns (good) . When the speed is decreased to 135 rpm , the Surface

Roughness is increased and recorded as 10.38 microns (worst).

On observing the above three cases carefully it is noted that the surface finish is very good when the speed is 325 rpm and the feed is 0.205 mm/rev. When the speed is 325 rpm and the feed is increased to 0.260 mm/rev the surface finish may be good. By keeping feed as 0.260 mm/rev when the speed is decreased to 135 rpm the surface finish becomes worst. So it is stated that the Surface finish is not only depending on the Speed but also depending on the feed.

Second Surface :

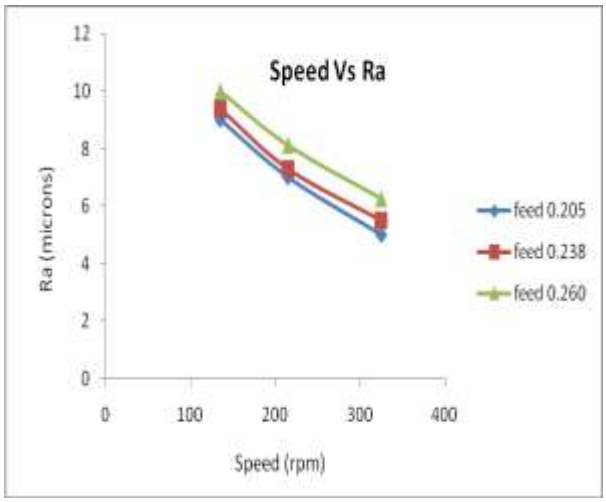

Figure : 5 Double Point Cutting Tool : Second Surface : Speed (rpm) Vs Ra(microns)

I. Speed (N):

Case (i)

For the feed 0.205 mm/rev and the speed 325 rpm the Surface Roughness is recorded as 5 microns (best) . When the speed is decreased to 135 rpm , the Surface Roughness is increased and recorded as 9 microns (bad).

Case(ii)

For the feed 0.238 mm/rev and the speed 325 rpm the Surface Roughness is recorded as 5.5 microns (better) . When the speed is decreased to 135 rpm , the Surface Roughness is increased and recorded as 9.4 microns (worse).

Case (iii)

For the feed 0.260 mm/rev and the speed 325 rpm the Surface Roughness is recorded as 6.25 microns (good) . When the speed is decreased to 135 rpm , the Surface Roughness is increased and recorded as 10.01 microns (worst).

On observing the above three cases carefully it is noted that the surface finish is very good when the speed is 325 rpm and the feed is 0.205 mm/rev. When the speed is 325 rpm and the feed is increased to 0.260 mm/rev the surface finish may be good. By keeping feed as 0.260 mm/rev when the speed is decreased to 135 rpm the surface finish becomes worst. So it is stated that the Surface finish is not only depending on the Speed but also depending on the feed.

We also note that Second surface has better surface finish than the first surface which is desirable.

First Surface :

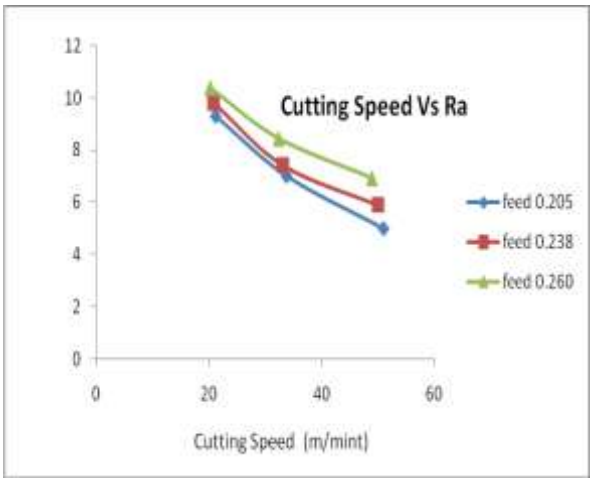

Figure : 6 Double Point cutting tool : First Surface : Cutting speed vs Ra

II. Cutting Speed (V):

The value of the cutting speed (V) depends on the diameter of the workpiece to be turned and speed of rotation of the workpiece (N) and they influence the surface roughness of workpiece.

Case (i)

For the feed 0.205 mm/rev and the cutting speed 51.025 m/mint the Surface Roughness is recorded as 5.01 microns (best) . When the cutting speed is decreased to 21.195 m/mint , the Surface Roughness is increased and recorded as 9.3microns (bad).

Case(ii)

For the feed 0.238 mm/rev and the cutting speed 50.005 m/mt the Surface Roughness is recorded as 5.9 microns (better). When the cutting speed is decreased to 20.771 m/mint , the Surface Roughness is increased and recorded as 9.8 microns (worse).

Case (iii)

For the feed 0.260 mm/rev and the cutting speed 48.984 m/mt the Surface Roughness is recorded as 6.92 microns (good). When the cutting speed is decreased to 20.347 m/mt , the Surface Roughness is increased and recorded as 10.38 microns (worst).

On observing the above three cases carefully it is noted that the surface finish is very good when the cutting speed is 51.025 m/mint and the feed is 0.205 mm/rev. When the speed is 48.984 m/mint and the feed is increased to 0.260 mm/rev the surface finish may be good. By keeping feed as 0.260 mm/rev when the cutting speed is decreased to 20.347 m/mint the surface finish becomes worst. So it is stated that the Surface finish is not only depending on the cutting Speed but also depending on the feed.

Second Surface :

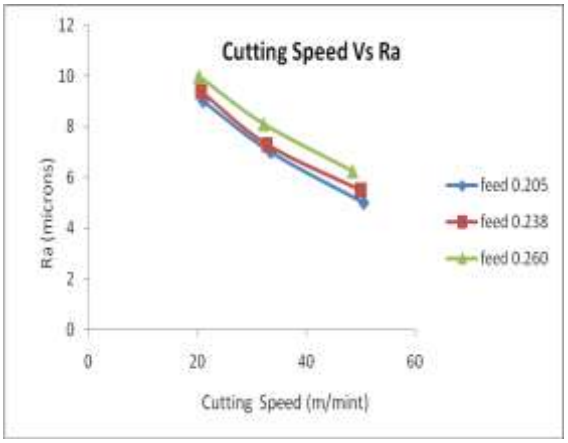

Figure : 7 Double Point cutting tool : Second Surface : Cutting speed vs Temperature

II. Cutting Speed (V):

Case (i)

For the feed 0.205 mm/rev and the cutting speed 50.514 m/mint the Surface Roughness is recorded as 5 microns (best) . When the cutting speed is decreased to 20.983 m/mint , the Surface Roughness is increased and recorded as 9 microns (bad).

Case(ii)

For the feed 0.238 mm/rev and the cutting speed 49.494 m/mt the Surface Roughness is recorded as 5.5 microns (better). When the cutting speed is decreased to 20.560 m/mint , the Surface Roughness is increased and recorded as 9.4 microns (worse).

Case (iii)

For the feed 0.260 mm/rev and the cutting speed 48.474 m/mt the Surface Roughness is recorded as 6.25 microns (good). When the cutting speed is decreased to 20.135 m/mt , the Surface Roughness is increased and recorded as 10.01 microns (worst).

On observing the above three cases carefully it is noted that the surface finish is very good when the cutting speed is 51.025 m/mint and the feed is 0.205 mm/rev. When the speed is 48.984 m/mint and the feed is increased to 0.260 mm/rev the surface finish may be good. By keeping feed as 0.260 mm/rev when the cutting speed is decreased to 20.347 m/mint the surface finish becomes worst. So it is stated that the Surface finish is not only depending on the cutting Speed but also depending on the feed.

We also note that Second surface has better surface finish than the first surface which is desirable.

First Surface :

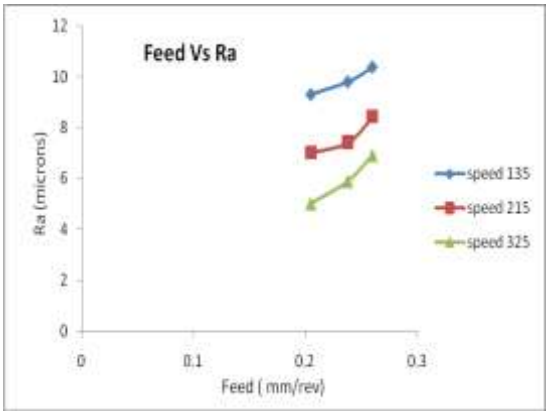

Figure : 8 Double Point cutting tool : First Surface : Feed vs Ra

III. Feed (f)

Case (i)

For the speed 135 rpm and the feed 0.205 mm/rev the surface roughness is recorded as 9.3 microns. When the feed is increased to 0.260 mm/rev , the surface roughness is increased and recorded as 10.38 microns. Ie the surface roughness is increased by 1.12 times.

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Case (ii)

For the speed 215 rpm and the feed 0.205 mm/rev the surface roughness is recorded as 7.02 microns. When the feed is increased to 0.260 mm/rev , the surface roughness is increased and recorded as 8.44 microns. Ie the surface roughness is increased by 1.20 times.

Case (iii)

For the speed 325 rpm and the feed 0.205 mm/rev the surface roughness is recorded as 5.01 microns. When the feed is increased to 0.260 mm/rev , the surface roughness is increased and recorded as 6.92 microns . Ie the surface roughness is increased by 1.38 times.

Second Surface :

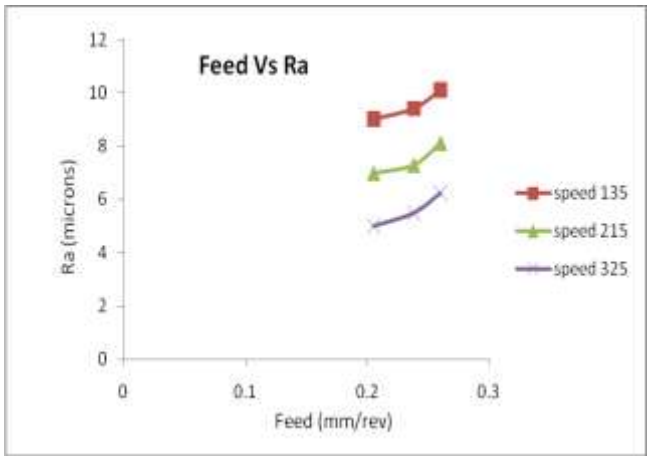

Figure : 9 Double Point cutting tool : Second Surface : Feed vs Ra

Types of Chip :

(i) At N = 135 rpm

Figure 10 (a) f = 0.205 mm/rev

Figure 10 (b) f = 0.238 mm/rev

Figure 10 (c) f = 0.260 mm/rev

(ii) At N = 215 rpm

III. Feed (f)

Case (i)

For the speed 135 rpm and the feed 0.205 mm/rev the surface roughness is recorded as 9 microns. When the feed is increased to 0.260 mm/rev , the surface roughness is increased and recorded as 10.01 microns. Ie the surface roughness is increased by 1.11 times.

Case (ii)

For the speed 215 rpm and the feed 0.205 mm/rev the surface roughness is recorded as 7 microns. When the feed is increased to 0.260 mm/rev , the surface roughness is increased and recorded as 8.12 microns. Ie the surface roughness is increased by 1.16 times.

Case (iii)

For the speed 325 rpm and the feed 0.205 mm/rev the surface roughness is recorded as 5 microns. When the feed is increased to 0.260 mm/rev , the surface roughness is increased and recorded as 6.25 microns . Ie the surface roughness is increased by 1.25 times.

The experiment results of double point cutting tool on Surface Roughness well correlated with the cutting speed and feed rate. On comparing all the cases it is very clear that the speed, cutting speed and the feed rate have greater effect on the surface finish.

We also note that Second surface has better surface finish than the first surface for various speed, cutting speed and feed rate which is desirable.

Figure 11 (a) f = 0.205 mm/rev

Figure 11 (b) f = 0.238 mm/rev

Figure 11 (c) f = 0.260 mm/rev

At N =325 rpm

Figure 12 (a) f = 0.205 mm/rev

Figure 12 (b) f = 0.238 mm/rev

Figure 12 (c) f = 0.260 mm/rev

- A Discontinuous chip is obtained when turning is done at N = 135 rpm and f= 0.205 mm/rev.
- A short curled continuous chip is obtained when turning is done at N = 135 rpm and f = 0.238 mm/rev
- A curled short continuous chip is obtained when turning is done at N = 135 and f = 0.260 mm/rev

Figures 10 (a),(b) and (c) have shown the same.

- A curled discontinuous chip is obtained when turning is done at N = 215 rpm and f= 0.205 mm/rev.
- A short continuous chip is obtained when turning is done at N = 215 rpm and f = 0.238 mm/rev
- A curled long continuous chip is obtained when turning is done at N = 215 and f = 0.260 mm/rev

Figures 11 (a),(b) and (c) have shown the same.

- A curled long and thin wire type continuous chip is obtained when turning is done at N = 325 rpm and f= 0.205 mm/rev.
- A curled long continuous chip is obtained when turning is done at N = 325 rpm and f = 0.238 mm/rev
- A curled long and thick wire type continuous chip is obtained when turning is done at N = 325 and f = 0.260 mm/rev

Figures 12 (a),(b) and (c) have shown the same.

It is noted that at N =325 rpm for various feed rates such as f= 0.205,0.238 and 0.260 mm/rev the Continuous chip is obtained . Continuous is not desirable because it disturbs the turning process and even it may spoil the surface of the machined surface. But good surface finish is obtained at N =325 rpm and f = 0.205 mm/rev. Hence suitable chip breakers may be incorporated to break the chips.

CONCLUSION:

The performance of the double point cutting tool is quite satisfactory. The investigation on surface roughness in MS bar after turning by using HSS double point cutting tool obeys with HSS single point cutting tool. That is as the Speed , the cutting speed increases the surface finish also increases (roughness decreases) when the feed rate is low.

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