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EVALUATION OF SURFACE ROUGHNESS ON TURNED SPECIMEN BY USING COATED CARBIDE INSERTS [CNC TURNING]

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ABSTRACT

In manufacturing industry, beside the dimensional and geometric tolerance of a component, surface quality is most commonly specified requirements. Surface roughness plays an important role in the performance of the component.

- This is a study of the influence of the cutting parameters on the surface roughness during the turning of HCHCR alloy steel with coated tool.
- Coating on tool: titanium-nitride, AlcrN, LATUMA
- The objective was to optimization of the machining parameters as cutting speed, feed rate and depth of cut for surface roughness.

INTRODUCTION

Machining is any of various processes in which a piece of raw material is cut into a desired final shape and size by a controlled material-removal process. The processes that have this common theme, controlled material removal, are today collectively known as subtractive manufacturing. There are three basic machining operations which are classified as turning, drilling and milling. Other operations except the above three operations are coming under the categories shaping, planing, boring, broaching and sawing.

- **Turning** operation is an operation in which rotating the workpiece is a primary method and the cutting tool is moved against the workpiece. Lathes are the principal machine tool used in turning.
- **Milling** operation is an operation in which the cutting tool rotates to bring cutting edges to bear against the workpiece. Milling machines are the principal machine tool used in milling.
- **Drilling** operation is an operation in which holes are produced in workpiece by bringing rotary cutter with cutting edges at the lower extremity into contact with the workpiece. Drilling operations are done primarily in drill presses but sometimes on lathes on lathes or mills.

LITERATURE REVIEW

Milton D. Selvam & P. Senthil (2016) decided to find the best possible machining parameters in CNC turning operation to obtain better surface quality. The CNC turning was carried out with titanium nitride-coated carbide insert on hardened C45 medium carbon steel. The turning parameters, namely speed, feed, depth of cut and nose radius were chosen to conduct the experiment based on L9 orthogonal array. The surface roughness of the machined specimen varies based on the machining parameters. They observed that with increase in speed the surface roughness there is a reduction in the surface roughness and it gets reduced with reduction in depth of cut and same in case of feed rate. M.Dhanenthiran (2007) considered quality and time as the main factor that an industry needed on their product. So, investigation is made on the effect of process parameters in turning operations on cast iron using titanium carbide insert. Then result is analysed based on the factors like surface roughness, machining time, metal removal rate, tool wear. From this investigation it was analysed that quality will be improved by maximum spindle speed, maximum depth of cut and the feed. From the result it was found that quality will be achieved high on cast iron using titanium carbide insert. Anand Kumar, Pardeep Kumar, Bhupender Singh (2013) considered dimensional and geometric tolerance of a component and surface quality is the most commonly specified requirement by the manufacturing industry. Based on this they made a turning operation with TiN coated carbide insert on AISI 1045 steel rod. The design of experiment is based on Taguchi technique. The objective was to optimize the machining parameters such as feed, speed, depth of cut for surface roughness. The result obtained by this experiment shown that coated carbide insert provides better surface roughness than the uncoated one.

CNC LATHE MACHINE

Figure 3.2 CNC lathe machine

Computer numerical controlled (CNC) lathes are rapidly replacing the older production lathes due to their ease of setting, operation, repeatability and accuracy. The tool paths programmed by the CAD/CAM process or manually by the programmer and the resulting file uploaded to the machine, and once set and trial led the machine will continue to turn out parts under the occasional supervision of an operator.

The machining of the mild steel using CNC lathe is shown in the figure. CNMG is used for machining process. Then the machining is carried out under different cutting condition as shown in table. During machining the machining time is noted.

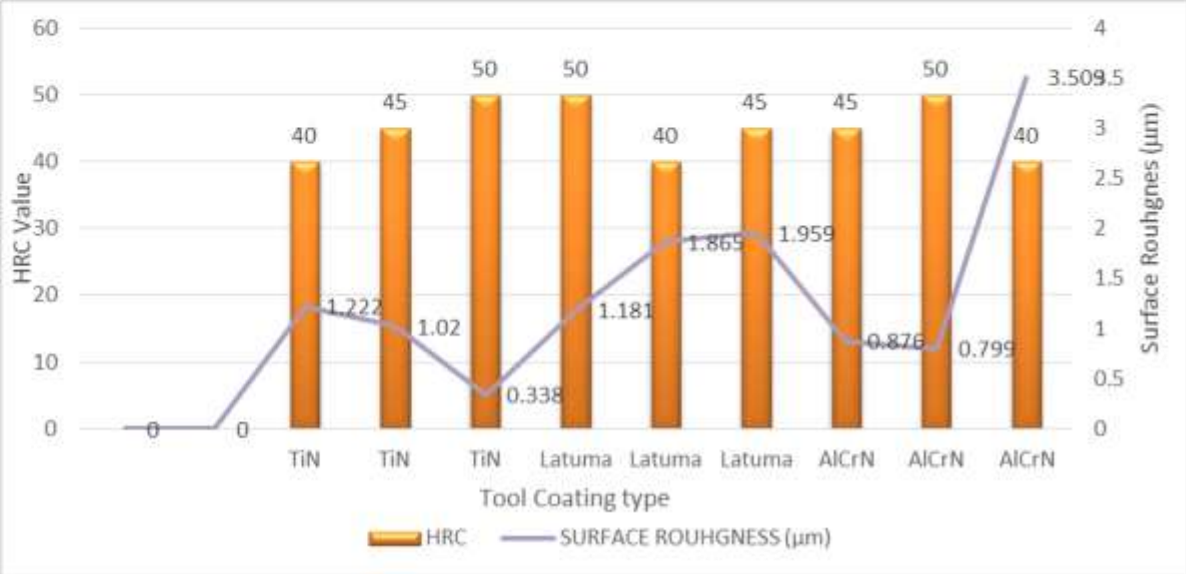
Table 3.1: Experimental data for turning CNC TURNING

SL.NO	COAT TYPE	SPEED (rpm)	DEPTH OF CUT (mm)	HRC	FEED (mm/rev)	SURFACE ROUHGNESS (µm)	TIME (sec)	NO. OF PASSES
1	TiN	600	0.4	40	0.2	1.222	82	2
2	TiN	600	0.4	45		1.02	91	3
3	TiN	600	0.4	50		0.338	84	3
4	Latuma	900	0.6	50		1.181	52	2
5	Latuma	900	0.6	40		1.865	54	2
6	Latuma	900	0.6	45		1.959	52	2
7	AlCrN	1200	0.8	45		0.876	28	1
8	AlCrN	1200	0.8	50		0.799	34	2
9	AlCrN	1200	0.8	40		3.509	29	1

RESULTS AND DISCUSSION

Surface roughness is defined as the shorter frequency of real surfaces relative to the troughs. If we look at machined parts, you will notice that their surfaces embody a complex shape made of a series of peaks and troughs of varying heights, depths, and spacing. Surface roughness is greatly affected by the microscopic asperity of the surface of each part. Differences in surface roughness obviously lead to visual differences, however, they also influence a variety of other characteristics. Examples: the amount of wear, the ability to form a seal when a part contacts another surface, and the thickness of the paint needed to coat a part. Therefore, it is necessary to quantify surface roughness, that is, the microscopic asperity of surfaces.

GRAPHS:


HRC Value
Surface Rouhgnes (µm)
Tool Coating type
TiN
Latuma
AlCrN
HRC
SURFACE ROUHGNESS (µm)

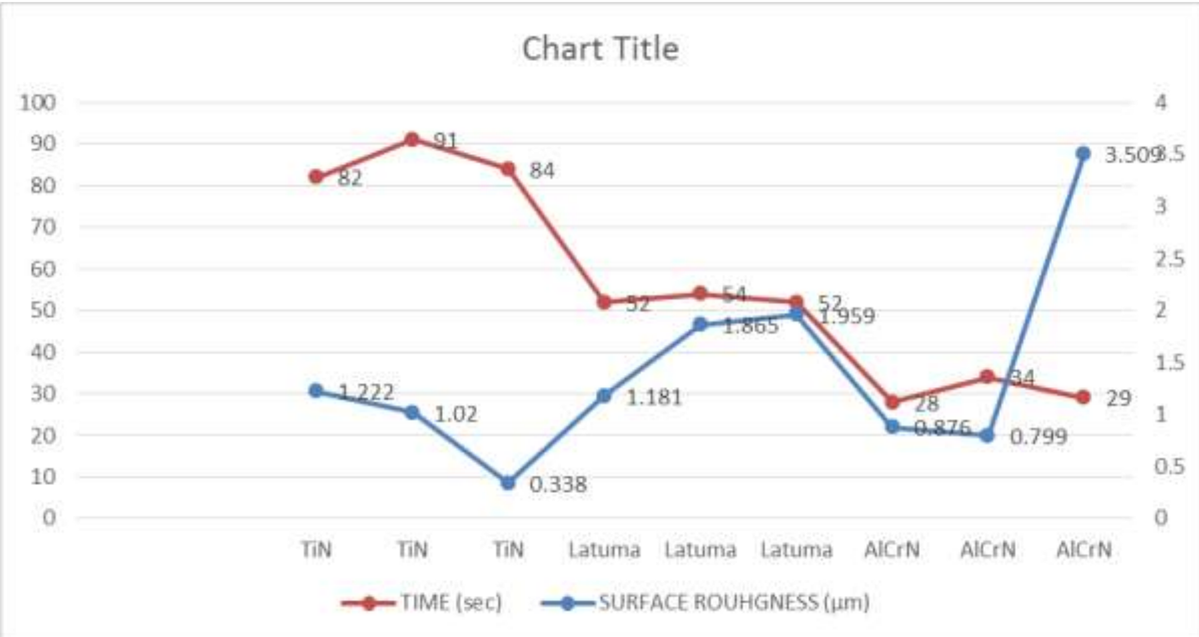


Chart Title
TiN
Latuma
AlCrN
TIME (sec)
SURFACE ROUHGNESS (µm)

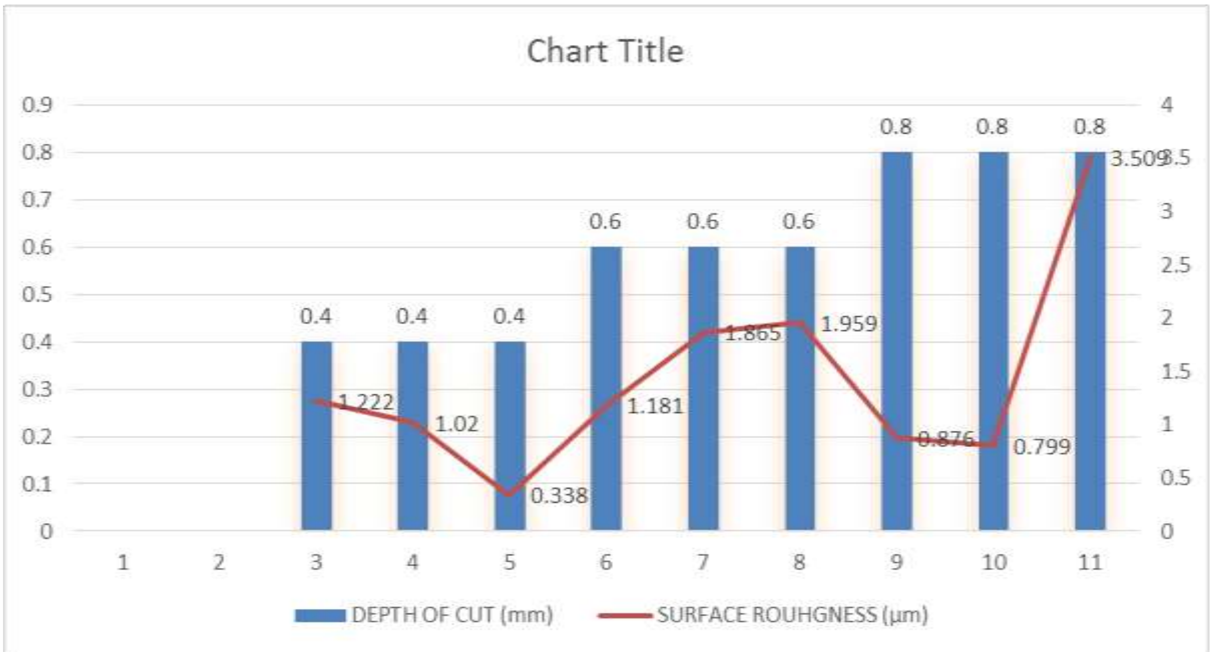
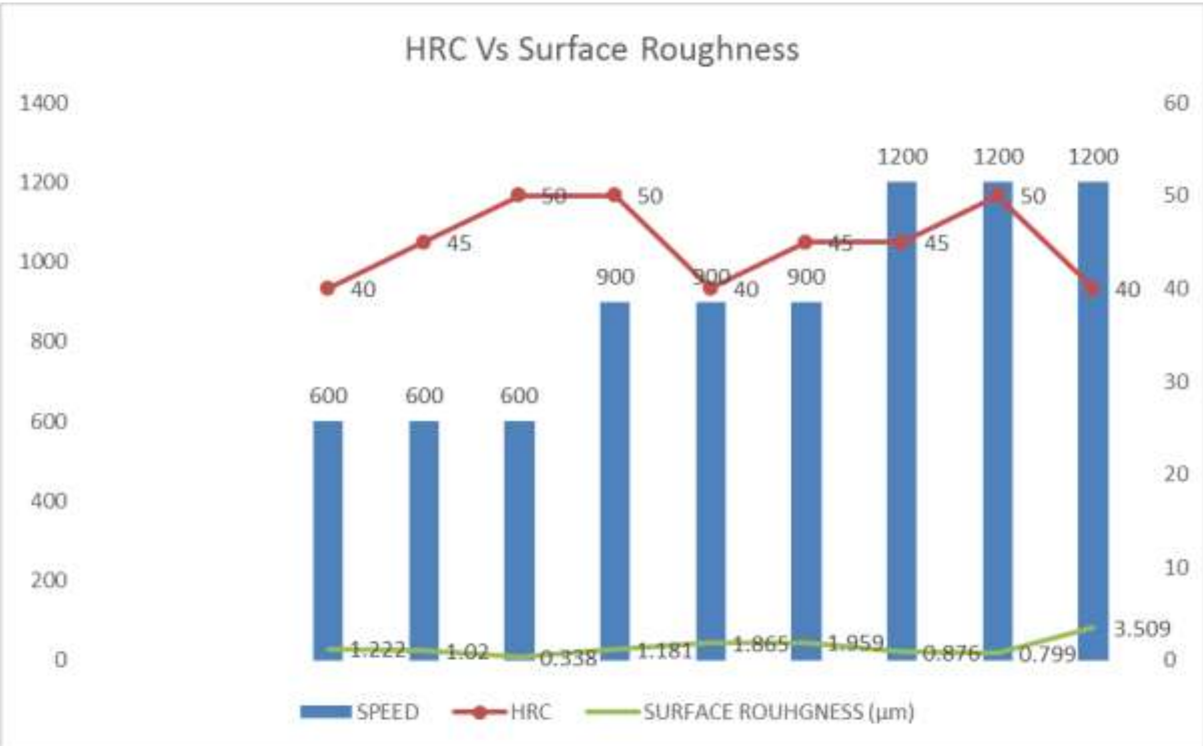


Chart Title
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4
3.5
3
2.5
2
1.5
1
0.5
0
1 2 3 4 5 6 7 8 9 10 11
0.4 0.4 0.4 0.6 0.6 0.6 0.8 0.8 0.8
1.222 1.02 0.338 1.181 1.865 1.959 0.876 0.799 3.509
DEPTH OF CUT (mm)
SURFACE ROUHGNESS (µm)


HRC Vs Surface Roughness
1400
1200
1000
800
600
400
200
0
60
50
40
30
20
10
0
600 600 600 900 900 900 1200 1200 1200
40 45 50 50 40 45 45 50 40
1.222 1.02 0.338 1.181 1.865 1.959 0.876 0.799 3.509
SPEED
HRC
SURFACE ROUHGNESS (µm)

CONCLUSION

The experiment presented here is an overview of project work carried out in turning process. From the above discussion it can be concluded that:

1. The value of surface roughness increases with increase in speed, depth of cut and feed.
2. The value of hardness reduces after machining the workpiece with coated insert when compared with raw material hardness.

Thus, this project explains about the details which we obtained by experimentation and relates it with the surface roughness value to be obtained. The scope of this project can be extended for studying the tribological factors of the insert.

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